LeRoy Cook

TEACHING FLIGHT

Guidance for Instructors Creating Pilots

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Teaching Flight
by LeRoy Cook

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BIO

A lifelong student of aviation, LeRoy Cook is an experienced pilot and instructor who's been flying and teaching for more than 50 years. He holds ATP certification for single and multi-engine airplanes and commercial certification for gliders and seaplanes. His Gold Seal flight instructor's certificate has ratings for single-engine and multi-engine airplanes, instrument (airplane), and glider. Cook is the author of over 1,700 magazine articles and has written or co-authored four aviation books, including *Beyond Flight Training*, *Flying the Light Retractables*, and *Caravan: Cessna's Swiss Army Knife with Wings*. He wrote the "CFI" column in *Private Pilot* magazine for 34 years and was the editor of *Twin & Turbine* magazine from 2012 to 2016.

FOREWORD

As a young boy, LeRoy Cook wandered onto an airfield with a dirt strip and taildragger airplanes. General aviation was blessed. LeRoy learned to fly. He got his private certificate, commercial, flight instructor, instrument and ATP…as have so many others.

But, LeRoy was different.

He never stopped learning. LeRoy Cook, after 60 years of flying, plus or minus a year or two, is still learning. He is still exploring the magic of lift, the symmetry of balanced flight, the mystery of the perfect landing. It is a personal quest. But, he is happy to share that quest with those that share his love of flight.

But that is only part of the blessing. LeRoy Cook has written numerous articles and books about flying. They range from the techniques of piloting an airplane to the joys of being in the air. His writing is infused with a quiet, plain-spoken philosophy that encourages flyers to do their best in whatever it is that they fly.

LeRoy's style of writing is lean. He never uses two words when one will do. The result is a short sentence packed with information. So, readers, pay attention. In this, his latest book, LeRoy is writing to new flight instructors. But it is must reading for any flight instructor or anyone that might aspire to become one. As a flight instructor and a Designated Pilot Examiner, I attest to the fact that the information in this book is sorely needed in the aviation community.

In this, the age of glass cockpits and the miracle of the magenta line, we are producing electronic data managers. As a result, stick and rudder skills have deteriorated. Our leading cause of accidents is classified as "Loss of Control." Many of today's flight instructors were trained to be electronic data managers. It is no surprise that that is what they teach. Keeping the ball in the center is secondary or even tertiary to the colorful screens in the cockpit. Traffic advisories send them heads down in the cockpit searching for possible airborne conflicts, when their eyes and attention should be on the horizon.

LeRoy Cook does not disparage the advanced avionics that are part of aviation today. But he does emphasize the basics of flight and the eclectic craft of teaching those basics.

Read LeRoy Cook's book. If you are a flight instructor or aspire to become one, this book will be a trusted guide.

David Bradley
CFI and DPE

INTRODUCTION

AN INTRODUCTION TO INSTRUCTING

A few years ago, when I passed the mark of 10,000 hours of dual given, it was suggested that I write a book about learning to fly. I hesitated, because there have been many, many books written about flight training. What could I possibly add that has not been said before? However, I have had the advantage of a long perspective, passing from the age of dirt runways, tailwheel trainers, tube-type radios and minimal instrumentation, to the development of today's full range of advanced aircraft. Even in this day of cockpit displays and composite airframes, the sky does not change, only our means of participating in flight.

In the course of more than 50 years of flight instructing, I have taught only a few hundred people to fly. One might expect the total to run into thousands, but the reality of aviation is that we have to introduce numerous people to flying in order to make a single licensed pilot. I once analyzed the student record folders accumulated from a dozen years of instructing; of those sticking with the program long enough to make their first solo flight, only a third continued on to gain their private license.

What happened to the other two-out-of-three? The reasons, or I should say the excuses, varied widely, but most of them boiled down to loss of interest. In some cases, a relocation interrupted the student's flying lessons; there's always the hope that those who left the local area eventually completed their training elsewhere. The fact remains, learning to fly is more work than some people want to deal with. Most who shared their feelings used the excuses of spousal impediment, poverty, lack of time and just plain fearfulness. It takes considerable effort, both in the air and with ground study, to complete the course, and we must not assume it's for everybody.

Flying, unlike many other activities, cannot be evaluated from afar. There has to be an initial period of participation before a decision can be made about continuing to devote time and treasure to the training.

Thus, a large dropout percentage is normal. Dilettantes need not apply. I try to explain the commitment required during the initial Q&A session, but there still has to be a few experimental hours flown to test the waters. I can't always judge who will last and who will wash out. I like students to say things like, "this is great!" and, "I don't want to stop!" But when the real work of building layers of piloting skill is undertaken, I know there will be hours that test resolve.

