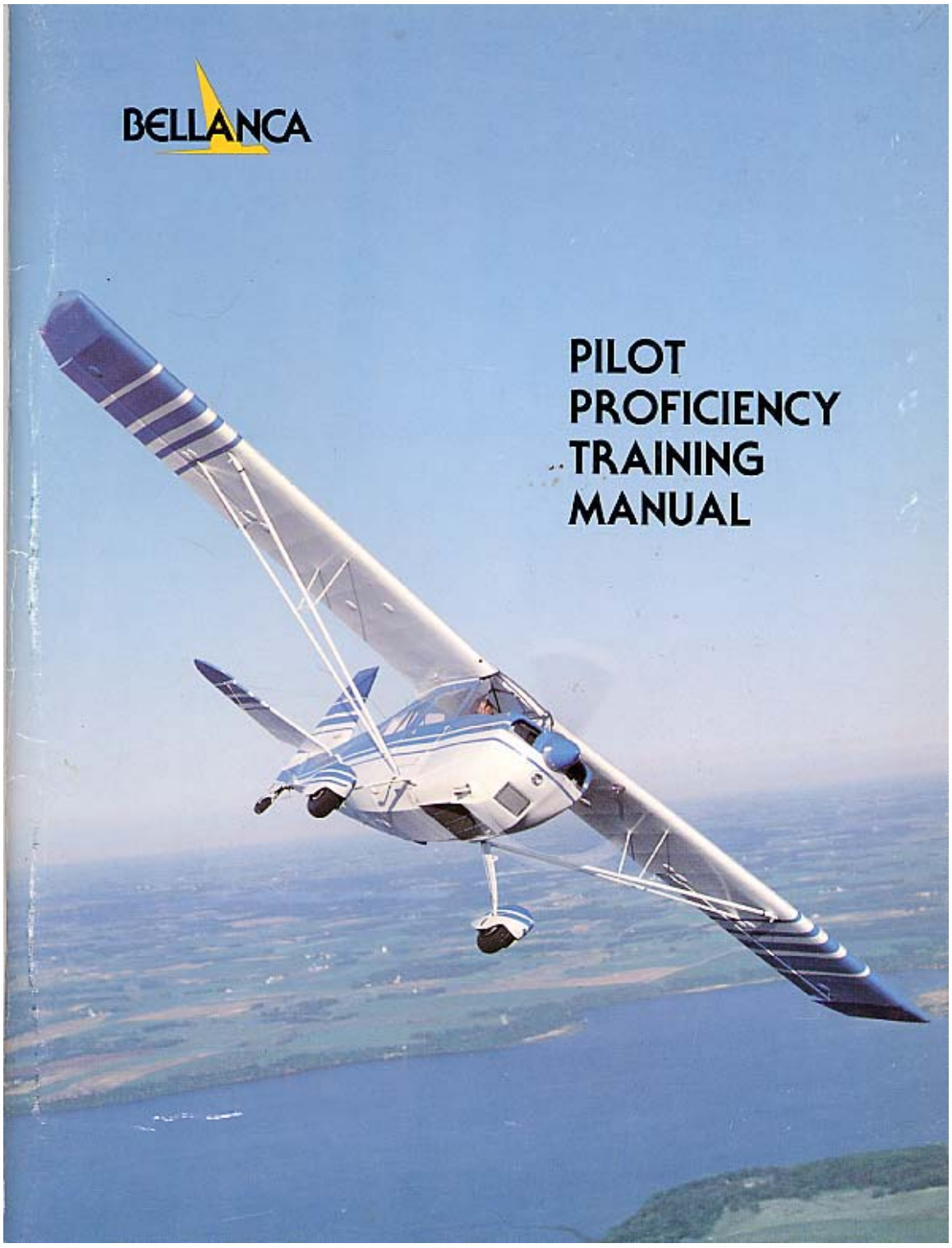
BELLANCA

PILOT PROFICIENCY TRAINING MANUAL



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Bellanca Introduces Its Pilot Proficiency Training Program and Debbie Gary

Bellanca Aircraft Corporation is pleased to make available its Pilot Proficiency Training Program. Its principal goal is to make you a safer and better pilot. We also hope that you will become aware of the potential enjoyment of sport aviation and of the role our Citabria and Decathlon aircraft can play in enhancing your pilot skills; though these goals are secondary to your greater safety through broader knowledge and increased skill levels.

Bellanca is particularly fortunate in having Debbie Gary as the author of this program. Having devoted the last seven years entirely to aerobatic flying, Debbie is one of the best known and most widely acclaimed airshow pilots in the world today. She is an outstanding solo and formation aerobatic performer, and an experienced aerobatic instructor. Her total flying time is more than 5,000 hours, and she has a commercial license in gliders, single engine land and seaplanes and multi-engine land and seaplanes, and instructor's ratings for both gliders and powered airplanes.

Her first aerobatic demonstration was in a Citabria with Jim Holland Airshows. She later was selected from among 40 applicants from all over the world to fly the slot position in one of the four Pitts comprising the Canadian Carling Aerobatic Team, and still later she flew the left wing position on the world's only civilian jet aerobatic team, the Bede Jet Team. Since then, she has been flying solo aerobatic shows all over North America. In 1977 Bellanca engaged her to fly its Super Viking, to do public relations work at airshows, and to assist on its Citabria training program.

As Debbie indicates, **this course should only be taken with a Certified Flight Instructor who has qualified to instruct for Bellanca's Proficiency Training Program. Bellanca in no way warrants the use of the course except under these terms, for the proficiency purpose for which it is intended, and in a Bellanca Citabria or Decathlon that has been properly maintained and is operated under appropriate flight and weather conditions.**

Given this combination, you have the opportunity to gain flying confidence by being more familiar with your airplane in unusual—and perhaps unexpected-attitudes.

Have a safe and enjoyable flight!

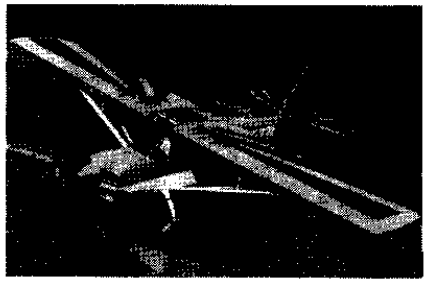
I. WHY BELLANCA'S PILOT PROFICIENCY TRAINING PROGRAM?

Our Two Unique Trainers

The uniqueness of the Citabria and Decathlon as trainers has enabled Bellanca to design this special proficiency course to teach you to fly taildraggers, and to learn to control an airplane through all possible flying attitudes.

Both are sturdy, maneuverable airplanes with tandem seating, control sticks, tailwheel steering, and aerobatic capabilities. Their engines range from 115 horsepower in one of the Citabria models to 180 horsepower in one of the Decathlon models. With its symmetrically shaped airfoil and inverted fuel and oil systems, the Decathlon is capable of more advanced aerobatic maneuvers than the Citabria. Either airplane can be used for the training on this course, but for the sake of simplicity, model references will be to the Citabria.

CITABRIA



SUPER DECATHLON

Why Taildragger Flying?

One out of four airplanes flying today is a taildragger. At one time, before modern nosewheel steering was invented, all airplanes were taildraggers. Today this configuration is still the choice of designers and manufacturers who are interested in its specific advantages.

It is used on airplanes that need to operate in tight spots on the ground. The full swiveling tailwheel allows taildraggers to pivot around one wheel in a space the size of their wingspan. Taildraggers can operate on rough terrain with less hazard because their three

point attitude allows more clearance between the ground and the propeller. For these reasons, the tailwheel design is still used for bushplanes, agricultural airplanes, glider towplanes, and for other airplanes in which ground clearance and maneuverability are essential.

The entire tailwheel steering mechanism is much smaller, lighter and less complicated than the nose wheel steering unit. This has made it more desirable for airplanes in which the lightest weight and the greatest performance are required, such as competition racing and aerobatic airplanes.

Whether you dream of competitions in the Decathlon, War Bird flying in the Spitfire, a trip to your hunting camp in a Scout, or an air taxi job in a DC-3, the first step you need to take is mastering the taildragger.

The Citabria will start you on your way into that world filled with hundreds of exciting new and old airplanes that you've never been able to fly before.

Why Loop, Roll and Spin?

Although this course uses the Loop, Roll and Spin to teach you **All Attitude Orientation**, it is **not** intended to be an aerobatic course. The intent is to teach you to be oriented and in control of your airplane while flying in any attitude. The Loop will take you through all possible pitch attitudes, and a speed range from above cruising to below stalling. The Roll will take you through 360 degrees of bank, and will teach you to recover from inverted flight. The Spin will teach you the outcome of excessive yawing, minimum altitude loss recoveries, and will help you prevent accidental spins.

When you can do these three maneuvers well enough to see, analyze and understand the mistakes that are part of learning them, you will have gained a lot of insight into what you and your airplane can do. This will enable you to remain in control in situations that previously would have disoriented you.

The Purpose of This Manual

This manual is a training aid to be used as a **supplement** to flight instruction from a **Bellanca approved Instructor.** No matter how complete a manual is, it cannot replace the flight instructor.

Only a qualified flight instructor can:

- Analyze what you are doing right or wrong on each flight
- Give you constructive encouragement to help you progress
- Answer questions that are not in the manual
- Show you how the maneuver will look when you do it right
- Take control when you need help

The purpose of this course is to make you a safer, more aware pilot, and that means that **you must have flight instruction from a qualified instructor.**

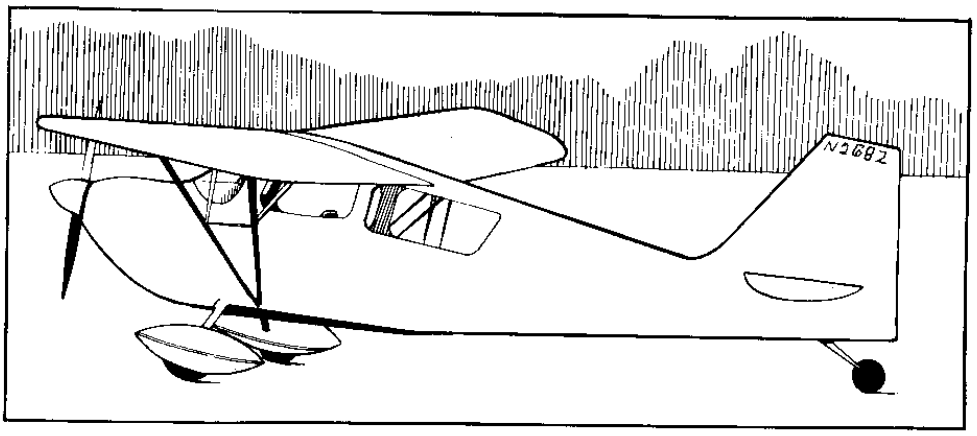
II. TAILWHEEL CHECKOUT

COCKPIT FAMILIARIZATION

Beginning Your Checkout

You should begin your checkout in the Citabria by reading the Pilot's Operating Handbook. There you will find the recommended preflight checklist, starting procedures, operating limitations and other information pertinent to the model that you will be flying.

When you make your preflight inspection, refer to the handbook and pay close attention to the things that are new to you.



Three point attitude.

On the Ground

As soon as you climb into the front seat, determine whether seating height and distance from the rudder pedals are appropriate. Make sure you are close enough to the rudders so that you can get full rudder travel with your knees still bent. If you have to stretch your legs and move your hips for full rudder travel, you will limit critical reaction time on the rudders. If you need to put extra cushions behind you, make sure that you can still pull the stick all the way back without hitting your body, the person in the back, or either of the seats.

When you are comfortable with your seating, look around the cockpit to locate guages and switches. Then note some of the things that are new to you- for instance, the tandem seating, the control stick, and the Citabria's three point attitude.

Tandem Seating

Tandem seating has lots of advantages. The most obvious one is that your view is equally good out of either side of the airplane—no more looking around the instructor to clear traffic, or to find references on your right side.

Being on the airplane's centerline makes runway alignment and your corrections easier. You don't have to visually compensate for sitting off to one side. When the airplane looks straight, it is straight.

Having the instructor in the backseat has another advantage. He or she is less obvious back there. This will make you feel less self conscious and you'll take the initiative faster. Quite naturally, this will make you progress faster.

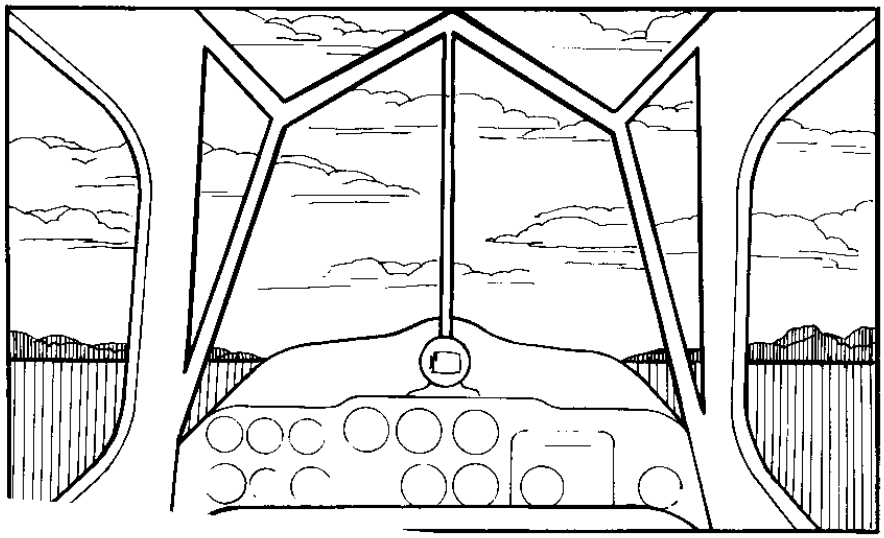
Control Stick

Another experience that will be new to most tricycle gear pilots will be flying with a stick. Although you might imagine that this is going to seem awkward, you'll soon find it isn't. It's less like driving and more like flying. The stick most naturally correlates the pilot's action to the airplane's reactions. The control stick appears to extend through the intersection of the airplane's control axes, and toward the direction in which the airplane responds.

You may also be delighted to find that the throttle is on the left, allowing you to fly with your right hand.

