Highlights and Margin Notes in
Wolfgang Langewieshe's

Stick and Rudder: An Explanation of the Art of Flying
Chapter 9 Notes

Perhaps my notes and observations will inspire you to buy your own copy and learn from this classic…or to take the copy you already own off the shelf and revisit its great lessons, just as I am doing again now.

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Continuing my notes on Wolfgang Langewiesche's essential classic, ***Stick and Rudder***:

Part III: The Controls

Chapter 9: "The Flippers and the Throttle"

Page No.	Highlighted Text (Langewiesche's words)	My margin notes
146	The controls of the airplane become the harder to understand the more you fly.	The more you know, the more you need to learn
	In some situations the controls actually reverse their usual effects.	
	Much of the difficulty of flying, much of the wasteful inefficiency of primary flight instruction is due simply to the fact that the student does not know really *what* he is doing when he moves his stick, his throttle, or his pedals.	Not just students….
	The instructor fears that a thorough discussion of control effects would only confuse…"control analysis" is the accumulated experience of hundreds of hours of flying.	Instructor fear, or inability? If the instructor is *not* tasked with passing along the lessons of his/her "hundreds of hours of flying," then what?
147	The real trouble with "control analysis" is not that it goes too far. It does not go far enough.	
	If control analysis is carried far enough, it becomes simple and most helpful.	"Making the complex simple"—my goal as an instructor.
	Actually there are no reversals of control effect. Each control does a certain thing, does that thing only, does it always, and faithfully; but the thing it does is not what you first thought it was.	Movement relative to airframe, not the horizon.
148	The elevator doesn't elevate	Angle of Attack control
	Most fatal airplane crashes happen precisely because the pilot has the controls so labeled in his mind and tries to "elevate" himself, or at least hold himself up, by pulling back desperately on the so-called "elevator"	Failure to recognize load factor and AoA
149	The controls cannot be labeled in terms of the flight path	
	The stick should be labeled "nose up" and "nose down," with the terms "up" and "down" referring not to the sky and the ground, but to the pilot himself.	More correctly, label for the airplane axis each controls: elevator = lateral/pitch axis, aileron = longitudinal/roll axis, rudder = vertical/yaw axis.
150	The elevator determines the Angle of Attack at which the airplane will fly.	
	Angle of Attack is the central fact of all flying. A pilot who refuses to think in terms of Angle of Attack simply does not understand the airplane.	The "feel" of the airplane
	When the pilot pulls the stick back and thus deflects the elevator upward, the net result is the same as if he had simply changed the angle at which the horizontal stabilizer is attached to the airplane's tail; the airplane	

	then assumes a different Angle of Attack.	
151	An airplane essentially needs no moveable flippers….All it needs is some device by which the angle of attack can be changed.	"Flying tail" on jets, Mooneys. Even changes in power.
	The airplane goes up or down because of the way the throttle is handled. The elevator has an *indirect* up-and-down effect.	Elevator – speed (AoA). Power = altitude (vertical speed). In reality, it's *both* power and elevator that affect both speed and altitude, because power also changes angle of attack. It's a balancing act.
152	Generally speaking, the airplane flies on less power when flying at the higher Angle of Attack.	Lift = AoA + Power
	The stick is speed control…. If you feed it a lot of power, it will climb at that speed; if you feed it less power, it will fly level at that speed. If you cut the power entirely, it will glide at that speed.	The airplane will fly at the speed (AoA) for which it is trimmed.
154	The airplane's real up-and-down control is its throttle.	
156	The landing approach with power on…is another perfectly "practical" maneuver in which the elevator *must* be used as the speed control and the throttle as the up-and-down control.	
	In most airplanes, the tail surfaces are exposed to the propeller blast, and thus the stick is more powerful when the throttle is open. Also, the thrust of the powerplant may have the effect of nosing the airplane up.	
157	With the stick in a given back position, the average airplane *will actually slow down when the throttle is opened wider*.	Flight at Minimum Controllable Airspeed…the "back side" of the power curve.
	There are certain stick positions (pretty far back but not all of the way back) which with power off will not slow the airplane up to stalling speed, while with power on the same stick position will stall the airplane. This is why so many fatal stall-and-spin accidents occur with the engine running at cruising power.	Would be interesting to test and quantify.
	The speed of the airplane is controlled by the position in which the pilot holds the stick.	
	A change of speed and Angle of Attack may have one effect in a climb and an altogether different effect in the glide; it may affect the flight path differently at fast speed and at slow speeds. Any change of stick position has usually two effects on the flight path, first a quick immediate effect (usually a ballooning when you pull the stick back) and then a steady long-run effect (sometimes a downward deflection of the flight path).	Flight path management
158	Perhaps we shall see airplanes with an up-and-down lever which controls throttle and also spoilers, drag plates or flaps, in their place of honor; and the stick, atrophied into a glorified stabilizer (trim-tab) control, mounted somewhere at the pilot's side as a speed lever. Who knows?	L. anticipates autothrottle and side-stick control.
159	Afraid of the ground, the victim tries to set his controls for "up" or at least for "not so much down, very desperately so. Actually, the stick being the speed control, what he does is to put on the brakes!	Panic pitch-up into an accelerated stall
	The pilot who discovers that his "elevator" fails to get the desired results, that is, fails to hold him up, is not likely to suspect that he has done the wrong things; he is much more likely to think that he has done the right thing; but not hard enough.	Pitches up even more
160	Epitaph: "He did not know he was pulling the stalling lever."	
	Stalls and spins are caused by having too slow a speed or—what is practically the same thing—too high an Angle of Attack.	The airplane will naturally descend to remain at 1G and the same AoA. It will nly stall if the pilot *makes* it stall by pulling "the stall lever."
	Unless the stick is in the stalling position, an airplane cannot stall and hence cannot spin.	Green, yellow, and red bands of extension of the control column.
161	Ten cents worth of wire will make any airplane unstallable, will solve one of aviation's biggest	Limit elevator travel to remove the ability to completely stall…but what about a mush?

	problems, and will simplify flight training enormously [by] "restriction of controls…."	2018 note: in modern terms, "envelope protection" such as is the latest thing in light airplane autopilots.
	A stick restricted so that with power off it could barely not stall the airplane might nevertheless stall it while the power is on.	Increase control authority/effectiveness with prop blast.
	When an airplane is even only near the stall, misuse of rudder or ailerons—without further pull back on the stick—can bring on a stall on one wing, and hence a spin.	2018 note: angle of attack indicators don't fix the problem any more than conventional stall warning.
	If you tied all three controls down so that none of them could be moved very far, you would still have perfectly sufficient control for all ordinary flying except perhaps three-point landings and steep sideslips; and at the same time you would have a "foolproof" airplane, incapable of spinning.	L. is arguing for limited-control airplanes.
162	Just remember that an airplane cannot stall or spin unless the controls are set for stalling and spinning; and keep that hand from creeping back.	The airplane can stall *only* if the pilot, the autopilot or the trim *makes* it stall.

I'll add chapter highlights and notes until we reach the end of the book. If you're impatient—and I hope you are—you won't wait for my musings, but instead will secure your own copy of *Stick and Rudder* now. Beyond simply reading its words, you'll truly analyze, criticize, mark up and understand Langewiesche's teachings to, as Adler suggests, **make this book your own**.

I look forward to your comments on these notes and the larger work. Please send your thoughts to me at mastery.flight.training@cox.net. Thank you.

Pursue *Mastery of Flight.*

Thomas P. Turner, M.S. Aviation Safety
Flight Instructor Hall of Fame
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year