And so, we instructors have to be innovative to keep as many students as possible hungering for more. I can't teach them all, nor should I expect to. Personality conflicts aside, the sky is not for everyone, the responsibilities of a pilot-in-command are demanding, and if a person doesn't want to be there, they should not be coerced to continue. I don't often call up truant students to beg them to make an appointment. If they want to continue their lessons, they know where to find us. That said, everyone needs encouragement at various times, and we CFIs must not lose sight of our role in encouraging and facilitating.

As a part-time CFI in a limited market, I only give a few hundred hours of instruction each year, and much of that is recurrent training and advanced schooling. But, I take my greatest satisfaction from primary flight instruction, when I can mold raw clay into the image of an aviator, give it a tinge of the passion I feel, and know that I was responsible for everything that new pilot knows about flying. I can't command that same measure of parental pride when helping a pilot gain a commercial

rating or make a transition to instrument flying. Overseeing a pilot's induction into the solemn priesthood of CFI certification is close, but that's more of a passing of the torch, rather than attendance at a birth.

LESSON PLANS

The employment of formally-constructed lesson plans varies considerably from instructor to instructor, and from student to student. Innovation is the hallmark of an effective teacher, and strict adherence to a written plan of instruction limits such creativity. Nevertheless, one certainly has to have an organized plan of action when setting out to teach; something to refer to, as a means of making sure everything was covered. Just writing down the order of the steps, reading it over, and reviewing the plan after the flight, may be enough. After some years in the right seat, lesson plans become pretty well ingrained.

Most importantly, the instructor has to stay flexible. The cramped, noisy, jostling cockpit is a lousy classroom, and a very expensive one. We cannot waste time pursuing rigid monkey-motion that may not be applicable to this student on this day. If they aren't grasping the concept being introduced, drop back to a simpler previously-used maneuver that has been mastered, then work up to the advanced steps. If the day turns unsuitable, because the ceiling drops or the wind turns sideways, switch lesson plans to cover something of equal value.

In truth, lesson plans don't have to be complicated. At the start, put down the objectives of the lesson, then state the means by which these objectives will be taught, and then show how we are to know the objective has been met; can the student perform within tolerances, can they explain the maneuver, can the task be performed unaided? The technique used can vary, but the objectives remain the same. Remember, lesson planning doesn't have to be complicated.

CURRICULUM

Teaching flying requires a steady addition of more challenging material after simple, basic maneuvers are learned. Think of it as building a brick wall; lay down the first course of bricks, tamped carefully in place and aligned correctly, then follow with additional bricks on top of that foundation. You must not advance to complex maneuvers until the fundamentals are mastered.

To make the process of attaining a pilot license less daunting, I speak about doing it in phases. The first phase is to achieve solo flight status,

which includes spending time practicing maneuvers without the instructor. Phase two is the cross-country section, when dual cross-countries are followed by solo trips, developing confidence and meeting all the requirements for the license. And phase three is the finishing-up segment, preparing for the flight test, a.k.a. "the checkride," by polishing and perfecting everything it takes to be a successful certificated pilot. Preparing for and passing the Knowledge Exam, a.k.a. "the written," is a phase of its own, inserted whenever it's appropriate. If there is going to be a need to halt flight training temporarily or switch instructors, it's best to do it after completing one of the phases, to minimize costly refresher training.

PACE YOURSELF

How many students can you handle? How many hours should you instruct per day? Only as many as you can enjoy. I usually supervise six, sometimes a dozen, active students—ones that fly regularly—and I try to have them spread out in various phases; two in pre-solo, a couple on supervised solo, two more in cross-country and one or two in the checkride-prep stage. Such variation helps maintain one's sanity and focus. Trying to fly 1,000 hours of dual per year guarantees burn-out. Stick with a limited number of students to make it fun. But do not put your CFI certificate into hibernation once you have a career established; keep instructing to pass along your expertise, and you will learn from ever-inquisitive students, who will challenge you to keep growing.

CONDUCT

As a certified flight instructor, conduct yourself in a professional manner. Do not demonstrate risk-taking, lest lesser-experienced eyes be watching your example. Hold to higher standards of safety, suggest better alternatives and never let your frustration with inept students show in word or action. Always empathize, remembering how you felt when you were a student pilot.