Three Point Attitude

Unlike a nosewheel airplane, the Citabria sits on the ground in its landing configuration. You should sit in the Citabria for awhile **before** you start the engine and visually absorb the landing height and nose attitude picture. **Remember this attitude.** It will speed up your landing checkout.



The view from the cockpit.

TAXIING

Basic Technique

After you've looked around the cockpit, checked your seating arrangement and memorized the landing picture, fasten your belts, start the engine and let's see what's so different about tailwheel flying.

If your instructor doesn't help you with the first moments of taxiing, you'll know immediately!

One of the Citabria's great advantages is the ease with which it turns on the ground. This same fact may be disarming at first. All taildraggers require more attention when you first learn to taxi them. Unlike stiff nosewheel steering, the tailwheel can move freely and can turn rapidly.

There is no trick in learning to taxi, but you must use total concentration. Concentrate on the nose. Do not let it turn, even the slightest amount, unless you want it to. Otherwise, you'll soon discover that any unchecked turning or swinging will not only continue on its own, but will accelerate as the tail gains momentum.

Before your first flight, practice taxiing on the ramp or taxiway. Taxi slowly. When you can, keep the airplane straight. Practice turns. Watch the rate at which the nose of your Citabria turns. After you have initiated the turn with the rudder, gently use some opposite rudder to keep the turn rate from accelerating. If the turn rate does accelerate, use lots of opposite rudder to slow or stop the turn, and brake if necessary. However, don't develop the bad habit of overusing the brakes in turns.

Preventing a Ground Loop

One of the hazards of taxiing too fast, or turning too fast and relying on brakes to stop a turn, is the ground loop. One of the forces in a turn, even on the ground, is centrifugal force, which pushes to the outside of a turn. The faster the turn rate, the greater this force. On the ground, where the airplane doesn't bank into the turn, this force can tip the airplane toward the outside of the turn. Using that brake could worsen the situation and the airplane could tip more in that direction until the wing touches the ground. A blast of power may help straighten things. The answer, of course, is prevention. Pay attention! You don't need to ground loop.

Windy Days

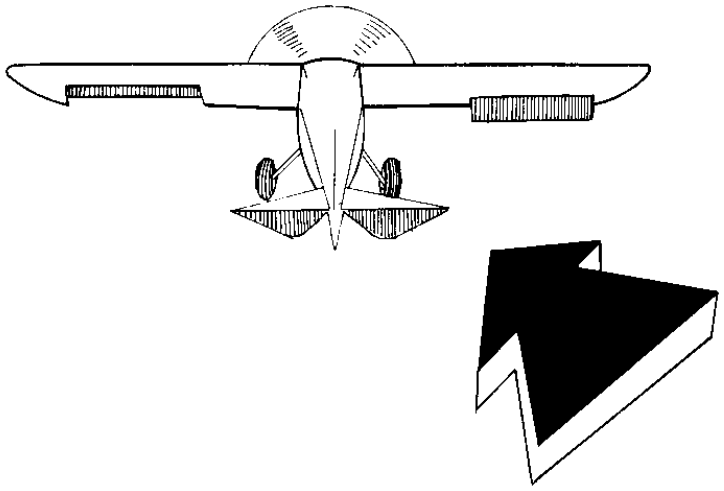
If you're flying on a windy day, you'll discover several other things.

The vertical surfaces of any airplane tend to make it weathervane, or turn into the wind. This is more noticeable with a tailwheel airplane, and can make crosswind taxiing difficult.

If there were more weight above the tailwheel, it would be more effective. You can't increase the tail's weight, but you **can** increase the downward force on it if the wind is blowing across the elevators. Therefore, when taxiing with the wind on the nose, keep the elevators **up.** With the wind behind you, put the elevator **down** to help increase the tailload.

Besides causing weathervaning, a strong crosswind can also lift a wing while you're still on the ground. Position the stick to keep the upwind wing down. If the wind is directly off to the side, or slightly to the front, hold that aileron **up** with your stick in that direction. This is probably common sense to you. However, when taxiing with a strong crosswind behind you, you need to call on either your memory or your imagination to figure out what

best keeps the wing down. With the crosswind behind you put the aileron **down** on the windward side, by holding the stick in the opposite direction.



Control positions while taxiing with quartering tail wind.

There are several ways to imagine or remember this rule. Visually, you can imagine the wind pushing down on the back of the down aileron, or you can mechanically think of holding the stick as though the wind were blowing it downwind. If the wind is from the right rear, hold the stick to the left front.

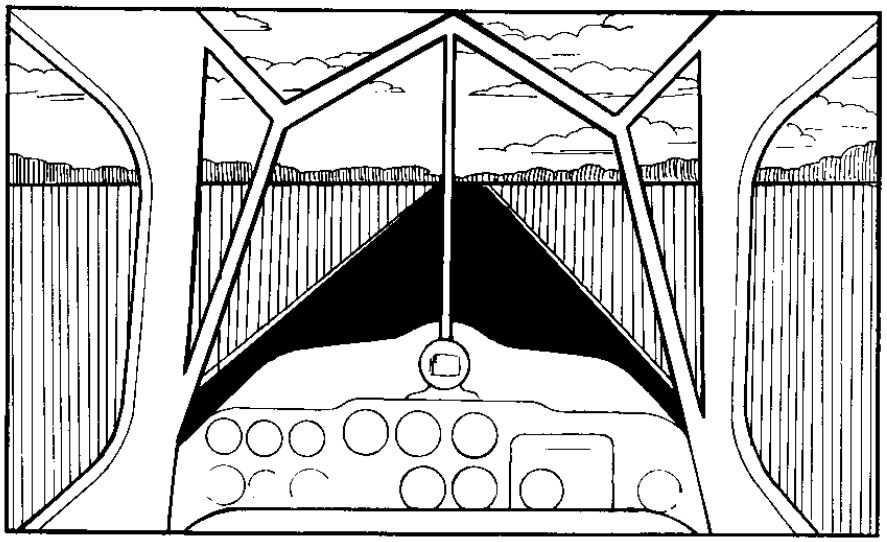
This rule applies to both nosewheel and tailwheel airplanes.

TAKE OFF

In all single engine airplanes, certain elements are standard on takeoff:

1. Feed in full power smoothly, using right rudder to counteract torque.
2. Stay on the centerline by aligning the nose of the airplane with some distant object at the end of the runway.
3. Just above stall speed, lift the nose off and climb out at the appropriate airspeed.

These same factors apply to a taildragger's takeoff. There are only two other items to consider—raising the tail from three point to level attitude, and getting used to rudder reaction during acceleration.



The view on takeoff.

Raising the tail to a level attitude reduces aerodynamic drag and allows the airplane to accelerate faster. This requires some forward pressure on the stick as the airplane picks up speed. Watch the airplane's reaction when you do this. If you are alert, you'll notice that as you move the stick forward and the nose goes down, the airplane will have a tendency to yaw to the left. Counteract the yaw with right rudder. This yawing is primarily due to gyroscopic precession. A fast turning propeller acts like a gyro. If you apply a force from the back by pushing on the stick, it will precess and yaw the airplane to the left. Pulling on the stick will yaw it to the right.

This is true in any airplane with a propeller, but is primarily noticed in taildraggers on takeoff, or in aerobatic airplanes on high G pullups.

The more smoothly you raise the tail, the more easily you can counteract this yawing with a small amount of right rudder.

Rudder Response

The rudder's responsiveness will increase throughout the takeoff roll. Consequently, what was the appropriate amount of rudder for your corrections at the beginning of the

takeoff roll will be too much as the airplane accelerates. Try to keep the airplane on the centerline. If you start to wander off to one side, stop the drift, but don't panic. The nose may only be a few degrees to the right or left. Use just enough rudder to make the nose parallel to the centerline. When you are ready to move the airplane back onto the centerline, do it with a **small** heading change so that another small rudder correction the other way will align you on the runway.

On your first few takeoffs, stopping the drift and trying to parallel the centerline may be all you can cope with. Intentionally moving right or left requires anticipation—knowing how much opposite rudder will straighten the nose down the runway again.

Typically, a tailwheel trainee will let the airplane wander before noticing the alignment isn't perfect, then will rush to straighten things out with too much rudder one way and then the other. The result is a series of swerves and tire squeals!

After a few exciting takeoffs like this, you may become so tense that you'll unknowingly lock both legs on the rudders and push one foot against the other in struggle for control.

Naturally, it takes time to learn the airplane's control response, but the fastest way to a successful takeoff is to concentrate on the **exact** direction of the airplane's nose. If you find yourself swerving from side to side and scaring yourself, chop the power, bring the tail back down, brake smoothly, then taxi back and start again.

Lift Off

Lift-off in the Citabria occurs between 45 and 50 mph, and is basically the same as for other airplanes you've flown. Gently apply back pressure to rotate the nose from your level, two-wheel attitude to the appropriate climb attitude. Your best rate-of-climb airspeed in the Citabria is 69 mph. Best angle-of-climb speed is 58 mph, and best cross country climb is 75 to 80 mph. Use whatever is appropriate.

ATTITUDE AWARENESS

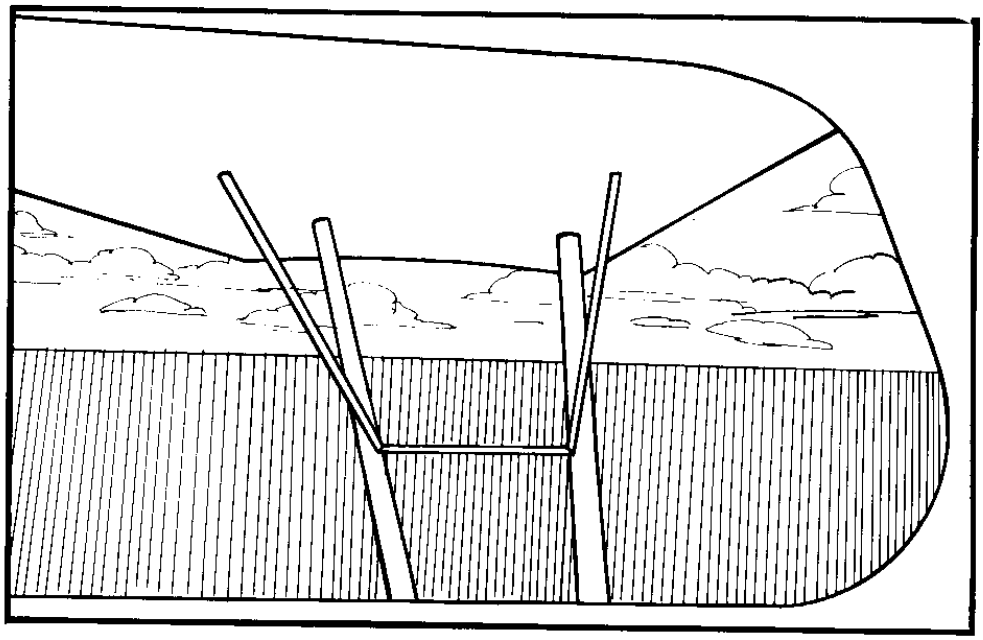
Climbout

Use the time climbing to altitude to begin practicing "attitude awareness". Learn exactly what nose attitude gives you climb airspeed at full power. Then look at your wings. The bottom of your wingtip will form a climbing angle with the horizon, one that you can learn for reference.

Another useful exercise will be to check to see that your wings aren't banked. When they are level, look at the nose again. Without looking inside at the slip ball, you can tell how much right rudder you need during the climb. That is, just enough to prevent the nose from yawing, or skidding to the left during your wings-level climb.

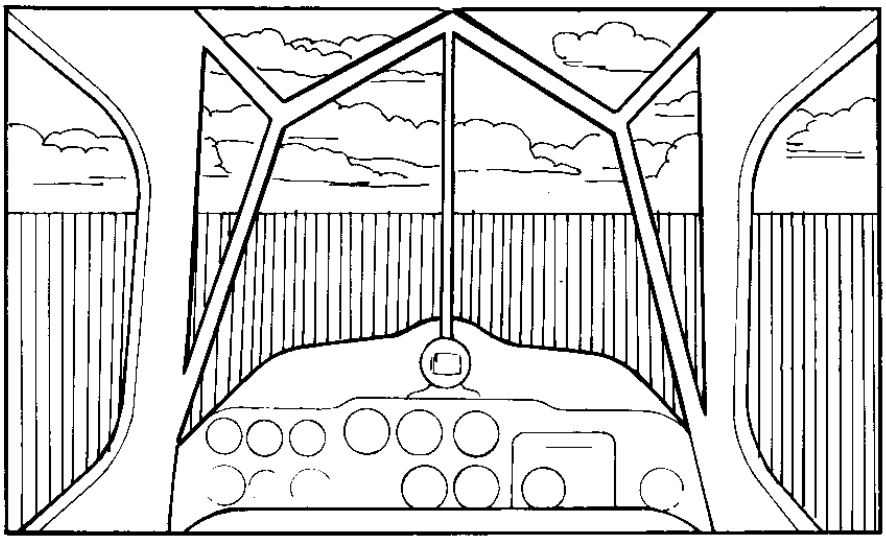
Level Flight

Leveling out at altitude, apply the lesson you started during the climbout. Check the attitude of the bottom of the wing on the horizon. This is the fastest way to determine the correct picture for level flight in any new type of airplane you fly.



Level flight side view.

Think about that. The wing is set on the fuselage in all airplanes at just a small angle of incidence, so the angle between the wing tip and the horizon in level flight will not vary greatly from type to type. On the other hand, the relationship between the top of the nose and the horizon in front does vary greatly from type to type, depending on the slope of the cowling. You'll save yourself a lot of time in leveling out if you check your wing picture, and then correlate it to the nose attitude picture.



Level flight front view.

TURNS

When you are satisfied that you have the correct picture of level flight, practice some turns, learning how the picture changes in differing banks.

Rolling In

Check for traffic in your desired turn direction each time; then focus your attention back on the nose as you roll into the turn. Do not let the nose yaw as the roll-in begins. Concentrate on rudder usage during the roll-in. The amount you need will vary with your airspeed. When you're accustomed to how much rudder is required, try the same thing while looking at either wingtip. You can see adverse yaw there, too. The wing should move straight down or straight up on the roll-in and the roll-out. If you haven't used enough rudder, you'll see the downward moving wing also move forward, or opposite the turn direction, as it goes down. If you use too much rudder, it will yaw backwards. Pick a reference on the ground as a check to make it easier to see.

