by LEONE M. WALTON • AOPA 24621

The Fifth Fundamental Of Flight

An understanding of 'change of airspeed' as a control and fuel saver is something many VFR pilots miss, but an instrument pilot soon learns the value of being able to control airspeed while maintaining altitude

When you and I learned to fly, we were taught that there were four fundamentals of flight—straight and level, climb, glide, and turn—and that all other maneuvers were a combination of two or more of these basic ones.

In learning instrument technique, I soon found that there is a fifth fundamental—change of airspeed. Like climbs and descents, it can be performed either in straight flight or in turns, yet within itself it is basic. This is a very tricky maneuver, but can also be very helpful —in some cases, a lifesaver.

In a Link trainer, without trim tab, it proves to be one of the most difficult of all instrument maneuvers for strictly "seat-of-the-pants" VFR pilots to perform, probably because they have never done anything like it before. This is borne out by remarks like, "What's the purpose of this maneuver?" or "Why do we have to use two different airspeeds?" or this, from a flight instructor, "I never paid any attention to airspeed before."

Perhaps it is little wonder that change of airspeed is slighted in visual training. The nearest thing to it in the Flight Instructor's Manual is slow flight. At first glance, it may appear that slow flight and change of airspeed are one and the same, but there is one very important difference. Slow flight is practiced to give the pilot kinesthetic training in sensing the approach of a stall and to teach him to keep the airplane under control at minimum airspeed, power off or power on. In any maneuver where either minimum airspeed or minimum power is being used, it is essential that the student pilot use power to control altitude, pitch attitude to control airspeed. This rule may well save his life during an approach for landing, but it has the adverse effect of making his instrument training more difficult, especially the art of changing airspeed without change of altitude.

Since some instrument training is now mandatory for everyone, the student should have at least a working knowledge of the "fifth fundamental" by the time he goes cross-country, even though this is not a required maneuver for the private flight test. He should realize that there is a range between maneuvering and cruising speeds where the airplane has a *reserve* of both power and airspeed. This reserve makes it possible to interchange pitch and power for altitude and airspeed control. In fact, military manuals list both airspeed and altimeter among the pitch-control instruments, but only airspeed under power control. Without this interchange, an attempt at change of airspeed can be pretty frustrating.

Since the student has been taught to control airspeed with the elevators, the logical way to decrease airspeed is to apply back pressure on the stick or wheel. Fine! The airspeed is soon reduced to the desired maneuvering speed, but in the meantime what happens to altitude? In many lightplanes used for instrument training, a change of pitch attitude that will produce maneuvering speed without change of power will also produce a 500 f.p.m. rate of climb. Why not reduce the power setting, then, until the vertical speed falls back to zero. This works fine, but without a change of pitch attitude, the airspeed falls far below that desired.

Thus we arrive at but one conclusion. A change of airspeed while holding a constant altitude necessitates a change of both pitch attitude and power setting. Actually, it makes little difference which control is used for which instrument if the pilot wants to juggle stick and throttle until he haphazardly reaches the right indications. However, it does seem more logical, in attitude flying, where a pre-determined power setting is established as soon as possible, that elevator control be used to hold altitude constant while power is changed to reduce airspeed to maneuvering. If the pilot then wishes to hold airspeed constant while establishing a definite rate of climb or descent, it is more logical to hold airspeed with elevator while adjusting power to establish correct vertical speed. A good rule to follow, then, is: "Use elevator control for the pitch instrument that is to remain constant while making changes of speed or altitude within the cruising-maneuvering range." This is especially important in the climb-out following takeoff, when the airplane is not considered safely airborne until the vertical speed is established and remains constant.

The phrase "holding airspeed (or altitude) constant" may be misleading. At first glance, it appears that the stick or wheel is to be held constantly in the same position, or that the amount of pressure is to remain constant. This is not the case at all. Holding an instrument constant by means of elevator control means that the indication on the instrument itself is held constant by small, subtle *changes* of back or forward pressure as needed. Even after adjusting the trim, some control pressure will be required to prevent oscillations, especially in rough air.

"Maneuvering speed," previously mentioned as our purpose in reducing airspeed, may be unfamiliar to many who have had little or no instrument training. By computation, it is about 75% of cruising airspeed (somewhat less than twice the normal stalling speed). Thus, an airplane that cruises at 120 m.p.h. would have a maneuvering speed of 90. However, some aircraft rated at 120 m.p.h. will only cruise 110 at prescribed r.p.m., making 80 m.p.h. a more comfortable speed for maneuvering.

What is the purpose of maneuvering speed? In the "good old days" it was recommended for starting any abrupt maneuver, such as snap rolls, to prevent popping out too many rivets. Since abrupt maneuvers are sometimes imposed by Mother Nature, a more practical, everyday use of maneuvering speed is to avoid stress on the aircraft whenever rough air is encountered. Maneuvering speed, then, is the speed at which the load imposed on the wings will not exceed the safe operating load

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factor as designed by the manufacturer. To reduce speed quickly when encountering rough air, it is helpful to lower the gear on aircraft having retractable gear. However, it is unwise to extend flaps, just as it is unwise to use controls abruptly. Abrupt control usage may be employed at maneuvering speed in smooth air, but, in combination with rough air, would far exceed the safe operating load factor.