Pay attention to grooming and hygiene, given the close confines of your classroom. Body odor, perspiration and expectoration are unavoidable byproducts of cockpit activity, but must be minimized. Dress one level above your student, to set the right tone of authority: If they wear blue jeans, wear dress pants; their polo shirt requires that you wear a dress shirt; if they show up in a dress shirt, you add a tie; if the student wears a tie, you should wear a blazer. Dress modestly, never to draw attention, but in business-like attire.

Even in the intimacy of an airplane cockpit, you must respect the student's space. Watch for discomfort and avoid acts that can be misunderstood, particularly with mixed-gender or age-gap situations. While it's normal to become friends with students, particularly those with similar non-aviation interests, NEVER indulge in dating or close social activities. This only interferes with the learning process. If truly interested in pursuing a cute student, wait until the license has been attained, or hand them off to another CFI.

INNOVATE, INNOVATE

The purpose of this book is to set down my methods of teaching primary flight instruction, acquired from dozens of instructors I have known, and mingled with my own experience. Bear in mind, no one technique works for every student, the CFI's job is to evaluate the effectiveness of their own teaching and to keep trying new things to help the student overcome an obstacle to learning. Dogma is a luxury applicable to simpler pursuits; innovation is key to the transfer of knowledge.

Never demand that every student become a clone of your assessment of what it is to be a pilot. Each individual must eventually seek their own path, whether it's flying for fun, for business or personal travel, for growth or release, or to have a fulfilling career. Most graduated students will be satisfied to remain at a level you find incomplete, yet it will be enough for them. I have trained only a few totally dedicated disciples. If you are lucky enough to receive one of those for a student, enjoy the experience.

In this spirit, I will simply discuss what this half-century of pedagogical airmanship has taught me, particularly as it relates to conducting a course in flight training, and I'll leave it to you to judge if it was worthwhile. For me, it most certainly has been.

CHAPTER 1

FUNDAMENTAL FOUNDATION

As said in the introduction, any structure must be built up on a solid foundation. Each row of bricks must be firmly tamped in place, settled and evenly aligned, before the next layer is added. Thus it is with learning a skill like flying; the fundamentals are the foundation upon which all else rests. We cannot proceed on to advanced work until we're familiar with the basics.

In the first hour or two of flight instruction, we'll set the tone for an entire career of flying. In addition to the fundamentals of flight, however, it's necessary to spend time explaining the cryptic confusion of cockpit management, what the instruments are telling us and how they are used. This training can be started on the ground, but a lot of it only makes sense when it's demonstrated in the air. Let's cover the fundamentals first, then round out the introduction with supplemental subject matter.

THE FOUR FUNDAMENTALS OF FLIGHT

No, the four fundamentals are not to be described as stall, spin, crash and burn. Gallows humor joking is a time-honored pastime in aviation, but we must avoid such pointless confusion here. Students are often laboring under some apprehension already, thus we must teach them how to manage risk to enhance safety, not dwell on poor outcomes.

In truth, there are only four things you can do with an airplane: climb, glide (descend), turn and fly straight and level. All else is made up of these four fundamental maneuvers, perhaps combined with one another or chained together, but they must be learned so well that they

come automatically, as with driving a car while talking to a passenger. You don't think about turning the steering wheel to round a corner, it's just an automatic response to following the curve of the road. And so it will be in flying, with practice.

The advantage one has when learning to drive, however, is that we saw our parents move the wheel, shift gears, brake and accelerate, from the time we started riding with them. It lost its mystery long before it was our turn to try it. Flying, however, is seldom learned in this way. We come to it entirely unschooled, and students have to adjust to its strange language, uncomfortable feelings, strident sounds, and unfamiliar gauges and controls.

The order of demonstrating things as they occur usually introduces a climb as the first fundamental maneuver. As we climb away after takeoff, the nose-high attitude of the aircraft is pointed out, and the best rate of climb airspeed is shown on the dominant instrument. Then, the student can see that raising the nose, by pulling back on the control wheel (or stick, or yoke, or whatever you call it), produces a response, with a slight delay, of a slower airspeed. Lowering the nose attitude gives the opposite response; airspeed increases after the nose goes down. Only one attitude is correct, the one that results in the best climb performance.

By now, there's frequently a need to turn the aircraft away from the runway heading to depart the traffic pattern. This generates the next teaching moment, illustrating how the turn is initiated with some aileron input and how the relatively shallow bank angle is stabilized by neutralizing the control. The turn continues as long as the bank is maintained, just as a bicycle leans when rounding a corner. When the desired direction is reached, opposite aileron lifts the lowered wing back to wings-level and the turn stops. Simple, no?