Rate of Turn

During the turn itself, keep the slip ball in the middle and then concentrate on seeing your rate of turn outside. That is, watch the rate at which the nose moves around the horizon. At a given airspeed and bank, you will have a certain rate of turn. You're undoubtedly used to checking a turn needle on the instrument panel to see this. It is also visible on the nose. Just look for it. You won't be able to say that what you see is exactly three, or five, or any number of degrees of turn per second, but you will get used to seeing what will become familiar rates of turn at various bank angles. You will also become more aware of the effects of correct and incorrect rudder usage.

Seeing Slips and Skids

Add rudder into the turn, and you will see the rate of turn momentarily speed up as the airplane skids. Then go back to the correct amount of rudder, checking the ball. Watch that rate of turn again for awhile. Then add some opposite rudder and watch the rate of turn slow up as you slip in your turn.

While you are getting used to seeing how the bank and rudder usage affect your rate of turn, experiment with back pressure. Set up a steady turn. Let the nose go around the horizon for awhile, then increase the back pressure to increase your rate of turn. If your bank starts to steepen, counteract that with your ailerons. If you pull too hard, you will feel the nibble of the stall buffet. As you know, that means letting off the back pressure.

The point of the rudder and elevator exercises is twofold. First, and most important, they will make you much more competent at maneuvering your airplane safely when your attention needs to be outside the cockpit looking for traffic or when you are close to the ground. Second, they make you much more aware of your total airplane and enable you to fly more aggressively when that is appropriate. Instead of rolling into a turn and waiting for the nose to come around, you will be more aware that you should be pulling the airplane around the turn with your elevator.

SLOWFLIGHT

Slow flight means just what it says—flying at slow speeds. It usually refers to flying just above stall speed to learn how the airplane reacts there, how much control movement is required to make the airplane respond, and how easily the airplane can be stalled with rough control movements.

Slow flight is an important maneuver in a check-out in any new type of airplane. It is part of exploring the range of speeds at which the airplane can be flown and, more importantly, it prepares the pilot for maximum control during landings. During final approach, the airplane is flown at slower speeds. You need to know ahead of time just how much control movement will be required to maneuver. Then, during the touchdown phase, the speed drops off even more. On a gusty day, much maneuvering may be required for control. Slow flight is the best preparation for that. If you've practiced it, you are better able to make the correct reaction to gusts immediately—not too little control movement, which would make the reaction slow, and not too much control movement, which might stall the airplane.

To practice slow flight in the Citabria, as with any new airplane, start with a speed below the speed you use for climbing; then when you can handle that comfortably, try a speed five or ten miles slower. Keep practicing slower and slower speeds until you reach a speed that is too slow, which is power-on stalling speed. Doing it in increments, and practicing each one for a while, teaches you more than just immediately going to the slowest speed would.

One of the significant things to learn in a new airplane is just how quickly the control response drops off. Is there a speed below which it suddenly becomes harder to control, or does the speed drop off slowly? How much more or less power does it take to hold the slower speeds? Explore a little bit. Books usually say that you shouldn't use more than a ten degree bank for turns. Is this really true? Maybe not. Or, maybe not until you are just on the edge of a stall with the wings level. If you do get sufficient practice in very slow, slow flight you will increase your proficiency tremendously. You will be able to maneuver at slow landing speeds with a sensitivity that you can't gain any other way.

The Procedure

To begin slow flight practice, clear the area to assure that there is no converging traffic that you won't be able to see when you are flying with your nose up. Smoothly pull the throttle all the way back, and gradually begin raising the nose to hold altitude while reducing the speed. As you approach your intended slow flight speed, begin feeding in the power. When the speed and power are stabilized, try turns.

Recovery to Cruise

The recovery process from slow flight back to level cruise, is the same procedure that you have used in other airplanes. Apply full power, then lower the nose gradually to prevent the airplant from climbing. When the airplane is accelerating in level flight, bring the power back to a cruise setting.

STALLS

Slow flight and stall practice go hand-in-hand. It is important to know how the airplane feels as it approaches the stall, and then when it has recovered. Stalls are practiced so that they can be prevented, and so that you can make the best possible stall recovery. This requires that you know all the factors that indicate the stall's approach—the changing sounds, the changing control response and the shuddering or buffeting of the wings. Likewise, it is essential that you know exactly when the stall has recovered, and exactly when and how quickly to raise the nose again to stop altitude loss.

For stall practice you may be accustomed to raising your nose a certain distance above the horizon, where the airplane is obviously going to stall, then lowering the nose to a point where it is obviously going to recover. To teach yourself more about stalls, do some experimenting. If you always raise your nose high for stall practice, you begin to feel that it has to be way up there for the airplane to stall. So, find the minimum nose high attitude at which the airplane will do a power-off stall. At this attitude it will take longer to stall. You will have more time to note the changing feel of the controls and the changing sound of the airflow. Consequently, you are less likely to be surprised in the future.

In addition, find out just how little you have to lower the nose to accomplish the recovery. This will affect how much altitude you lose. As with the stall entry, you already know that if you put your nose way down, the speed is going to build up and that your airplane is going to recover from the stall. The point, however, is not whether it will recover, but **how much altitude you lose in the process.** If you can become sensitive to exactly when your stalled wings are flying again, you can stop the airplane's descent sooner. Often pilots do not learn enough about stall recoveries. They raise the nose, listen to the aural stall warning, push the nose back down and let the speed build up so that they can raise the nose quickly without the dreaded 'secondary stall'. That's it. Two or three hundred feet of altitude loss doesn't seem like much, but it is when the ground is only two or three hundred feet below you.

Apply the same learning techniques to stall practice that you applied to landing practice when you were a student. First, you probably waited too long to begin the flare so you "flew the airplane into the ground" and bounced. On the next step you remembered to flare, but too suddenly, so the airplane ballooned up and dropped in. Not good enough. Your next correction probably resulted in flaring too high, and you still dropped in. So you tried to flare a little lower so the drop was a little less, and then a little less, until you were making a perfect landing that felt good and was good. The point is that when you follow one mistake with another opposite mistake (which is actually an exaggerated version of a correction), you must keep modifying your corrections until you have narrowed down the error and bracketed the proper technique.

Minimum Altitude Loss Recovery

The perfect stall recovery technique minimizes altitude loss. In order to achieve this, you must not raise the nose too soon or too suddenly, but you also must not leave the nose down any longer than is necessary. When you practice these recoveries, try to set each one up the same way so that when you change something in the recovery you get a true picture of its effect.

On your first stall, raise the nose to a predetermined point with the power all the way back. As the speed decays, the nose will start to drop. Don't let this happen. In order to get a full stall, keep increasing the back pressure at just the rate that is required to hold the nose on your point. At the stall, you will have reached full back pressure but won't be able to keep

the nose from dropping. If the nose was high, this speed decay will be rapid and the drop will be sudden. With the nose low, the speed decay and pitch change will not be sudden.

According to the way the airplane is designed and loaded, the nose of the airplane drops so that it recovers from the stall by itself. At the instant of stalling, your elevator is no longer controlling your pitch. As the airplane accelerates past stall speed, it is flying again and will react to the elevator. If the elevator is still all the way back, the nose would then come up above the horizon to a point at which it would stall again. You already know this from past experience and you have learned to recover by either releasing the back pressure or by pushing the stick forward. The best technique is simply releasing the back pressure. If the elevator isn't effective at the instant of stall, pushing it forward won't speed up the recovery. In fact, a large, abrupt movement of any of the control surfaces creates drag which slows the airplane up and consequently slows up the recovery process. The fastest way to help the airplane to accelerate is to smoothly release the elevator pressure rather than to push it. Full power should also be applied at the same time that the back pressure is released.

If you truly want minimum altitude loss, you must raise the nose back to level and then into a climb as soon as possible. This means you must find out just how soon you can apply back pressure again and get a reaction. Too soon or too sudden a movement will cause a secondary stall, but you should learn just what is too soon, or too sudden. Too late or too slow a movement aren't good either. The longer your nose is down, the more altitude you lose. The key is in the patient, bracketing process, remembering each time what you did the last time. Eventually you will develop a sensitivity to exactly when the airplane is unstalled and controllable again. Remember that 'minimally controllable' still means controllable if you have developed your stall and slow flight sensitivity.

An important point that must be stressed here is that the airplane does not actually stall because it is going too slow. It stalls because the angle of attack, or angle at which the airflow hits the bottom of the wing, is too great. The airspeed, thrust of the propeller, and load on the wings all effect the angle of attack, but it is the angle of attack alone that determines whether or not the airplane is stalled. In the flying you have done for your private or commercial license this has, no doubt, been stressed, but for the sake of emphasis, it is worth reviewing in your Bellanca Proficiency Course.

Power On Stalls

After you have done the power-off stalls and noted the indicated stall speed, do power-on stalls. The speed will be lower because the propeller's thrust helps carry some of the airplane's weight, and the slipstream over the wing root delays the beginning of the stall there.

The recovery procedure for the power-on stall is the same as for the power-off stall. Lower the nose and add full power, if you don't already have it on. One difference will be that you may have to use more rudder to keep the airplane straight as the nose drops because of the airplane's reaction to torque.

Loading and Accelerated Stalls

An airplane's listed stalling speed generally refers to the speed at which the airplane will stall at gross weight and one G force. If either of these factors are changed, the stalling speed will change. Lighter weights or lower G forces cause lower stalling speeds, and heavier weights or higher G forces cause high stalling speeds. From flight to flight, you may note some variations in stall speed depending on how you load your airplane and how much fuel you have in the wings.

the nose from dropping. If the nose was high, this speed decay will be rapid and the drop will be sudden. With the nose low, the speed decay and pitch change will not be sudden.

According to the way the airplane is designed and loaded, the nose of the airplane drops so that it recovers from the stall by itself. At the instant of stalling, your elevator is no longer controlling your pitch. As the airplane accelerates past stall speed, it is flying again and will react to the elevator. If the elevator is still all the way back, the nose would then come up above the horizon to a point at which it would stall again. You already know this from past experience and you have learned to recover by either releasing the back pressure or by pushing the stick forward. The best technique is simply releasing the back pressure. If the elevator isn't effective at the instant of stall, pushing it forward won't speed up the recovery. In fact, a large, abrupt movement of any of the control surfaces creates drag which slows the airplane up and consequently slows up the recovery process. The fastest way to help the airplane to accelerate is to smoothly release the elevator pressure rather than to push it. Full power should also be applied at the same time that the back pressure is released.

If you truly want minimum altitude loss, you must raise the nose back to level and then into a climb as soon as possible. This means you must find out just how soon you can apply back pressure again and get a reaction. Too soon or too sudden a movement will cause a secondary stall, but you should learn just what is too soon, or too sudden. Too late or too slow a movement aren't good either. The longer your nose is down, the more altitude you lose. The key is in the patient, bracketing process, remembering each time what you did the last time. Eventually you will develop a sensitivity to exactly when the airplane is unstalled and controllable again. Remember that 'minimally controllable' still means controllable if you have developed your stall and slow flight sensitivity.

An important point that must be stressed here is that the airplane does not actually stall because it is going too slow. It stalls because the angle of attack, or angle at which the airflow hits the bottom of the wing, is too great. The airspeed, thrust of the propeller, and load on the wings all effect the angle of attack, but it is the angle of attack alone that determines whether or not the airplane is stalled. In the flying you have done for your private or commercial license this has, no doubt, been stressed, but for the sake of emphasis, it is worth reviewing in your Bellanca Proficiency Course.

Power On Stalls

After you have done the power-off stalls and noted the indicated stall speed, do power-on stalls. The speed will be lower because the propeller's thrust helps carry some of the airplane's weight, and the slipstream over the wing root delays the beginning of the stall there.

The recovery procedure for the power-on stall is the same as for the power-off stall. Lower the nose and add full power, if you don't already have it on. One difference will be that you may have to use more rudder to keep the airplane straight as the nose drops because of the airplane's reaction to torque.

Loading and Accelerated Stalls

An airplane's listed stalling speed generally refers to the speed at which the airplane will stall at gross weight and one G force. If either of these factors are changed, the stalling speed will change. Lighter weights or lower G forces cause lower stalling speeds, and heavier weights or higher G forces cause high stalling speeds. From flight to flight, you may note some variations in stall speed depending on how you load your airplane and how much fuel you have in the wings.

The most variable stalling speed factor on any one flight is that caused by changes in G forces. When you try stalls in turns, you will be pulling back on the elevator and increasing the load on the wings, and you will note that the stalling speed will be higher than when the wings were level. The harder and more abrupt your pull is, the faster the airspeed will be when the airplane stalls. This is called the accelerated stall. In the second half of the course, in preparation for loops, it will be a good idea to review this again.

The lesson to be learned in the accelerated stall is showing yourself that the airplane can stall at high speeds. In fact, it can stall at any speed, if you move the elevators too suddenly. What happens is that the attitude of the airplane will change, but its flight path will not. The relative wind which had been hitting the bottom of the wing at a narrow angle suddenly hits it at a large angle. At this large angle the air will not flow over the top of the wing and the airplane will stall.

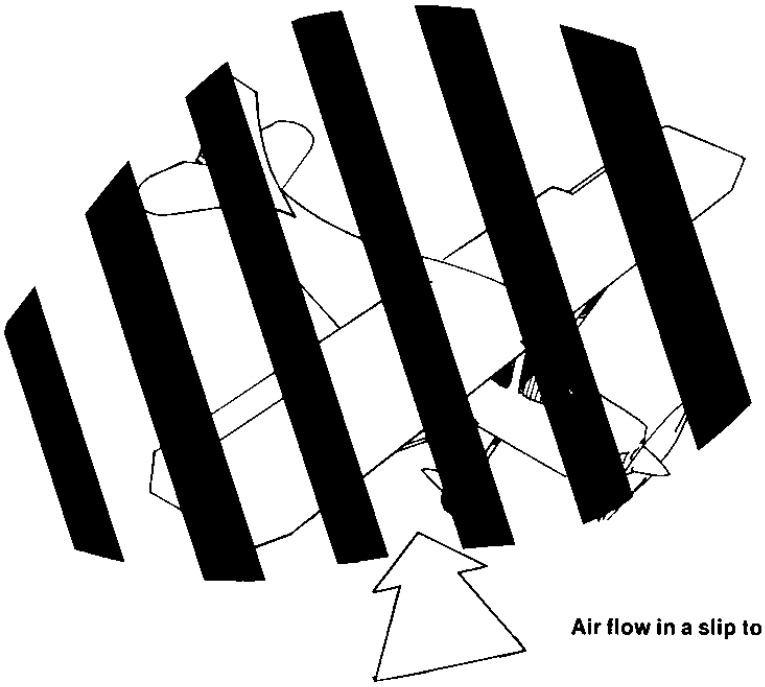
The recovery can be made in the turn or with the wings level. The important point is learning how much to release the back pressure to "unload" the wings for recovery. Just as you experimented to learn how little to lower the nose in the straight ahead stall, experiment here to find out just how much to release the back pressure in the recovery.

