

Upset Prevention & Recovery Training Ground School



Why are We Here?



NTSB 2017-2018

MWL

MOST WANTED LIST

OF TRANSPORTATION
SAFETY IMPROVEMENTS

*Prevent loss of control in flight
in general aviation*

Who am I?



Lt Colonel Tom Rogers, USAF Ret, 25 years



Captain Tom, Alaska Airlines Ret with 31 years flying B727, B737



- Became a CFI in 1976, 3000+ hours of instructing In Military and GA
- Primary Military Master Instructor with over 7200 Spins logged
- CFI in Floatplanes
- CFI with Olde Thyme Aviation, Bremerton WA (KPWT)
 - Tail Wheel Endorsements
 - Upset Prevention and Recovery
 - CFI Candidate Spin Training
 - Basic Aerobatics
- 23,750 Plus Hours in 48 years of flying

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Course Outline

INTRODUCTION

- ▶ Understanding what a Flight Upset and LOC are.

MAIN TOPICS

- ▶ Basic Aerodynamics as it relates to Stalls, Spins, and Loss of Control
- ▶ UPRT Philosophy - Introduction of Avoid, Recognize, Recover
- ▶ How to AVOID Flight Upsets
- ▶ How to RECOGNIZE Flight Upsets
- ▶ How to RECOVER from Flight Upsets
- ▶ Managing Startle and Fear

SUMMARY

- ▶ Putting it all together and Simplifying Flight Upset Recovery

What is an Upset?

- ▶ Wikipedia, AOPA, FAA, NTSB all have very detailed and educated descriptions.
- ▶ Rogers' Rule: If you are scared and find it difficult to react, IT'S AN UPSET!
 - ▶ Rogers Dad's rule: If you ain't never been there...
- ▶ Unusual Attitude versus Upset, Matter of severity
- ▶ Airline Upset Training versus General Aviation, Matter of: Cause Factors
 - ▶ High altitude emphasis in the Jets
 - ▶ Instrument procedures emphasis in the Jets

Loss of Control (LOC)

- ▶ LOC is the unintended departure from Controlled flight.
- ▶ LOC is the leading cause of fatalities in all sectors of aviation.
- ▶ FAA safety believes proficiency in all aspects of operations is key to avoid LOC.

- ▶ Indeed it is, but what do you do when things go wrong?

- ▶ **FIVE Most common causes of LOC**

- ▶ Unintended flight into IMC
 - ▶ Inadvertent stall/spin in traffic pattern
 - ▶ Low altitude maneuvering
 - ▶ Wake Turbulence
 - ▶ Distraction and loss of SA
 - ▶ System malfunction
 - ▶ Automation confusion



Advisory Circular

Subject: Stall and Spin Awareness Training **Date:** 1/6/16 **AC No:** 61-67C
Initiated by: AFS-810 **Change:** 2

1. PURPOSE. This advisory circular (AC) explains the stall and spin awareness training required under Title 14 of the Code of Federal Regulations (14 CFR) part 61 and offers guidance to flight instructors who provide it. This AC also informs pilots of the airworthiness standards for the type certification of normal, utility, and acrobatic category airplanes prescribed in 14 CFR part 23, § 23.221, concerning spin maneuvers, and it emphasizes the importance of observing restrictions that prohibit the intentional spins of certain airplanes.



Advisory Circular

Subject: Upset Prevention and Recovery Training **Date:** 1/4/17 **AC No:** 120-111
Initiated by: AFS-200 **Change:** 1

1. PURPOSE. This advisory circular (AC) describes the recommended training for airplane Upset Prevention and Recovery Training (UPRT). The goal of this AC is to provide recommended practices and guidance for academic and flight simulation training device (FSTD) training for pilots to prevent developing upset conditions and ensure correct recovery responses to upsets.