But, how do we know the wings are level? Look out at the wingtips, one after the other. There should be equal distance between wingtip and horizon on each side. No bank, no turn. At this point, I like to illustrate the effect of P-factor in the climb, showing that a slow progression into a left turn occurs when all control pressures are released (assuming a right-rotation tractor propeller). Then, I show that the merest pressure on the right rudder pedal stops this left-turning tendency, which is strongest at low airspeed and essentially disappears in level flight.

As we reach a safe maneuvering altitude, the nose is lowered to stop the climb, demonstrating the change in nose attitude relative to the horizon, and power is reduced to a cruise setting as airspeed builds and

emphasis is shifted to the altimeter, which now becomes our primary performance instrument. Ah, but we haven't retrimmed the aircraft. I release the cleverly-concealed forward pressure I'm holding on the yoke and the nose starts upward, as the airplane attempts to seek its trimmed speed, which was back at best-climb. I then demonstrate that adding some nose-down trim allows us to achieve hands-off flight, as we did in the climb.

This is the proper time to demonstrate the $E=MC^2$ of aviation. This begins with the concept of attitude (the relationship between the aircraft's nose, as seen from the pilot's seat, and the natural horizon line, where the earth meets the sky) and adds the variation of power to achieve performance. To be forever inscribed in the student's cerebrum, we chant "Power Plus Attitude Equals Performance" as we write it across the cockpit on a chalkboard of air. Pull the nose up, but with the throttle reduced, and no climb results; it's plain to see, half of the equation is in error. Add full throttle, but with the nose on the horizon, and only noise happens—there is no climb. Again, one half of the required inputs is wrong. Only when BOTH power and attitude are correct does the desired performance take place, something that must be learned for each maneuver we use in our flying.

To complete the four fundamentals, we then demonstrate the glide maneuver, as an antithesis to the previously-learned climb. What goes up eventually has to come down, and there's a proper, precise way to descend for a landing, just as there's a way to maximize climb performance. The power setting is reduced to dead idle, to emphasize that the engine is not totally necessary for flight. We note that the nose is now heavily weighted toward dropping over into a hands-off dive, so we have to oppose this nose-heaviness with back pressure on the yoke until a handful of trim adjustments are made. By now, the airspeed has slowed to the best-glide number and we point out the nose attitude, which is below level-flight position. Obviously, we're traveling down a hill, but at a stable rate of descent, in full control. There is, then, no immediate danger when the engine's power is taken away, although an eventual landing will result.

The point made, power is reapplied and trim reset to level cruising flight. The student has now flown in all four regimes of flight; climb, turn, straight-and-level, and glide. That's all there is to know, we stress; all else is based on those four basic maneuvers. Not only can you do it, it's been proven; you've already done it. All you need now is practice and development.

Inquiring minds often want to know, before the first flight, "how much of the flying will I get to do?" My answer is always "most of it," because we're not out for a ride, but rather for a flying lesson. There should be no wasted minutes, so from the time the checklist is picked up, the student should be involved in a tactile sense. The first time out, I'll hold the checklist and read it with the student, but they will move the control or switch in response. Once we're safely underway and I've demonstrated the proper ground steering technique, taxi control is passed to the student and they learn how to follow a yellow line, slow down for turns, apply the brakes and watch out for the protruding wingtips.

Instruction in ground handling continues throughout the pre-solo phase and beyond. Often given short shrift in training, control of the aircraft on the ground should be honed continually. While it's easy to learn how to steer a tricycle gear airplane, sloppy taxiing creeps in unless the instructor insists on correct technique. Even when they're inert, one must hold onto the flight controls, in anticipation of encountering a wind gust or prop wash. Taxi on the centerline, not in a parallel universe off to one side, and reduce speed for turns by throttling back in advance to minimize the need for brakes. Brakes, I always maintain, are a substitute for brains; plan ahead so you won't need them (except for airplanes built without nosegear steering).

Concepts for ground handling are foreign to nearly all beginning students; the throttle does not snap closed on its own, like a car. Rather, it requires a manual pull to achieve an idle. The primary steering control on the ground is accomplished with one's feet, with the hand-operated controls relegated to a secondary role. In the air, the situation is reversed—hands are primary, feet are secondary, and during takeoff and landing, there is a shift from one system to the other. A beginning student has to absorb all this, and they need to be assured that it's normal to spin the control yoke frantically from one side to the other until foot-steering becomes second nature, which can take five lessons or more.