Understanding the stall in such a way that you respect it but do not fear it, and do not overreact to it, may be one of the most important things you will learn on this course.

SLIPS

The slip is an important maneuver to review for your proficiency in general, and specifically for your training in the Citabria. It is a means of moving sideways through the air to create drag. Thus, it is a useful way to lose altitude without gaining airspeed. Some of the Citabria models, like all of the best aerobatic airplanes, are built without flaps, so slipping takes the place of flap usage on final approach. Another application of the slip is to keep any type of airplane going straight during a crosswind touchdown.

To slip the airplane means to hold the wing down with the aileron while preventing the airplane from turning in that direction with opposite rudder and some forward elevator. Books and instructors often categorize slips as "forward" slips and "side" slips, but these names are somewhat arbitrary and therefore confusing. What is important is that you know how to control the slip and when to use it.



Air flow in a slip to the right.

For Altitude Loss

If the slip is to maximize your rate of descent, you want to create as much drag as possible. This means you want to put the wing down as far as you can without turning. The key word here is **turning.** You can do the slip in a turn, but most often it is used on final approach, when the objective is to have the flight path aimed straight down the runway. Your limiting factors are how much rudder you have and what speed you want to maintain.

When you practice your slips at altitude, find out how far you can put the wing down and still prevent the airplane from turning with your rudder. Forward elevator also stops the turn, but too much of it increases your speed. Also note that your flight path is no longer in the direction that your nose is pointed. It is toward your low wing. Using a road or some straight ground reference aligned with the wind as a reference, note the angular difference between your flight path and the position of the nose at your intended approach speed.

If you can remember what this angle looked like, you can use it when you are turning from base to final on a high approach. Stop the turn onto final and start the slip with your nose at this same angle to the centerline of the runway by applying opposite rudder. If you didn't realize that you were too high before you rolled onto final, smoothly turn the nose this angular distance off to one side and then lower the wing toward the runway to slip.

It is important that your roll into the slip is smooth and controlled. Whatever you do, don't skid the nose over to one side with the rudder. That is sloppy and unnecessary. Also, pay close attention to your flight path during the slip. You will discover that the wind will affect your slip. A strong headwind steepens any approach because it limits your forward movement during your glide. You will also discover that if there is a crosswind, you must slip into the wind to maximize your descent. If you slip downwind, you will find that you can't put your wing down very far without moving in that direction, unless you put a crab angle in along with the normal angle between the nose and runway during a slip. This is pointless, because it means more turning and more work during the rollout from the slip. If you put the wing down into wind, you won't have to move the nose as far on the rollout; and therefore your control is greater.

Since your rate of descent is high during the slip, be sure that you recover from it in time to reduce it to a rate appropriate for a comfortable touchdown.

For Crosswind Landings

The slip that is used for crosswind touchdowns is a means of keeping the flight path and landing gear pointed straight down the runway. Most of the final approach may be flown using a crab angle headed into wind to make the airplane track straight down the centerline, but the nose and flight path must be going the same way prior to touchdown. If they aren't, the sideloads on the gear could damage the airplane. To use this type of slip, lower the wing into wind just enough so that the sideways movement of the slip counteracts the drift effect of the crosswind. Keep the longitudinal axis of the airplane lined up exactly with the runway centerline with the rudder. Continue to hold this slip during the touchdown, until the speed of the airplane has dropped off to a point where the wing cannot be held down into wind.

LANDING

Basic Principles

The final maneuver in the first half of your course will be the landing. The principles of landing are basically the same in all single engine airplanes.

1. Fly a rectangular pattern that is neither too large or too tight, depending on how quickly your airplane slows up to landing speed and how far it glides.
2. Begin to reduce your airspeed soon enough so that you can roll out on final approach with the nose trimmed to stay at the correct landing speed.
3. Make your final approach aimed straight down the runway, adjusting for headwinds or crosswinds. If there is a headwind, remember that there is often a wind shear near the ground that will cause a momentary drop in airspeed and an increased sink rate for which you may have to compensate. If there is a crosswind, stop your drift by either crabbing or slipping into the wind.
4. Find what nose attitude gives you final approach speed, then use that attitude picture. To control your angle of descent, pick the spot on the runway that you are aiming for and keep it moving away from you or toward you by making power, speed or slipping adjustments.
5. Flare just above the runway, allowing the speed to drop off and increasing the back pressure until the airplane gently settles onto the runway.

Plus...

These components of the landing are the same in either tailwheel or tricycle gear airplanes. What is different in the taildragger is that you must concentrate more on keeping the airplane perfectly straight on touchdown, and that in addition to the normal procedure of the "full stall" landing, it is also possible to fly the airplane onto the runway with a level, or wheel landing.

The Citabria's normal approach speed is between 60 and 70. Since its best glide speed is 65, that is the most practical speed to use. Below 60, your rate of descent will be high, and above 70 your airplane will float.

Be sure that your final approach is aligned with the runway centerline. When you get close to the ground remember that you are no longer sitting on one side of the airplane's "centerline". You are now in the middle of the airplane. Visually it is easier to see that your nose is going straight down the runway, but if you are used to adjusting your vision for sitting off to one side, you will have to remind yourself of this difference a few times.

Three point wheel landing.

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Three Point Landings

When you begin the flare, try to remember the three point attitude that you saw when you sat on the ground during starting and taxiing. It is the same picture for landings; so if you can remember it, reproduce it. Be absolutely sure that the nose is pointed right down the runway and that the airplane is tracking straight. If it isn't, get used to making those necessary rudder adjustments, because a taildragger has to be straight when it touches down. You learned how easily it turns during taxiing, and how easily it swerved during takeoff, and you will relearn the same thing on landing.

Besides concentrating hard to keep it straight with the rudder, there are a couple of other things you can do that will help. First of all, hold the airplane off as long as possible. The slower the airplane is moving on the ground, the lesser tendency it will have to swing. The other thing is, hold the stick all the way back to help keep the tail on the ground. If the tail is "light", or up in the air, it will turn more easily. So keep it down!

Another reason for holding that stick all the way back is to minimize bouncing, or porpoising, on touchdown. While you are holding the airplane off, waiting for the speed to drop off for touchdown, gradually and smoothly keep moving the stick back. Just as you touch down, get the stick all the way back into your lap. If the airplane were to bounce up, this would guarantee that it will then stall completely and that it won't bounce back up again. If you leave the stick loosely forward, the airplane may start porpoising. That is to say, the nose and tail will pitch up and down pivoting around the main wheels. If you start chasing this oscillation with your stick forward and back, instead of just calmly bringing the stick fully back and leaving it there, this is **definitely** going to happen. If the oscillations increase because you are chasing them it is possible to cause the airplane to pitch over so far that you hit the propeller. This "pilot induced oscillation" is a bad situation, and completely unnecessary, so don't get into it!

As with every other maneuver, there are several key points that make up a safe, controllable landing. Keep the airplane going straight, hold it off the ground as long as you can, and bring the stick all the way back to hold the tail down. Another reminder is not to relax just because you are on the ground. Keep paying full attention to the rudder control until you are stopped and parked.

Wheel Landings

The most practical type of landing is generally the three point attitude landing, because this assures that you touch down with the least amount of speed possible. Directional control is easiest, and wear and tear on the tires are minimal.

However, there is another type of landing that is possible in the taildragger. This is the wheel landing. The airplane can be flown onto the runway in a level attitude, touching down on the two main wheels with the tailwheel in the air. Your nose attitude will be just as it was in level flight.

Some pilots prefer to use the wheel landing on days when they want to land at higher speeds, as in gusty conditions, when they feel they will have more control if they "put" the airplane onto the ground with some flying speed rather than waiting for it to settle in a three point attitude. Among tailwheel pilots, this is a source of never-ending debate. The fact is, that this is a question of pilot preference, because even on a wheel landing you have to let the airplane slow up and the tailwheel drop down at some point.

When you are training in the taildragger, there is one advantage to the wheel landing. On a 'touch-and-go', you can land in this level attitude, maintain a bit of power and hold the airplane on the ground in this attitude as you practice keeping it going straight down the runway. Then, when you are ready to take off again, you can add full power and ease the stick back. The wheel landing attitude and the take off acceleration attitude are the same, just as your taxiing and full stall landing attitudes are the same.

Two point wheel landing.

To make the wheel landing in the Citabria use a 70 mph approach speed. While you are on final approach, take a couple of quick glances out at your wingtip and you will notice that the bottom of the wing will be parallel to the horizon just as it was in level cruising flight.

In the final stage of the approach, reduce your rate of descent as much as is practical. You will find that the lighter your touchdown, the less chance there is of bouncing. Bounces on wheel landings are more common, because the airplane is in a flying attitude and has flying speed. With any assistance from a bounce, it happily goes back into the air to keep flying!

When the wheels do touch, plant the airplane firmly on the ground with some forward pressure. This also assures that the airplane won't go back into the air. However, if you do bounce and start oscillating for any reason, the best solution is to ease the stick all the way back and keep the tail down. During the roll-out after the wheel landing, keep the forward pressure on the stick until the speed has dropped off to the extent that you can no longer keep the tail in the air. When the tail goes down, then pull the stick all the way back in the same way you learned with full stall landings.

Crosswind Landings

If you have already taxied the Citabria in a crosswind, and you have experience in other highwing airplanes in crosswinds, the correct crosswind landing technique will be familiar to you.

You must touch down in a slip—that is, hold the wing down into the wind with your aileron, but keep the nose pointed down the runway with opposite rudder. Be sure that the flight path of your airplane really is down the runway, too. It is no good pointing the nose that way if you are actually drifting sideways. Do not let the airplane touch until you are sure that you are going straight.

Since you are holding one wing down, your touchdown will initially be on one wheel. Depending on your experience you may want to hold the airplane in a wheel landing attitude on that one wheel or you may find that the full stall technique with the wing down is more appropriate. In either case, use the control positions you learned for taxiing in crosswinds after the airplane has slowed up to taxi speed.

Now that you are fully checked out in the Citabria you are ready to use the airplane for a type of training that you cannot get in other basic trainers. You are ready to explore **"All Attitude Orientation".**

III. ALL ATTITUDE ORIENTATION

WOULD YOU KNOW WHAT TO DO?

Whether you've been flying for twenty years, or just a few months, you must have wondered, at least once, what you would do if you found yourself inadvertently rolled upside down, spinning low level, or in some other flight attitude that you've never seen before. Standard flight training includes recoveries from unusual attitudes, but these attitudes are seldom truly unusual. Generally the pitch is restricted to 30 degrees nose up or down, and the bank is kept to 60 degrees or less. Consequently, these pitch and roll limits become your limits. Beyond them, you're disoriented.

If your airplane were rolled over and pitched down by an airliner's vortices, you couldn't be sure of automatically making a safe and smooth recovery. The correct recovery would be to push the stick forward to raise the nose, and to apply aileron to keep the airplane rolling back to level flight. Without All Attitude Orientation you wouldn't know that. The first time a pilot is inverted and sees the nose dropping, the reflex action is generally to pull back on the stick, which causes the airplane to gain speed and lose altitude.

Without spin training an accidental spin could also put you in trouble. If you don't know that you should stop the rotation with opposite rudder and apply forward elevator to break the stall, the airplane will keep rotating vertically toward the ground while remaining stalled.

If you do know what to do, but have never practiced it, your recovery may take more altitude that it should. A slow application of the recovery controls, a secondary stall, or a prolonged dive after the recovery, all will use up altitude unnecessarily. Experience and practice in spins are your best guarantee against getting into trouble with them.

This is true of any unusual attitude in an airplane. If you have seen it, and practiced it you will know what to do to get out of it.

That is the purpose of this half of the proficiency course—to take you through all possible flight attitudes, in a controllable manner, so that you can gain experience in those situations that have previously been disorienting.

Every motion that an airplane makes is some combination of pitch, roll and yaw. The Loop, Roll and Spin will take you through all possible extremes of pitch, roll and yaw.

PITCH, ROLL AND YAW

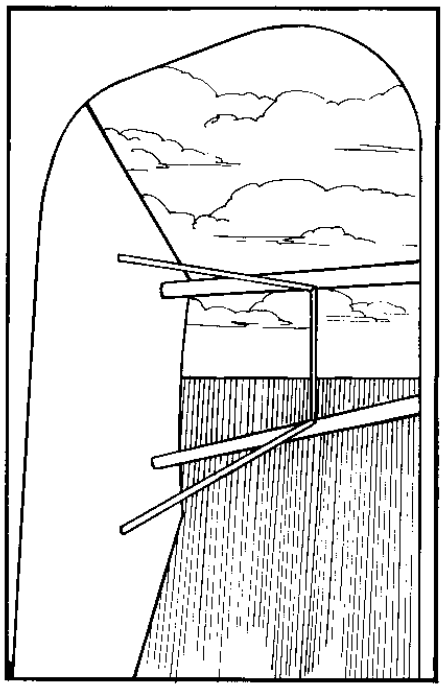
Since you are about to explore the extremes of pitch, roll and yaw, keep a very important fact in mind. **Regardless of your attitude, the controls do not change their function.** It is your interpretation of their function that will change through aerobatics. Think of their response in relation to your body, since your body's position in the airplane remains constant regardless of flight attitude.

The elevator always controls pitch. It moves the nose of the airplane toward your head or toward your feet, not necessarily toward the ground or sky. With this idea in mind, it will be easy to see that you need to use forward pressure to raise the nose when you are inverted. Forward pressure does not necessarily push the nose down. It pushes the nose toward your feet. If your feet are toward the sky, rather than the ground, then it pushes the nose **up.**

The ailerons roll the airplane toward your right or left, according to which way you move the stick. They don't necessarily put the wing up and down, unless your airplane is horizontal, and then you should learn to look in the direction you are rolling to see if the wing moves up or down. Stick movement to the right means a roll to the right. If you are right side up, that will be down. If you are inverted that will be up; and if you are climbing vertically, it will just be to the right.