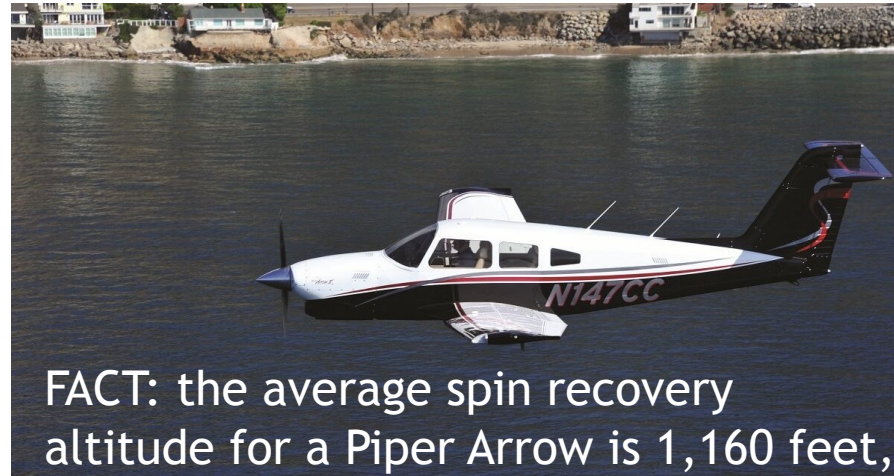
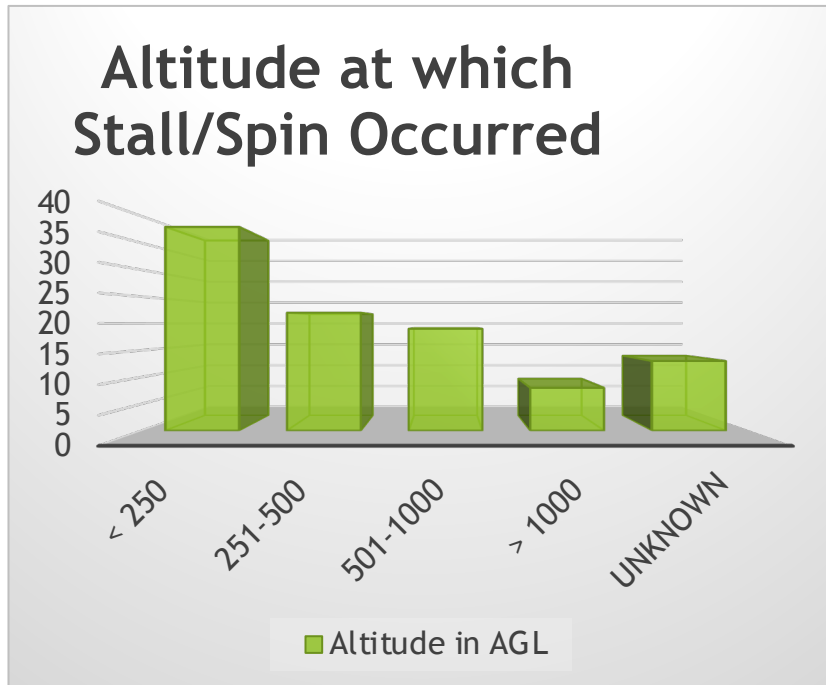
Advisory Circular

Subject: Stall Prevention and Recovery Training **Date:** 1/4/17 **AC No:** 120-109A
Initiated by: AFS-200 **Change:** 1

1. PURPOSE. This advisory circular (AC) provides best practices on training, testing, and checking of impending stalls and training of full stalls, including recommended recovery procedures.

Loss of Control-Stall/Spin, One of the Five

► Alarming Stats?



FACT: the average spin recovery altitude for a Piper Arrow is 1,160 feet, Greater than standard traffic pattern altitude.

80% of Stall Spin Accidents occur below 1000 feet AGL. (13% are unknown but probably low as well)

- **Prevention** is the MOST reliable strategy for upsets. The training is called Upset **Prevention** and Recovery Training.