The first takeoff or two are a shared responsibility; the student has already learned how to taxi, so following a runway centerline while the airplane accelerates toward liftoff is no mystery. I will take care of raising the nose when airspeed is sufficient, and point out that the airplane lifts off entirely on its own, the result of speed creating lift with the wing at a high angle of attack. By the time we've accelerated to V_Y, where the airplane will be in trim, I can turn the controls over to the student and begin the teaching of fundamentals. The next time we take off, I'll track

the centerline for the student, while they raise the nose and fly through the liftoff, and if all goes well the third takeoff is all theirs.

This does not mean, of course, that instructors can retreat from responsibility, most particularly when flying close to the ground. Never, ever, doze with unguarded controls when the runway is near. Even students with several lessons under their belt can react unexpectedly, and it only takes an instant to damage a nosewheel, depart the runway edge or zoom upward into a stall. I maintain, only half facetiously, that students teach themselves to fly. I am only there to protect life, limb and property, and to shorten the process by explanation, demonstration and tedious repetition.

CLEAN-UP WORK

The first few lessons are where we must slip in the tidbits of instruction that have to be learned to foster understanding. Once the process of turning is learned, by entering a bank and rolling out of it, we have to answer the unvoiced question, "but what about the rudder? I thought it had something to do with turning the airplane." And so it does, but only in a secondary role, I say. Its primary purpose is to swing the nose from side to side, something that's not normally desired. However, a turn begun without rudder input, I demonstrate, is a sloppy, hesitant

LESSON PLAN

OBJECTIVE

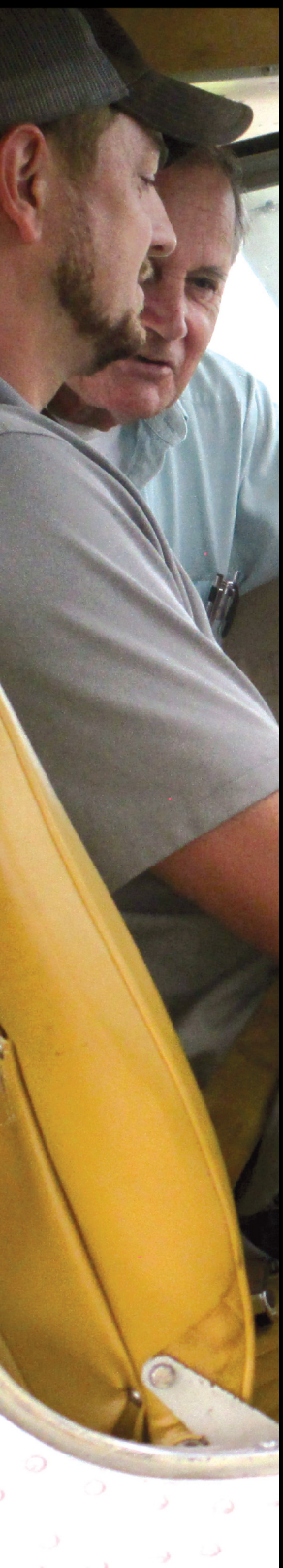
An introduction to the fundamentals of flight: ground handling, climbing, turning, straight-and-level flight, glides and use of the performance instruments.

TECHNIQUE

Brief students on the objectives, transfer control to the students as soon as they are capable, demonstrate each new concept and allow the student to practice, and explain how to achieve desired performance.

DESIRED RESULT

Student can taxi, enter and hold a steady climb, transition to level flight, adjust trim and power, make 90-, 180- and 360-degree medium-bank coordinated turns, maintain straight flight and hold altitude, and enter and hold a steady glide. Added elements; use of radio communication, maintain control during takeoff roll, follow the preflight inspection and use of checklist.



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Guidance for Instructors Creating Pilots

Beginning or part-time flight instructors (CFIs) are not always fully aware of what to expect as a student pilot progresses through the flight training process. In *Teaching Flight*, author LeRoy Cook lends his half-century of experience as a guide to motivate, inspire, and mentor new instructors.

Though airplane and cockpit technology has changed over time, the basics of flying remain and must be mastered all the same. To make the process less daunting for both student and instructor, Cook organizes training into four phases and advises how to work through each one: solo flight; dual and solo cross-country; passing the knowledge exam; and passing the checkride. With the goal of creating a new aviator, Cook's lessons take flight training beyond the mandated curriculum to give instructors the tools to provide pilots practical flying know-how.

Flight instructors following his steps will find a mentor in LeRoy Cook, while taking their students from first flight through certification. *Teaching Flight* offers a plethora of ideas for instructors to keep their students inspired, encouraged, confident, and competent on their road to earning a certificate and rating.

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