The rudder always yaws the nose in the direction that you move your foot—that is, either to your right or left. Upside down or right side up, there is no difference. However, the new aspects of this interpretation come in a situation in which the airplane is in a steep bank, or climb. In a 90 degree bank to the left, the rudder still yaws the nose right and left; but that will also be up and down. In a vertical climb, left rudder yaws the nose to the left; but if you are looking at your wing, you will also see that it yaws your wing up or down.

Looking at the wing in a vertical climb.



You don't need to remember any absurd ideas about controls reversing, or rudders acting like elevators, or any of a multitude of confusing things that people may tell you about aerobatic flying. All you need to remember is which way the controls work in relation to your body. That way their reactions will be predictable, and you don't have to memorize any rules that you'll forget.

AEROBATICS...
A WORD OF CAUTION

Remember, although this manual speaks directly to you, the pilot and student, it is not intended to be used by itself. If you attempt to teach yourself aerobatics without the aid of a qualified aerobatic instructor, you may also get into trouble. There are lots of mistakes to be made in any kind of flight training. Some merely result in sloppy flying, while others can be hazardous. The instructor's purpose is to monitor these mistakes and to help you learn from them.

Some mistakes you'll make will be the result of hours of flying right side up. Some will be the result of misunderstandings that you have, and some will tell your instructor that you are getting tired and it's time to end your lesson for the day. Each mistake has some significance. A good instructor will recognize the significance, and you can make your mistakes work for you, rather than against you.

AEROBATIC PREFLIGHT

Just as each new type of airplane you fly has new items on the preflight checklist, so does each new type of flying. With aerobatics, the new items are mainly concerned with the fact that your airplane will be subject to higher G forces and will sometimes be flying upside down.

Preflight your Citabria using the checklist in the Pilot's Operating Handbook, paying close attention to details.

There are some items that will be new to you—for instance, removing all loose articles. If you fly inverted, anything that is loose on the floor, in the door pocket, in the baggage compartment, or in your own pockets will fly around the cockpit on its own. These loose objects can distract and endanger you, or could end up lodged in inconvenient places.

Check your weight and balance for aerobatics. The permissible gross weight for the Citabria is the same in Acrobatic Category as in Normal Category, but you will find that it is best to fly at lower weights when you can. There is a gain in performance, and in safety margin. The Citabria is built to withstand 5 positive and 2 negative G's at gross weight with a margin. When you fly the airplane at lower weights, the total forces and stresses on the airplane are less, and therefore, the desirable safety margin is greater.

Although the airplane is certified for the same gross weight in Acrobatic Category, the rearward center of gravity limit is further forward, as listed in the Citabria pilot's operatng manual. This means that baggage in the baggage area is prohibited.

Externally, check everything to look for any problem that might be aggravated by the high speeds and G forces that you anticipate. Also note anything that might be affected by inverted flying, or full control deflection. Make sure that the fairings are on tight and that none of the control surfaces can rub, or get caught on anything. Check the fabric in the area near the battery for battery acid leakage.

Any new items on an aerobatic preflight are logical if you try to visualize what is different and new about aerobatic flying. The most important thing is that you **always** do a preflight and that you do not become complacent. Airplanes are like all machinery. They need to be checked and taken care of, so that they can take care of you.

In addition to new items to check in and on the airplane, other new items to consider before your aerobatic flight are choosing an appropriate practice area, and wearing a parachute.

CHOOSING A PRACTICE AREA

The Regulations

Since this half of the course is defined by the Federal Aviation Regulations as aerobatic, or acrobatic, there are several things to mention before you start. Part 91 of the FAR's covers a couple of things that you need to review.

9.171 'Acrobatic Flight' states: "No person may operate an aircraft in acrobatic flight—

a) Over any congested area of a city, town or settlement;
b) Over an open air assembly of persons;
c) Within a control zone or Federal airway;
d) Below an altitude of 1,500 feet above the surface; or
e) When the flight visibility is less than three miles.'

*For the purpose of this section, acrobatic flight means an intentional maneuver involving an abrupt change in an aircraft's attitude, or abnormal acceleration, not necessary for normal flight.

Basically, this regulation is very logical. Don't fly aerobatics where there is lots of other traffic, or if the visibility is not adequate to see what traffic there might be.

In addition, while you are picking a practice area that isn't in controlled airspace, or over a congested populated area, try to be considerate enough to pick one that isn't over any houses. There are few noises that are more annoying than the droning of an airplane overhead practicing maneuvers. For all you know, the guy in the house below may be sick or might work the night shift, and you'll be the culprit who keeps him awake all afternoon.

Locating the lightly populated area is best done from your airplane, but confirming that you are not in controlled airspace should be done with the use of a map on the ground ahead of time. The centerlines of airways are marked. Remember, they are four nautical miles wide on either side of this centerline. Take a pencil and lightly fill that space in. Control zones are marked with dashed lines so they are even easier to spot. In some area you may have to travel some distance to find an area that is legal according to the FAR's. **You must do it, however.**

Regions that have a lot of aerobatic activity usually have an approved aerobatic area. This means that some individual or group has applied to the FAA for a waiver so that they can do aerobatics in an area that did not technically meet the FAR, but which has been proven to be safe.

If there is one of these areas that you intend to use, check into it further. Sometimes its effectiveness requires that the pilot who plans to use it calls the local General Aviation District Office of the FAA to "activate" the area. That means that the local Flight Service Station will warn pilots that aerobatics will be taking place there during a specific time period.

Traffic and Terrain

One more thing. Regardless of the regulations or FAA safeguards, it is your responsibility to look for other airplanes any time you are up in the air. No one can keep you safe except you!

While you are thinking about safety in choosing your practice area, also give some consideration to the terrain below you. If you can find an area with a field smooth enough and big enough for an emergency landing, so much the better. There should be no reason why aerobatics would increase the chances of your engine quitting, but **any time** you are going to be practicing over one area for a while, give yourself a break, and make potential emergency landing sites a consideration.

PARACHUTES

Parachute Regulations

One other FAR that concerns our aerobatic flying is Part 91.15 which covers parachutes and parachuting. It explains when a parachute must be worn and how often the parachute must be repacked. The paragraphs that concern you the most are: (a) and (c) which state:

(a) No pilot of a civil aircraft may allow a parachute that is available for emergency use to be carried in that aircraft unless it is an approved type and—

(1) If a chair type (canopy in back), it has been packed by (a certified and) appropriately rated parachute rigger within the preceding 120 days; or

(2) If any other type, it has been packed by (a certified and) appropriately rated parachute rigger within the preceding 60 days.

(c) Unless each occupant of the aircraft is wearing an approved parachute, no pilot of a civil aircraft, carrying any person (other than a crewmember) may execute any intentional maneuver that exceeds—

(1) A bank of 60 degrees relative to the horizon; or

(2) A nose-up or nose-down attitude of 30 degrees relative to the horizon.

Wearing the Parachute & Parachute Jumping

Parachutes are like other pieces of safety equipment in airplanes. Their usefulness depends on your attitude toward them. They are only useful if you learn how to use them, treat them with respect and never let wearing one become an excuse for abusing your airplane.

Some aerobatic instructors feel that wearing a parachute makes certain pilots feel that it is safe to overstress, or overspeed their airplanes and otherwise be negligent, because they can always jump out if they get into trouble. If wearing a parachute does have that effect, then it is hazardous. Aerobatic airplanes may be designed and approved for higher G forces than standard category airplanes, but they **still** must be flown within their limits.

An emergency jump out of any kind of certified airplane should never be necessary if the airplane is **properly maintained, properly preflighted and is always flown within its approved speed and G-force limitations.** However, since parachutes are generally worn in aerobatic airplanes (and you are going to wear one), you should learn how to use them.

Inspecting the Parachute

During your preflight, inspect the parachute—its straps, pins, packing date card, fasteners, D ring and outer covering.

Be sure the straps and outer covering are in good condition. A water or oil stain on the outside could mean that the material on the inside is wet, and that the parachute will not open properly.

The D-ring (D for Deployment) will be on your left side and should be tucked into its pouch. The packing card date should be within the last two months for most back packs, or the last four months for seat packs. For members of the International Aerobatic Club, there is an exemption to this rule that permits a two month extension for certain back packs.

Make Sure It Fits

When you're satisfied that the parachute is in good condition, try it on, either by sitting on it in the airplane or by hanging it on your back. It should fasten around the top of your legs and across your chest. Tighten the straps so that the parachute is firmly held to your body. It should be on tight enough so that the sudden deceleration on opening doesn't whip your body and hurt you.

Emergency Jumping

For an emergency jump, you will need to get rid of the airplane's door. This means pulling the emergency door release and pushing it out from the front. Opening the door from the back is too difficult because of the force of the airstream.

When you jump out, be sure that you are well clear of the airplane before opening so that the parachute won't get caught on it. Before you pull the D ring, glance down and visually identify it so that you are sure you are pulling the right thing. Some instructors recommend that as you pull on the D ring with your right hand, to push against your right fist with your left hand to give the pull more force. Then either bring both arms back in or keep both arms out. If one arm is stretched out, it will act like an aileron and will spin your body around.

As you near the ground keep your knees flexed, and don't stretch your arms out to block the fall, or you may break a bone. It is better to tumble over when you land.

SEATING AND SEAT BELTS

Your seating is very important on any flight, but especially for aerobatics. Make sure that your sitting position is such that you are far enough forward to get full rudder travel, and full forward stick. If the seat isn't close enough, you may have to use extra cushions behind you. If you do have to sit forward in the seat, be sure that you can still get the stick all the way back without poking yourself in the stomach. If your stick or rudder movement are limited in any way, you may not be able to do the maneuvers, or their recoveries, properly.

On the Ground

The seat belts and the seats should all have been checked on your preflight. Check their condition, as well as where and how they are attached to the airframe.

All pilots are used to climbing into their airplanes and fastening the seat belts right away. It becomes a reflex that most pilots don't even think about. This reflex has occasionally led to forgetting the seat belt when a parachute is worn. The pilot fastens a set of straps (the parachute), and without further thought, feels he is strapped in, and goes on to the next step. Needless to say, the result during inverted flight is embarrassing, and has led to more than one story of unintentional bail-outs from open cockpits!

When you do fasten your seat belts, make sure they're tight. Don't cut off your circulation, but do make sure that you are held firmly to the seat. If you aren't the constant movement of your body during aerobatics will tire and distract you, making concentration difficult.

In the Air

In the air, as your body moves around, seat belts tend to loosen slightly; so retighten them from time to time. If you don't have them tight, the first time you roll inverted, your heart will jump into your throat as your body drops against the belt. You won't fall out, but for a split second it will feel like you might.

When you are strapped in tight enough the side loads and G forces of these new aerobatic maneuvers will seem less uncomfortable to you.

G FORCES

G forces are familiar to any one who has done a steep turn, made a hard landing, or flown an airplane on a bumpy day. The positive G forces push you into your seat, and the negative G forces throw you against your belt.

When you are standing still, or sitting in an airplane that is flying at a constant speed and direction, you will be feeling one positive G. Hanging upside down, you would be feeling one negative G.

Increased G forces are related to a change in direction or speed. When you pull back on the stick to turn or loop, you will feel increased positive G's. Likewise, if you push forward in an inverted turn, you will feel increased negative G's. If you push forward while flying right side up, you could push hard enough to feel negative G's, but it is more likely that you will merely feel the airplane approach zero G and you will feel as if you were floating.

The Variations

The changing G forces in the loops, rolls, and spins on **this** course will vary from -1½ G's on the low end to 3½G's at the high end. This is not a lot, but will, no doubt, be a new experience for you.

When you pull back hard on the stick, the G forces can affect your vision by limiting the blood flow to your head. The first noticeable affect will be some greying, or blurring, at the periphery of your vision. As soon as you release the back pressure on the stick, this will disappear. Holding the muscles in your stomach tense as soon as the pull begins usually prevents this from happening.

In extreme cases of high G forces, or G forces held on your body for too long, you can black out. These are not the type of situations that you would encounter learning primary aerobatics. The G forces on a **complete** primary aerobatic course can be held down to +4 and −1½ G's with an instructor's supervision.

Extremely high G forces are generally the result of mistakes that occur through ignorance and disorientation. **This is one of the most important reasons for not trying to teach yourself aerobatics without a qualified instructor aboard.** With the instructor's help, you will learn to anticipate and avoid situations that can create high G forces and overstress the airplane.

The Airplanes' Limits

The Citabria's certified limits of +5 and −2 are more than enough for the aerobatic maneuvers on this course. In addition to those limits, there is a built in safety factor, but the limits that a pilot must observe are +5 and −2. **This means don't attempt maneuvers that require higher G forces, and don't do aerobatics on days when turbulence can increase your chances of overstressing the airplane.**

As you are pulling and pushing on the stick, varying the G forces, the muscles in your body will be flexing or tensing to resist these forces. This will cause you to get more exercise than you would from other types of flying. In the initial stages, this may also cause you to tire faster than you expect.

EFFECTIVE LESSON LENGTH

The optimum length of each aerobatic lesson will vary from day to day, depending on your concentration. As soon as you stop concentrating, you should end the lesson. There is no merit in staying up past that point, since the sole purpose of the lesson is for you to learn. Staying up too long wastes your time, and sometimes slows up your progress by making you feel that you are doing worse than you usually are.

The main factors that will distract you are being tired, hot, cold, hungry or nauseated. The two most significant factors are getting tired or nauseated.

People can get nauseated for a number of reasons, but in most cases they get over it by taking short lessons on successive days. The main reasons are disorientation and fear. If you have ever had something frighten you, then you've felt how your stomach suddenly clutches, and you want to throw up. The same thing happens if you get totally disoriented.

Some people find that the feeling of G forces bothers them; others find that the rolling motion makes them feel dizzy; still others, more fortunate, find that nothing bothers them. In most cases, the apprehension disappears after repeated flights.

If you do have a sudden feeling of nausea sweep over you, you may find that flying straight and level will cure it. In other cases, the feeling continues. If it does continue, head back for the airport to land, and save the rest of the lesson for another day.