One of the most valuable uses of the fifth fundamental is that of stretching the fuel supply. Examine the cruise and range performance data of any lightplane and you will find that the lowest power settings will give the longest range. The saving in gasoline consumed per hour will far offset the lower airspeed.

The most common use of maneuvering speed is in instrument flying, during climbs and descents, holding patterns and approaches. According to new regulations, the pilot is expected to reduce speed at least three minutes before reaching a holding fix. This gives him better control over his airplane, saves fuel while holding, and takes up less room in the crowded airspace of a high-density terminal area.

Now that we know the purpose of the fifth fundamental, let's see how it can best be performed. The example used will be a single-engine four-place training plane that cruises about 110 m.p.h. at 2450 r.p.m. First, of course, we have to know the power setting that will let us hold altitude with normal load at a maneuvering speed of 80 m.p.h. This may vary from one airplane to another of the same make and model, and should be determined by careful experimentation. Let's say it is 1900 for our airplane.

First, reduce power smoothly to 1,700 r.p.m., holding airplane level by artificial horizon. As power is reduced, thus decreasing torque, change rudder pressure slightly from right to left to prevent a turn to the right. The sound of the engine should help to find the right power setting, with only a quick glance at the tachometer to verify it. Attention should now be centered mainly on the direction indicator and vertical speed. As soon as the vertical speed threatens to drop, begin cranking in nose-up trim. Include airspeed in the check from heading to vertical speed. When air-

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speed reaches 85 m.p.h., advance power to 1,900, shifting attention to heading and altitude. If altitude has changed slightly, it may be corrected by gentle elevator pressure with little effect on the airspeed. Make a final adjustment of trim after desired altitude and power setting have been reached.

In changing from maneuvering to cruising speed, the process is practically reversed. First, increase r.p.m. to about 2,200, while holding constant pitch attitude and increasing right rudder pressure. Then trim the nose down just above level flight attitude, and make a final adjustment of power and trim to cruising attitude and airspeed.

Changing airspeed in a turn is a little tricky. It is necessary to decrease the angle of bank as airspeed is reduced, increase it as airspeed is increased, in order to hold a standard rate turn, as angle of bank for a standard rate turn is dependent on the airspeed of the airplane. This makes a good training maneuver, but is usually unnecessary in actual practice.

Whether you plan to become an instrument pilot, or simply want to be a safer VFR pilot, don't neglect the use of that fifth fundamental—change of airspeed.

Even on flights when you don't need it, practice it once in a while just to keep up your proficiency. It could save your life sometime by easing the stress in turbulent air, stretching your fuel supply, or keeping you safely within the bounds of your assigned holding pattern. END

AOPAer Addresses Flying Realtors

Contrary to popular belief, no real estate values are harmed by their proximity to airports and some are even increased, members of the National Real Estate Flyers Association were told at a meeting recently in Detroit.

Citing studies by real estate appraisers, Philadelphia attorney Alfred L. Wolf (AOPA 5) said that the value of property near an airfield is at least as good, and sometimes better, than elsewhere because airport communities benefit in respect to the cost of schools, utilities, and the increase of "green space."

A founder and Secretary of AOPA, Wolf has specialized in aviation law for over 30 years. The editor of the "Legally Speaking" column, which appears monthly in The PILOT, he holds the rank of brigadier general in the U.S. Air Force Reserve.

Refuting the objections of communities that oppose airport construction on the basis of danger, Wolf pointed out the safety record of general aviation over a recent 10-year period. During this time, surface vehicles caused 115,000 fatalities, against 46 bystander-fatalities caused by aircraft, only 13 of which were general aviation.

Wolf outlined the explosive growth of general aviation, which now accounts for 97% of all civil aircraft registered in this country. In addition, 59% of all movements at Federally controlled airports are general aviation, he said.

Tracing the expansion of airports during their 35-year history, he added that their needs have also increased. Today the requirement is for a longer, though single, runway, and for the equipment necessary to permit all-weather, 24-hour airport operation. He emphasized the need for adequate airport planning, blaming later costly acquisition of land, structure removal and facility changes on lack of planning.

Wolf suggested two possible plans for airports of the future: The first, a "compatible airpark," would combine green area with a two-way single runway. It would have swimming pools, picnic areas, miniature golf, ball diamonds, bowling alleys, skating rinks, courts for various games, playgrounds, lunch rooms and other conveniences.

Wolf's second suggestion, an "industrial airpark," would contain banks, offices, warehouses, restaurants, parking areas, garages, stores, car rental facilities, supermarkets, discount centers, laboratories, barber shops, message centers and lavatories. END

Overnight Stop In Ohio

Moore Field occupies one of the few flat spots around Cadiz, O. The field's 2600-foot runway runs parallel to a divided four-lane highway in front and a deep, strip-mining trench in back *Tom Root Air Photo*