AIR FACTS

the journal for personal air travel—by pilots, for pilots

ARTICLES / JOHN'S BLOG / TOP ARTICLES / VIDEOS / NEWSLETTER / WRITE FOR

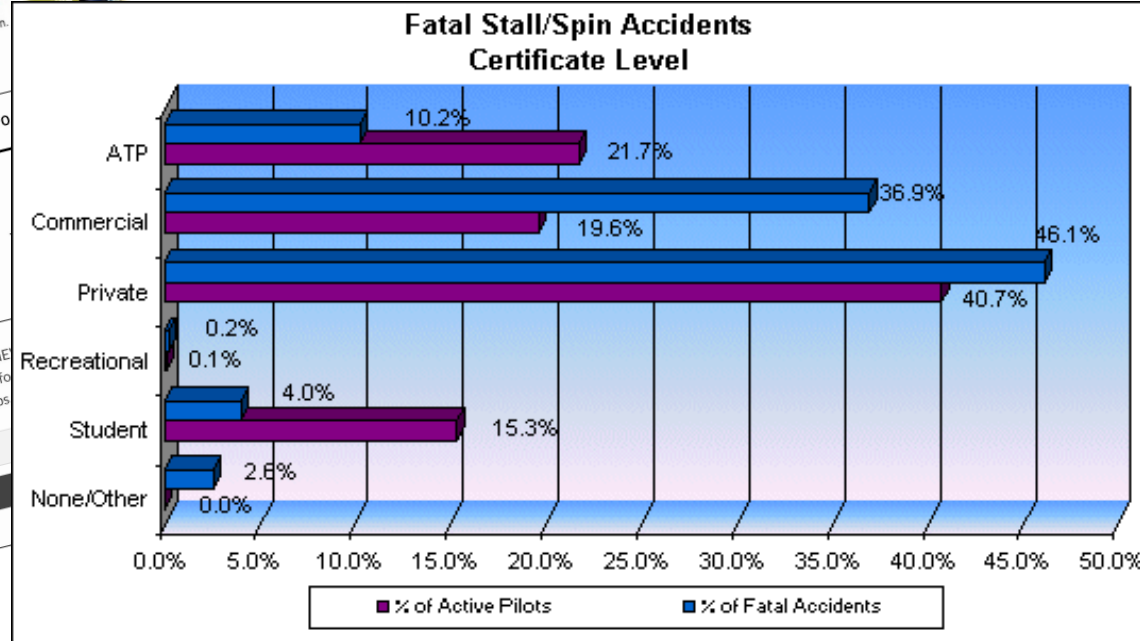
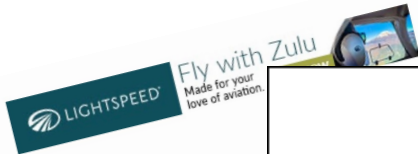
OPINION / JANUARY 13, 2020

Why Upset Training Just Doesn't Work

by Mac McClellan

During my 45 years of observing and writing about aviation, pilot upset training is a topic that has waxed and waned. For the past few years the idea of learning how to recover from an extreme attitude is in ascendance. But the reason upset training emphasis falls in and out of favor is because it just doesn't work.

The typical pilot upset training course takes pilots who fly normal airplanes for transportation reasons and puts them in an aerobatic-capable airplane. Most often the training airplane is something like an unlimited aerobatic piston single such as an Extra. The more costly programs use ex-military jet trainers such as the Czechoslovakian L-39 that was developed for the Eastern Bloc and is now widely available in the U.S.



ACCIDENT ANALYSIS



STALL/SPIN: ENTRY POINT FOR CRASH AND BURN?

Stall/spin myths exploded

Pilots who believe that aerobatic training will enable a recovery from an inadvertent spin in the traffic pattern are fooling themselves. That myth - and other misconceptions about stalls and spins in GA aircraft - is exploded in this new ASF study. This study is not intended to discount the value of properly conducted aerobatic and spin training. Training in a controlled environment with a trained instructor is beneficial. The most important aspect of the training should be recognition and prevention.

Course Outline

INTRODUCTION

- ▶ Understanding what a Flight Upset and LOC are.