In regards to getting tired, you will find that aerobatic flying is more physically demanding than the other types of flying you've done. You'll be moving the controls around a lot, and tensing your muscles against the G forces, as though you are doing isometric exercises. It may make you tired, but it will also keep you in shape!

Besides the physical exercise, the mental effort that goes with learning, and steady concentration will also tire you more than doing what is already familiar. So don't be surprised when 30 or 45 minutes of aerobatics is all you can effectively absorb in one lesson.

If you are feeling ill before the lesson stay on the ground. You will gain nothing from the flight since you will be distracted the whole time. Distractions inside or outside the cockpit are a hazard.

CLEARING THE AREA

More than ever

Looking for conflicting traffic and clearing the area cannot be overemphasized. Especially note anything coming from behind you. The pilot may be planning to pass on your right according to regulations, or he may think there is no conflict because he is going to pass some distance below you, or maybe he doesn't even see you. Use your judgment and turn to a heading where he won't pass near you.

Several types of traffic are a special problem—those directly above or behind you, and those piloted by people who think it would be fun to watch you.

Planes passing above or below you are sometimes hard to see, and they won't know that you will be climbing and descending rapidly in your maneuvers.

The spectator airplanes are one of the worst hazards and annoyances, because they don't know where you are going, but they want to circle and watch, sometimes getting in your way and often distracting you.

Regardless of what kind of traffic there is in your area, look for it by maneuvering your airplane to see the entire area in which you will be flying. When you find traffic that might be conflicting, change your direction so that you are travelling away from it.

While you are learning, your instructor will help you look for traffic, but as you become more and more in control during your lessons, take more of the responsibility for the lookout. Never assume that the other guy sees you and will stay out of your way. It is up to **you** to stay clear of traffic.

Conserve Altitude Too

Make a habit of clearing the area between each maneuver. If you lost altitude during the maneuver, clear the area in a climbing turn. Then you can dive for maneuvering speed as you turn toward your ground reference line.

Coming out of the loop, for example, finish the maneuver by letting the nose come up to the horizon; pause there, then before the extra speed dissipates, pull the airplane up into a climbing turn. This allows you to conserve altitude and clear the area at the same time.

PRE-AEROBATIC REVIEWS AND DEMONSTRATIONS

Reviews

As a "warm-up" and a review prior to your first aerobatic maneuvers, practice some steep turns and accelerated stalls.

In the steep turns, keep the airplane from slipping or skidding and pull the airplane around the turn.

When you are feeling comfortable with your turns, pull the elevator back more firmly. Stall the airplane both partially and completely. Note the feeling of the stall buffet, and the fact that the airplane stalls at a higher airspeed when you are pulling G's.

When you have done some accelerated stalls in turns to the right and the left, and have cleared the area again, you are ready to try the loop.

Demonstrations

Each maneuver will be demonstrated by your instructor before your first attempt. In some cases, you instructor will also help you with your first attempts or may decide that coaching you verbally is adequate help.

Later the instructor should correctly demonstrate the maneuver again, since your performance of the maneuver is dependent on your understanding its object and being able to see that it looks and feels correct.

THE LOOP

All Pitch Attitudes

The object of the loop is to fly the airplane around a vertical circle by using a coordination of speed control, elevator back pressure and power adjustments. The reason for learning the loop is to be able to recognize and interpret all pitch attitudes, and to know how to fly your airplane through them.

To accelerate for a loop in the Citabria, dive to 140 mph, keeping the wings level, and monitor the tachometer, to hold the RPM below red line. At 140 mph, bring the nose up to the horizon. Make a quick check, left and right, for level wings, then begin the loop, with smooth, firm back pressure on the stick.

When the nose is well above the horizon, add full power. Keep increasing the back pressure so that the nose is steadily changing its pitch attitude.

At about 45 degrees from the top, or inverted, portion of the loop, stop pulling back, and let the nose continue on its flight path by itself. Here, the nose, which has been going up starts to move down, and gravity and decreasing airspeed will help make the nose continue moving in the proper direction.

Closer to inverted, the nose will begin to drop **too** rapidly, so you will have to use some forward pressure to slow up the movement. This forward pressure is necessary until the nose has passed about 30 degrees below the horizon.

Here the airplane will be accelerating and will be more responsive. If you leave the stick forward, the airplane will now react by maintaining a 30 degree nose down inverted dive.

Instead, start applying some back pressure again, gently at first, then more firmly as the nose continues down, and the airplane accelerates. Also, just past inverted, ease the throttle back to halfway or so, to keep the RPM's from exceeding the redline during the vertically downward portion.

The back pressure is again steadily increased during the second half of the loop. That is, until the very end, where if your trim is set for level flight, you may have to push forward again, to keep the nose from pitching up too rapidly.

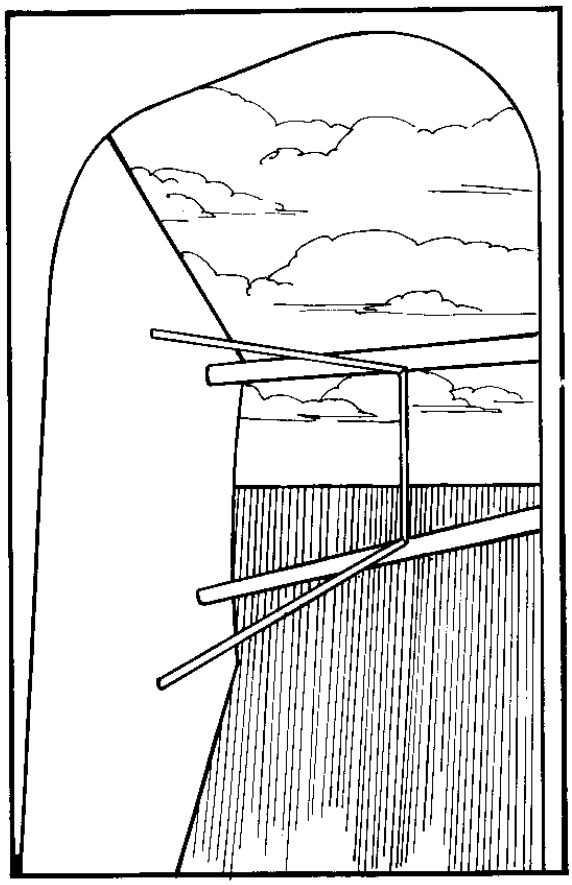
After you have done many round loops, and have seen many of them demonstrated properly, you will know how the G forces change according to your elevator back pressure throughout the maneuver. The variation will be from about 3 or 3½ positive G's at the beginning, through zero or ½ positive at the top, then back to 3 or 3½ at the finish.

The changes are subtle. A faster and more accurate method of learning to recognize a round loop is to look for the rate of pitch change during the maneuver. Use the elevator to keep the nose pitching at a fairly constant rate throughout the loop, except over the top where the rate should be somewhat slower.

This concept would be easy to use immediately if there were always a visual reference to measure in front of your nose. You could sit looking forward and watch how the nose pitches faster when you pull back harder, and how this rate slows up when you ease off the back pressure.

Looking At The Wing

However, when your nose is pointed straight up, there will be nothing to see over the nose except the sky. The solution is to learn to look out the side window at both wings to see the horizon there. With experience, you'll learn to interpret pitching movements by looking at the wing.



Going straight up.

Pitch Exercise

There is an exercise to aid you here. Starting with level flight, look at one wing as you pitch the nose down, and then up. Shift your vision to the other side. Continue to pitch down and up steadily for awhile, keeping the wing level without looking over the nose. This will teach you to interpret pitch changes while looking out to the side.

Don't do this exercise for too long at one sitting, though, or the steady rocking motion may nauseate you.

Ground References

The loop should be done without any yawing or turning. You can see that you have turned or yawed severely if you do your loop directly above a straight line ground reference, such as a road. When you begin, make sure that your flight path is exactly in line with the road. Then, when you complete the loop you can measure whether your heading has changed.

Be sure to use your ground reference line properly. If you're not directly over it when

you're ready to begin, either align your airplane parallel to it, or take a few extra seconds and fly over to it. When you are nearly on top of it, turn so that your alignment is exact.

As an example of what might happen, imagine that you merely note that your airplane is flying at an angle pointed toward the reference line. Then, you unknowingly roll during the pull up. Coming out of the loop, you could then be pointing at the same angle, but going away from the line. You might not notice your error because all you remembered was a vision of an angle.

The ground reference doesn't help you fly your airplane through all its pitch attitudes in the loop, but it does show you that you enter and exit on the same heading, and whether or not your flying is precise.

No Ailerons

To prevent any rolling during the loop, be sure that you pull straight back on the stick, and are not holding any aileron. That may sound easy to do, but, in fact, it takes some concentration. If you move your whole right arm, when you pull the stick back, you will tend to pull to the right as well. A solution which may seem awkward at first, is to hold your elbow out away from your body, and to pull back with just your forearm.

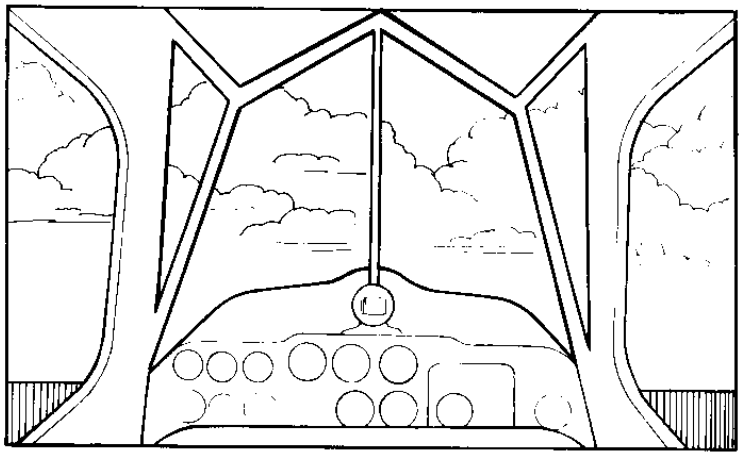
If this is too uncomfortable, then you'll just have to concentrate harder!

Changing Visual References

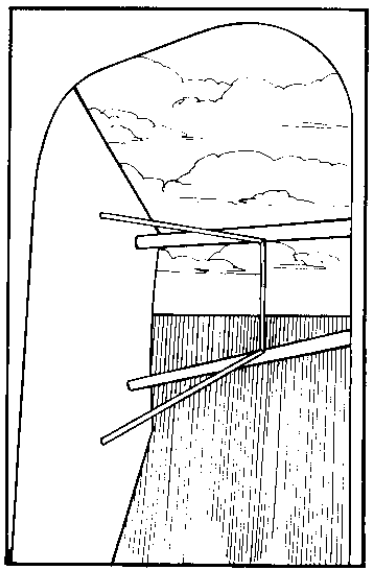
Throughout the loop, keep checking from side to side to see that you have not rolled the airplane. If you have, you will see that the relationship between the horizon and each of the wings will look different. If you only look out to one side, there will be a tendency to pull the stick in that direction.

Approaching inverted, lean your head back to look through the overhead greenhouse window. Here, again, you can check for level wings, and can find your ground reference.

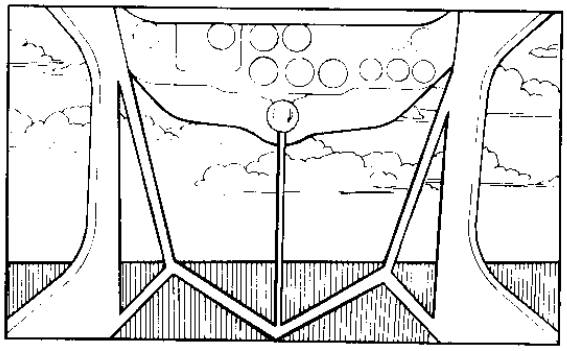
Using this practice of changing your visual focus from over the nose, to the wings, through the greenhouse, then back to the nose, you'll soon be able to stop any problems of "pulling up crooked", and rolling during the loop.



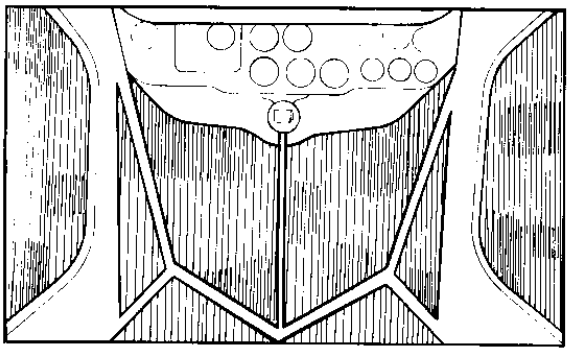
Nose up.



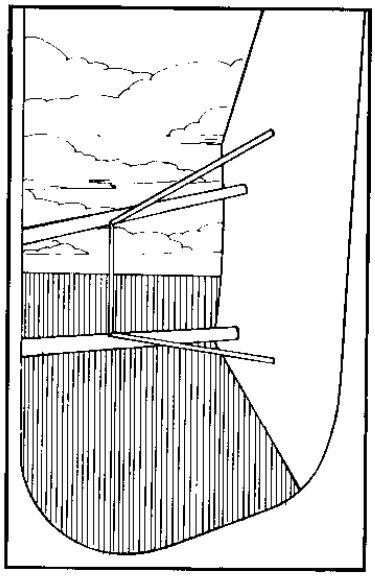
Vertical Up View- Side Window



Level Inverted- Looking Straight Ahead



Nose Down Inverted



Straight Down- Side View

Rudder Usage

The next concern in the loop is to use the rudder properly so that there is no yawing. To prevent yawing, first, look for it; and second, use the rudder to stop or prevent it.

Since the airplane and vertical fin are trimmed for cruise speed, during a dive the airplane will always yaw to the right. Use left rudder to counteract this.

As the speed bleeds off in a climb, the propeller's thrust will yaw you to the left, and you'll need some right rudder.

These two factors, and one other, will account for your rudder usage during the loop. The G force during the pull up acts on the prop, which is spinning like a gyro, and makes the airplane yaw to the right. This reaction is precession.

When an airplane's propeller is turning clockwise (as seen from the cockpit), there will be a yawing to the right when you pull back firmly on the stick, and a yawing left when you push forward.

The slip ball should be centered throughout a loop, but don't sit there staring at it. The ball will be out of center if your airplane is yawed, and yawing will be visible as a movement of the nose or wing. Look outside for an indication of yawing.

