Highlights and Margin Notes in
Wolfgang Langewieshe's

Stick and Rudder: An Explanation of the Art of Flying
Chapter 7 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.

FLYING LESSONS is an independent product of MASTERY FLIGHT TRAINING, INC. www.mastery-flight-training.com

Pursue ***Mastery of Flight***™

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

Part II: SOME AIR SENSE

Chapter 7: "What the Airplane *Wants* to Do"

Page No.	Highlighted Text (Langewiesche's words)	My margin notes
110	Take your hands off a good airplane's stick, and it will do a good job of flying all by itself…generally speaking it wants to do whatever is necessary to maintain healthy flight. This built-in will of an airplane is….*stability*.	Stability, trim, and control: the very first lesson I (used to) present, and what I teach during a First Flight experience.
	An airplane is stable if it wants to do the right thing, unstable if it wants to do the *wrong* thing.	
	The art of flying consists in the very first place of doing nothing…because of this tendency of the airplane to do the right thing.	
	The pilot is always being guided by his airplane's feel.	
111	It is the airplane's own will, conflicting with ours, that puts up the resistance we feel as control pressures.	
112	The airplane is not concerned about its own *attitude*…the airplane is concerned with…the relative wind.	The airplane will seek a trimmed airspeed, or more correctly, trimmed AoA
	The airplane wants to fly at a certain speed	Part of my first lesson
114-115	The tail of the airplane is arranged to resist this diving tendency. The horizontal tail fin is probably the least understood part of the airplane.	
115	The purpose of the horizontal tail fin is not to hold the tail up, but to hold it down…a wing set at a negative Angle of Attack.	
	The tail operates in the downwash of air that flows off of the wings.	
	The weight of the airplane tends to nose it down; the horizontal stabilizer needs to nose it up.	In this context "weight" means "CG location."
116	The longitudinal stability of the airplane has been described…in terms of *speed,* but the engineers describe it in terms of *Angle of Attack*.	What I said
	In straight flight…if the airplane is at a certain speed, it also has a certain Angle of Attack.	
117	In curving flight, the airplane loads itself down…with centrifugal force; it then needs additional lift in order to sustain that added "weight." Therefore, if it is to continue to fly at the same *speed* it needs more Angle of Attack; or if it is to continue to fly at the same Angle of Attack, it needs *more* speed.	The graveyard spiral
	A stable airplane keeps its Angle of Attack constant and will allow its speed to change if that is necessary….	
	In order to keep its Angle of Attack constant despite the "weight" of centrifugal force caused by the turn, it will	A spiral is *not* a stall

©2018 Mastery Flight Training, Inc. All rights reserved.

	drop its nose and pick up speed. If the turn is a tight one, the airplane will go into quite a steep dive and go to a very high speed, but all the time its Angle of Attack remains the same; in fact it is *because* the Angle of Attack "wants" to remain constant that the airplane dives!	
	In every turn we have to combat it by pulling back pressure on the stick—often quite hefty back pressure.	
118	The tail carries…itself in that position where the horizontal tail surfaces will be exactly lined up with the [relative] wind, so that the wind will create neither an up force nor a down force on it.	
	The tail wants to ride in that particular position because of the angle at which the tail fin is set on it.	
119	What happens…when the pilot changes the angle of that trim surface? The tail then meets the wind of flight at a slight Angle of Attack and develops a force…the force will disappear only when the whole airplane finally rides at a higher Angle of Attack.	Trim changes
	"G" load…the relative wind will blow against the wings from slightly underneath and…more upward against its belly….Realative Wind would then strike the underside of the tail surfaces and would blow them upward; the tail would swing up; the nose go down; and the airplane's Angle of Attack…would go back to what it was before…. It's *attitude* would be more nose down.	
	Balance only at the Angle of Attack for which its horizontal tail is "trimmed."	
120	[with power off] it will simply remain, in gliding or diving flight, at the same Angle of Attack and the same speed which it had originally in level flight with power on.	Airplane seeks its trimmed AoA
	In most conditions of flight, the tail surface exerts a downward force…. In truth the two kinds of action are superimposed upon each other…and it is the horizontal tail fin's job to keep that all-important air flow coming—evenly.	
121	Very few airplanes, if any, actually behave quite so well; very few will actually fly, with the stick released, in straight flight, at constant speed regardless of power.	
	A starting point from which to measure the new ship's characteristics: to what extent is the ship stable, and in what particulars does it fall short of perfect stability? If you can answer those questions about an airplane, you really know that airplane.	This is why flying at Minimum Controllable Airspeed and stalls is so important in transition training and checkouts.
	Most airplanes have a tendency to *hunt*…but will oscillate up and down.	
122	Such an airplane is really "trying" to do the right thing…it "overcontrols" itself….	
123	An airplane wants to speed up if you close its throttle, and it wants to slow down if you open its throttle!	
	Propeller blast…thrust-line location.	
124	Go-around: …it wants to climb like mad right up to a power stall.	"Trimmed stall"
	Trim in the glide…getting too low…. Power will indeed stretch you glide; but it will also slow you up and get you dangerously high Angle of Attack…if you just keep holding the same amount of back pressure.	
	Every airplane has a built-in tendency to keep its own Angle of Attack constant, and hence (except in curving flight) to keep its speed constant.	
125	The airplane is not concerned with its own attitude relative to the ground.	
	What the airplane does want to do is to stop slips and skids by rolling against them…. As long as flight is *straight*, this means that the ship will hold its wings *level* and, if disturbed, will bring them back to level…. In *turning* flight, it means that the airplane wants to *bank* "just right"—so as neither to slip nor skid. If slip or skid does for some reason develop…the airplane will	