Speed Control

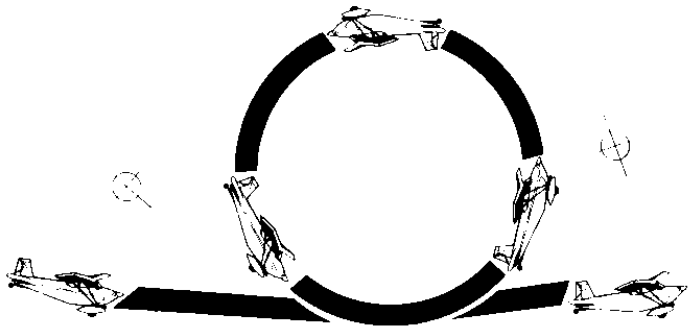
One of the most important aspects of the loop is your speed control as you fly around it. The idea is to enter and exit the maneuver at the same airspeed, and to make the loop a round circle, rather than a figure nine, or an ellipse.

When the loop is round, the speed and altitude on entry and exit will be the same. The key is how the back pressure is varied from a firm pull when the speed is high, to a lessening of pressure as the speed drops off at the top of the loop.

Everyone who has learned to loop has done his or her share of loops that looked like backward figure 9's, or eggs on end. The figure nine occurs when too much back pressure is kept on going over the top of the loop. So the loop may have started correctly, with a good pull in the beginning, but when the speed was slow at the top of the loop, the back elevator pulled the airplane around a small circle.

The egg shaped loop is the result of too gentle a pull in the beginning. The airplane starts a big, lazy loop, and runs out of speed near the top. The nose drops going over the top, then the pull out is also too gentle so the circle gets large again, as the speed builds up.

Another natural pitch mistake in the loop is either letting the nose drop too much after inverted, resulting in excess speed gain and altitude loss, or pulling back too hard, or too soon, and stalling the airplane. As with any stall in the loop, just relax some of the back pressure, then continue the loop.



The loop.

Stalling in the Loop

There is nothing magic about being able to make a round loop, except that it means you will have learned a lot about airspeed control and stalls in the process.

If you pull too **gently** in the beginning, the airplane will run out of speed and momentum before it gets to the top of the loop. Consequently, the airplane will stall. If you pull too **hard** at the beginning, the excess G forces cause the airspeed to bleed off rapidly, and there is also a chance of stalling.

In the loop, a stall when you are inverted will **not** be what is called a "negative", or inverted stall, unless you have pushed forward too much here. As long as it was caused by pulling back on the stick it will be a "positive" stall, that is, a stall caused by positive G forces. In this type of stall, the recovery would be familiar. Just ease off the back pressure that you applied to cause it to happen. The nose will drop and the speed will quickly be above stall speed and you can continue the loop.

If the stall **was** a negative stall, that is, if you pushed forward too much at the top of the loop, the recovery would be to release that forward pressure to let the nose drop. **Whether the stall is positive or negative, release all, or some, of the elevator pressure you are holding to reduce the angle of attack. Let the nose drop, and keep the airplane straight with your rudder.**

If you elevator control on the first portion of the loop was steady increase of back pressure, you will be likely to get to the top of the loop with plenty of speed to fly over the top. In some cases, your airplane will go over the top of the loop below stalling speed but will not stall. This is only if the pitching movement of the nose has been steady, and the G force is low enough, that is, less than one G. However, at some point during the learning process, everyone pulls back too hard going over the top of the loop and proves to himself that there is no big deal to accidentally stalling there.

One mistake that you should **never** make in the loop, or any other maneuver, is starting the maneuver at **too low an altitude.** If you were to spin from a stall at the top of the loop you need enough altitude below you to give you time to recognize the spin, and then to recover from it safely.

If you started the loop too low, lost excessive altitude during it, and then pulled back too hard at the end when you saw that you were low, you would cause your airplane to lose even more altitude through a high speed stall.

Always start the maneuvers high enough so that you can make mistakes, lose altitude, and still complete a recovery with 1500 feet of altitude below you.

Another warning that will be repeated—**don't teach yourself any of the aerobatic maneuvers without a qualified instructor aboard.** No book, training manual, or verbal explanation from the ground can give you the insight that an instructor in the back seat can. No one outside the airplane can prevent you from making a confusing mistake, or take control when you need help.

THE ROLLS

Different Types

In basic aerobatics there are four types of rolls—the aileron roll, the slow roll, the barrel roll and the snap roll. Of these four, the precision slow roll is the most useful for this course. Throughout the slow roll, you will learn how to keep the airplane from losing altitude, and the nose from turning as you roll through 360 degrees of bank.

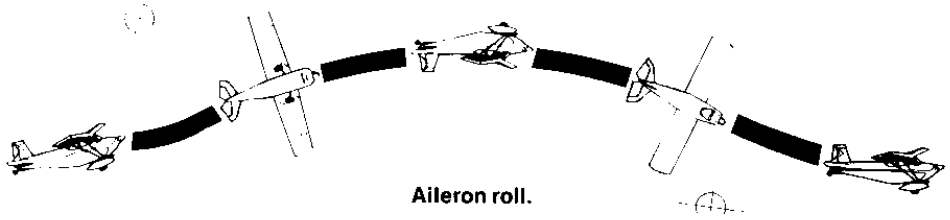
The barrel roll and the snap roll are worth learning for fun or competition, but do not specifically suit the aim of this course. In the barrel roll, the airplane is flown through a corkscrew flight path, with the airplane pitching up and down, turning one way, then the other, and rolling through 360 degrees of bank, all at the same time.

In a snap roll, one wing is forced to stall at higher than normal stall speed, with rudder usage, and the other wing rapidly rotates around the longitudinal axis. It's hardly a maneuver for recovering from unexpected trouble!

The aileron roll is the simplest of the four rolls. It is taught on this course not as a means of recovering from inverted, but rather, as a means of getting accustomed to rolling through 360 degrees of bank attitudes.

The Aileron Roll

When the aileron roll is done properly, the airplane will maintain a fairly constant altitude and heading. In a fast rolling airplane, such as a jet, the altitude and heading can be held exactly. In a Citabria, which rolls more slowly, the nose will describe a small semicircle, beginning above the horizon and ending slightly below the horizon. The airplane's flight path will climb slightly above the starting altitude, and then will drop back to the same altitude at the finish. It should never end up lower. This is what is called a ballistic flight path, with none of the negative G forces that cause your engine to sputter and your body to hang on the seat belts when you maintain level inverted flight.



Aileron roll.

Aileron Usage

To do the aileron roll, use cruise power and an airspeed of 120 mph. Raise the nose about 20 degrees above the horizon. Then, before you begin the roll, remove the back pressure and move the stick all the way to the left, for full aileron. Hold it there until the airplane has rolled all the way back around to level again.

Rudder Usage

At the beginning of the roll, use just enough left rudder to prevent any adverse yawing to the right. Then, remove the rudder so that it doesn't pull the nose down through

the horizon. Use left rudder again toward the last portion of the roll, when it can help hold the nose up.

Elevator Usage

The elevator movement during the aileron roll is small, but significant. At the beginning of the maneuver, when you have raised the nose with back pressure on the elevator, be certain that you stop the pitching of the nose before you begin the roll.

This is called "checking" forward with the stick. Checking means moving the stick in the opposite direction just enough to stop the pitching motion, but not enough to cause the nose to move that way. If you don't remove the back elevator, the nose will pitch further up.

As soon as the airplane has rolled about 45 degrees, a small amount of forward pressure is necessary to prevent the airplane from turning in that direction. This same forward pressure will help minimize the altitude loss inverted by keeping the nose from dropping down rapidly. Then again, on the last portion of the roll it stops the turning, which normally accompanies banking. The amount of forward elevator pressure should be just enough to prevent turning.

Too much forward pressure will push the nose the other way, and will make you feel negative G's when you are inverted. At the finish of the roll, use some back pressure again to keep the nose up.

At the beginning of the aileron roll the nose was pitched 20 degrees above the horizon. Since it is a maneuver that is done without negative G's, the nose at the finish of the roll will have dropped down to a level nose attitude with the top of the cowling below the horizon, the way you normally see it in level flight.

Common Errors

The most common errors in performing the aileron roll are varying the rate of roll, turning off heading and losing altitude inverted.

The key to maintaining a constant rate of roll is to be sure that you are holding full aileron throughout the maneuver. In other words, keep pushing on the aileron. This will be a new experience because your past rolling experience has been with turns. Rolling into a turn seldom requires full aileron; and once the bank is established, the aileron is returned to neutral. Consequently, you will have to learn to hold full aileron to keep the roll going.

The faster the airplane rolls, the less tendency there will be for it to turn. However, a slow rate of roll isn't the only reason that your airplane will turn. Since your arm pivots at the elbow, you will be likely to apply some back elevator at the same time that you apply the aileron. This causes the nose to pitch, and the airplane to turn.

The problem with turning and pitching is that this causes the nose to drop down as the airplane approaches inverted, and the whole result can be quite a bit of altitude loss.

If you do begin a roll, and you see that the nose has started to turn, stop the roll and then roll back to level and start over again. You can stop the turn with forward pressure, but in the initial stages of learning, just start over and try to keep from applying the back pressure which caused the turning.

Another factor that will cause you to lose quite a bit of altitude through the inverted portion will be not getting your nose high enough before you begin the roll. If you start with the nose in a level flight attitude, then the nose will drop quite far as it passes through inverted.

As with all of the maneuvers you will progress through these, and, no doubt, other problems; but as your instructor will tell you, there is something to be learned from each of the mistakes. Just keep trying. One day it all works and you will have trouble understanding

why you couldn't keep the nose straight, or why you couldn't see what was happening since it eventually becomes so clear.

A Rolling Exercise

You may find that the orientation in the very beginning of the roll is a source of later problems during the roll, like finding yourself inverted with the nose below the horizon, and having to push the stick forward to get the nose back up.

After you've done some rolls and have found what the problems were, you may be interested in this exercise of rolling from bank to bank while holding the airplane on heading.

To do this, start with the nose above the horizon. Roll the airplane into a bank in either direction, with the aileron. Use back elevator, first, to raise the nose, followed by neutral elevator. Then use some forward elevator when you see that the airplane starts to react to the bank by turning. At first you will have to see the turning start before you know how much elevator to use, then later, you'll be able to anticipate the amount.

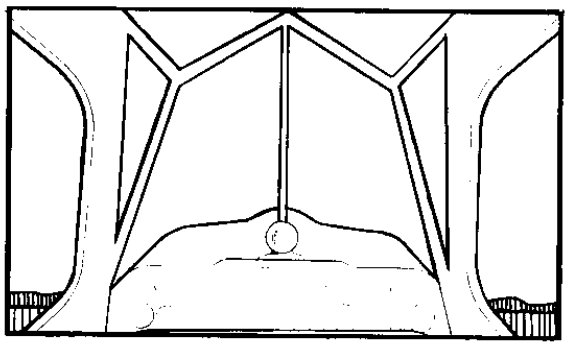
Use the rudder initially to prevent adverse yawing, then to stop the nose from dropping while the airplane is on its side. Then, when you use the aileron to reverse the direction of bank, you'll probably find that you need to increase that rudder to full rudder. This keeps the nose from dropping and gives you your best rate of roll.

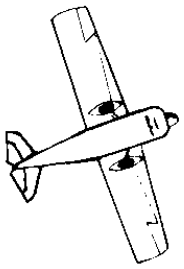
This is an exercise that you can practice even when you are going cross country by yourself. However, it may not be a good thing to do for long if you have a passenger aboard. The rocking motion may not be as much fun for his or her stomach as it will be for you.

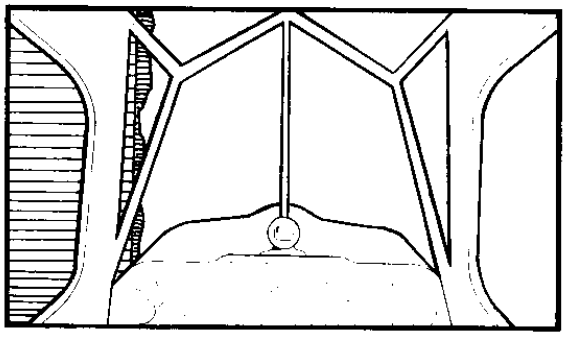
THE SLOW ROLL

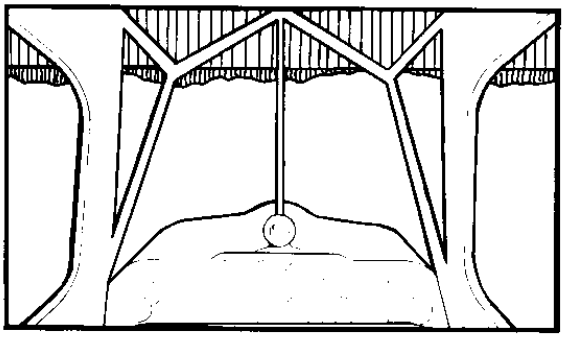
The slow roll differs from the aileron roll in that the airplane's nose is prevented from dropping with rudder when it is banked, and forward elevator when it is inverted. The airplane's flight path is more nearly level, which means that during the inverted portion you will experience one negative G, and will hang on your belts.