©2018 Mastery Flight Training, Inc. All rights reserved.

	promptly bank or unbank to whatever degree is necessary to stop the slip or skid.	
	Lateral stability is *not* the tendency of an airplane to keep its wings level…. Lateral stability is the tendency of an airplane to bank or unbank its wings so as to avoid sideslipping.	
	The tendency of an airplane to refuse to sideslip is due mostly to its "dihedral."	
126-127	[in] sideslip…one wing presents itself at a much higher Angle of Attack than the other…the airplane will therefore roll…and the sideslip will stop.	
127	Directional stability…the tendency of the airplane always to fly head-on into the relative wind; to yaw around around as necessary to *point* in the direction in which it is actually *going*…. It does not want to slip or skid…but if such a slip or skid occurs it stops itself by yawing into the slip.	
128	Stabilizing is done largely by the vertical tail fin…. If the airplane did not have this vertical tail area, it would have a positive tendency to set itself crossways to the Relative Wind….	
130	Not all airplanes will tighten and steepen their turning into a spiral dive. Some will very soon reach an angle of bank and an airspeed, a rate of turn and rate of descent at which as stable equilibrium is found.	
	Most airplanes will, however, keep increasing the angle of bank, the rate of turn, the speed, and the rate of descent….a true spiral…an ever-tightening turn—combined with an ever-steepening dive.	
131	High speed and the tightness of turn, the g load becomes so fierce that airplanes have broken up in such dives….no stall is involved…the controls will function in a normal manner.	Demonstration of a spiral, and recovery
	If there is any disturbance in the right-and-left sense, the airplane's stability will always respond to that disturbance in two ways, *both ways at once*… yaw around so as to hold it pointing head on into the direction it is actually moving….and at the same time…refuse to sideslip…lift one wing and drop the other so as to regain its lateral balance.	
133	Overbanking tendency…nullifies the attempt of the dihedral.	Bank beyond about 30 degrees and the airplane tends to continue to bank when the controls are centered. You have to apply slight aileron opposite the bank to maintain bank angle.
134	What the airplane "wants" to do once it is in a turn; it wants to "overbank", it wants to sideslip inward, toward the low wing, and it wants to put its nose down	
	Controls during a turn and the pressures the pilot exerts on stick and rudder during a turn are nothing but an effort to block the unstable, ill-behaved intentions of the airplane.	
135	The typical glider accident is not the stall or the spin, but a spiral dive.	

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.

©2018 Mastery Flight Training, Inc. All rights reserved.

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

©2018 Mastery Flight Training, Inc. For more information see www.mastery-flight-training.com, or contact mastery.flight.training@cox.net.

©2018 Mastery Flight Training, Inc. All rights reserved.