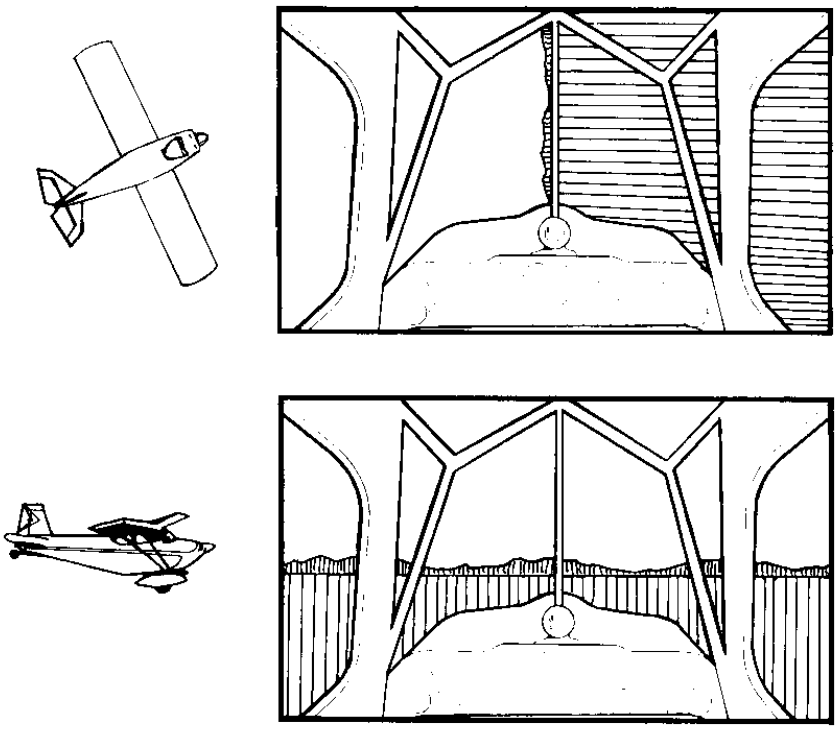
The object of the slow roll is to maintain a relatively level flight path, a constant rate of roll, and a constant heading while rolling 360 degrees around the airplane's longitudinal axis.











Control Usage

To do this, raise the nose about 20 degrees above the horizon with back elevator. Then release the back pressure so the nose stops climbing. Apply full left aileron and, initially, just enough left rudder to prevent the nose from yawing to the right as the right aileron goes down. Throughout the roll, maintain left aileron.

At about 30 to 45 degrees of bank, begin to apply a small amount of forward elevator to keep the nose from turning toward the banked wing. At the same time, begin to apply some right rudder (top rudder), to keep the nose from dropping. As the bank increases, so will the amount of top rudder that is necessary to hold the nose above the horizon, until finally full rudder is being used.

The amount of forward pressure during the banked portion of the roll should be just enough to keep the airplane from turning toward the bank, but not so much that the airplane's nose is pushed in the opposite direction.

Approaching inverted flight, use a combination of top rudder and forward pressure to keep the nose above the horizon. When the airplane is level inverted, increase the forward elevator to keep the nose above the horizon.

As the airplane rolls beyond inverted into a bank in the other direction, release some of the increased forward pressure, and add some top rudder again to hold the nose up. Note here, that since the airplane is now banked to the right the top rudder is now left, rather than right rudder.

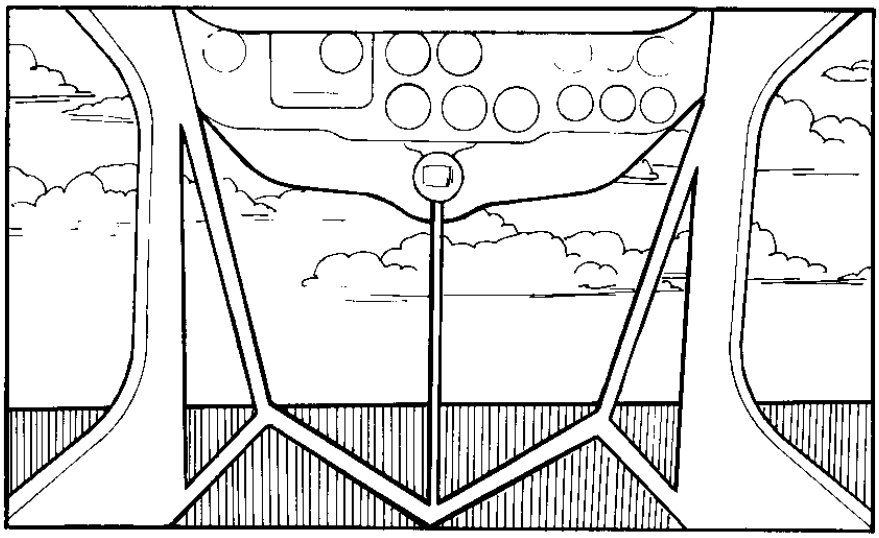
Throughout the second half of the roll, keep increasing the top rudder, until you are holding full rudder; and then as the airplane returns to level flight, return the rudder to neutral.

The amount of forward pressure that was necessary to hold the nose up in the inverted portion is decreased during the rollout. Past 90 degrees of bank, approaching right-side-up again, hold just the amount of forward pressure that is required to keep the nose from turning. This means that, as the bank lessens, reduce the forward pressure to zero; then toward the very last portion, apply some back pressure to hold the nose up.

While the elevator and rudders are being varied throughout the slow roll, hold the aileron all the way to the left to give the airplane a constant rate of roll—that is, until approximately the last 90 degrees of the roll. At this point, for the first time in the roll, you will be using both full left aileron and full left rudder. This causes the rate of roll to increase noticeably. Since you must hold full rudder to keep the nose up, reduce the amount of aileron.

Inverted Flight

It is during the slow roll that you will learn to be oriented and comfortable during inverted flight. To do this divide the slow roll into two halves—rolling to inverted, and stopping the roll there; then rolling from inverted back to right side up.



Level inverted flight.

Some of the Problems

As in any aerobatic maneuver, there are certain natural mistakes that a pilot will make while learning. Some of these mistakes merely result in sloppy flying, but others can result in airplanes being overstressed, and excessive altitude being lost. This can be the case in the slow roll if a pilot tries to teach himself without an aerobatic instructor to monitor his mistakes.

Throughout much of the roll, the elevator and rudder usage are primarily for keeping the nose above the horizon. First one control accomplishes this, then a combination of two controls, then the other control, then a combination, and so on. Knowing exactly how much

of either rudder or elevator to use at any time requires clear visual and mental orientation.

Neither a book nor a verbal explanation can teach a pilot to do a proper slow roll. It can only be learned through a combination of demonstration by an expert, trial by the student, corrections and explanations by the instructor and repetition by the student.

The most common and the greatest danger in "self-instruction" in the slow roll is due to letting the nose drop approaching inverted due to inadequate rudder usage before inverted. With the nose below the horizon, the airplane will be picking up airspeed, and the inexperienced aerobatic pilot will lose visual orientation with the horizon.

The correct recovery would be to smoothly, and gently, push the nose above the horizon with forward elevator pressure. This is a learned reaction, and not a natural reaction for a pilot on his first aerobatic lesson. The natural reaction, learned through hours of flying right-side-up, is to pull back on the stick when the nose drops below the horizon.

During inverted flight this pulls the nose further down, resulting in an excessive speed built-up, which makes overstressing the airplane possible, and a tremendous altitude loss certain.

Another common error is called "dishing out." This means pulling back, incorrectly, on the stick toward the end of the roll. Since the airplane is banked, the airplane suddenly turns and loses altitude. Depending on where the airplane is in the roll, the altitude loss could be 200 to 500 feet. This isn't dangerous when the airplane is flying up high, but it is a classic mistake that occurs when an unskilled pilot does an impromptu roll close to the ground to show off for his friends.

If you learn nothing else from either of the rolls, learn not to pull back on the stick when you are inverted, and not to pull back in a bank unless you want to turn.

THE SPIN

A spin is a maneuver that can be done for aerobatics and fun, or it can be the result of a scary mistake. The difference is in the pilot's training.

A spin is caused by one wing stalling while the other wing continues to fly. As the stalled wing drops, the nose pitches down, and the flying wing continues to develop lift which rolls the airplane toward the stalled wing.

An accidental spin is generally caused by yawing the airplane with excessive rudder while flying near stall speed. Yawing makes one wing move through the air faster while the other wing slows up slightly.

A Yawing Exercise

If that possibility seems confusing to you, try an exercise while you are flying level. Look to either side, and note the relationship between the wing tip and the distant horizon. There will be no apparent motion between them. When you push the rudder opposite the direction you are looking, you will see the wing move forward on the horizon. It has speeded up. When you move the rudder in the same direction you are looking, it will appear to move backwards, as it slows up. Incidentally, you will also note that the airplane rolls as you yaw it because the faster wing will develop more lift.

While this speed differential on the wings merely causes skidding and rolling at cruising speeds, it can cause a spin at slow speeds.

Accidental Spins

Sudden, accidental spins can be confusing, and their resulting height loss can be dangerous. Therefore, you will learn the spin on this course for the same reasons that you learned the stall. The more you know about it, the less chance there is of doing one accidentally.

Check Your Altitude

Before your spin practice, check that you have enough height below you for the spin, and for a smooth recovery above 1500 AGL. The altitude loss should be about 300 to 400 feet per revolution, but plan on more than that while you are learning.

Also be sure that there is no traffic that will be under you while you are spinning, or in your way on your recovery.

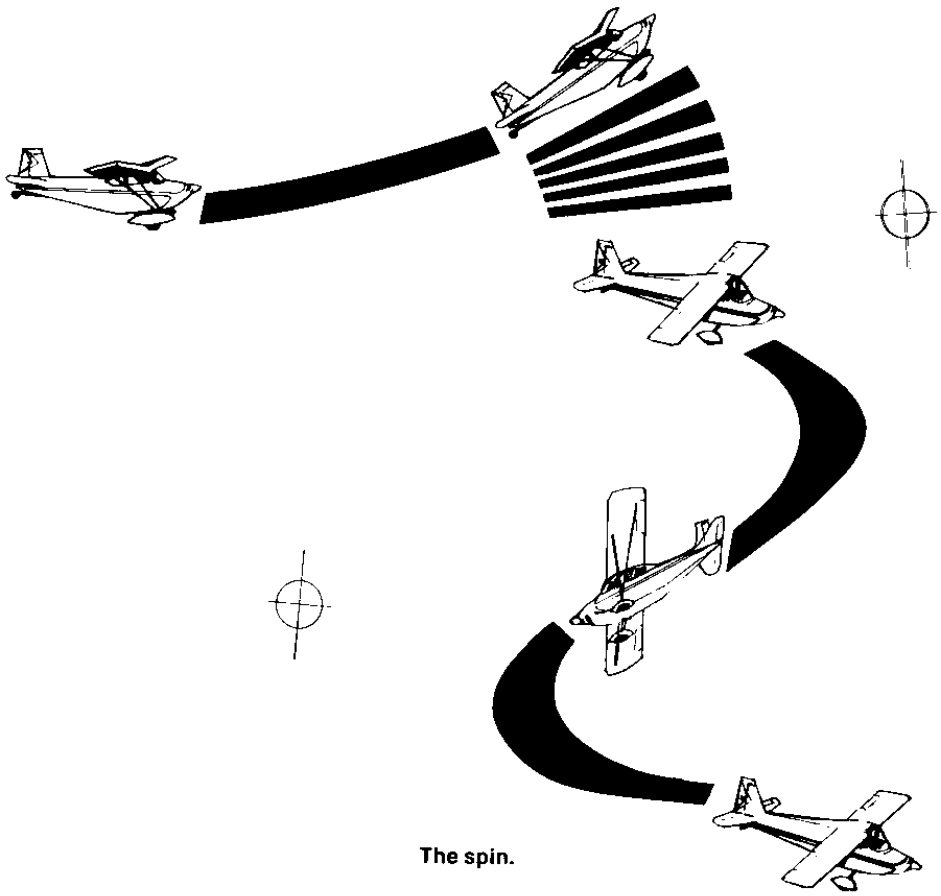
The Spin Entry

To enter a spin, slow up the Citabria by raising the nose and easing the throttle all the way back, just as you would for a stall. When the Citabria is ready to stall, push full rudder in the direction you want to spin and pull the stick all the way back.

The nose will drop nearly straight down and the airplane will rotate in the direction you hold the rudder. Just as the nose begins to fall, there will be a brief few seconds of zero G's. During the rotation itself, the G loading will be very slight and you may experience some of the side loading that you feel when you skid an airplane. The highest G's will be on the pullout, but if your speed isn't too high, they will only be 2½ to 3 G's.

While the airplane is spinning, the speed will be stablized just above stalling, even

though the nose is pointed down. If the speed is increasing the airplane is spiralling, not spinning, and the correct recovery procedure is to roll the wings level and ease the nose back up to the horizon.



The spin.

The Recovery

To recover from the spin, use opposite rudder to stop the rotation and forward elevator to "break the stall". The elevator movement should be smooth, but positive. Some instructors suggest moving the stick to the "neutral" elevator position. This may confuse you if you think you are at "neutral" and it doesn't recover. It is much better to think of moving the elevator until you feel and hear that the airplane is no longer stalled.

The Citabria recovers easily from a spin, but a spin recovery in some other types of airplanes may take more forward elevator movement, and it is just as easy to learn the spin with that in mind. Be sure that the forward movement is positive, but not abrupt. Any abrupt control movements slow up rather than speed up recovery. When you are sure that the airplane is no longer stalled, smoothly pull the elevator back again and raise the nose to level flight, or into a climb to regain your altitude.

When you apply the opposite rudder to stop the rotation, hold it until the rotation stops, then put the rudder back to neutral. Be sure that you don't try to use the ailerons on

the initial recovery, because the drag of the down aileron on the stalled wing will further slow it up, thus delaying rather than aiding the recovery process.

If this seems hard to comprehend, look out at one of your wings in level flight and move the aileron in the opposite direction. The aileron will go down to lift the wing you are looking at. If you look carefully you'll see that the wing not only starts to go up, but is also yaws backward slightly. This "adverse yawing" is caused because the down aileron creates more drag than the up aileron. Keep this in mind on your spin recoveries.

The Citabria's spin characteristics and recovery procedures are quite straightforward. This is one of the factors that makes it a good training airplane. As long as you have loaded the Citabria properly and apply the correct recovery technique, it will recover from a spin in 180 to 360 degrees of rotation.

Before you attempt a spin in any other type of airplane, read its operating manual. In some airplanes, spins are prohibited. In others, they are only permitted under certain circumstances. Whatever the case, observe the warnings in the manual.

A Reminder

The most important warning regarding spin practice is that you begin from a high enough altitude. Allow for extra height loss due to a slow recovery. Remember, unlike in the loops and rolls you will definitely be losing altitude each time you do a spin. Be prepared for it.

Concentrate on a smooth and proper recovery. Being in a rush will cause you to make mistakes.

IN SUMMARY

Now that you have completed Bellanca's proficiency training course, you are on your way to an exciting new world in flying. It's the world of tailwheel travels that can take you into airstrips that would not suit you in tricycle gear airplanes. It's the world of loops, rolls, and some "fun flying" that you couldn't do before. Most significant of all, it's the world of greater awareness and flying skill and safety.

Bellanca welcomes and congratulates you!