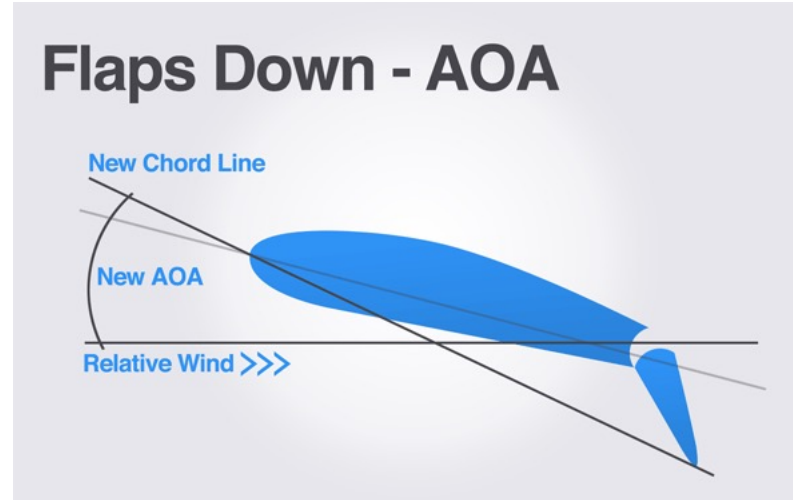
MAIN TOPICS

- ▶ Basic Aerodynamics as it relates to Stalls, Spins, and Loss of Control
- ▶ UPRT Philosophy - Introduction of Avoid, Recognize, Recover
- ▶ How to AVOID Flight Upsets
- ▶ How to RECOGNIZE Flight Upsets
- ▶ How to RECOVER from Flight Upsets
- ▶ Managing Startle and Fear

SUMMARY

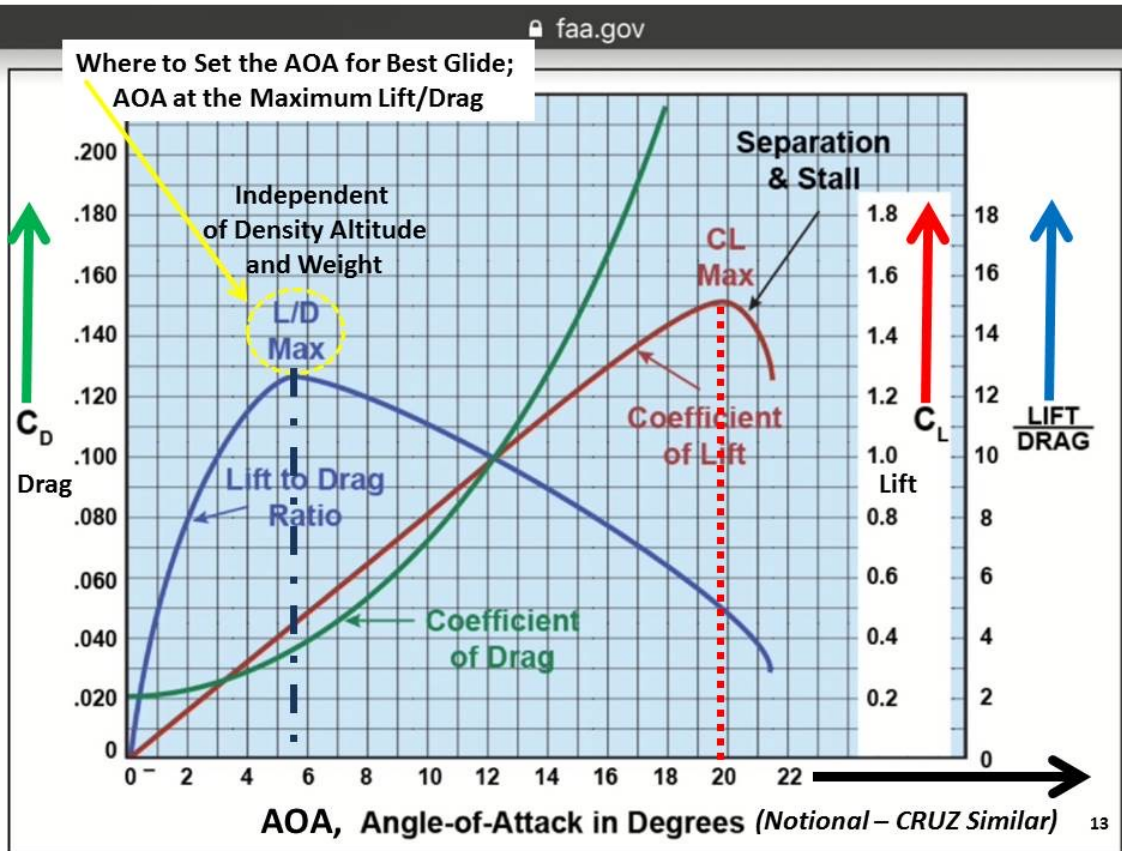
- ▶ Putting it all together and Simplifying Flight Upset Recovery

Aerodynamics Relating to LOC



- ▶ Angle of Attack (AoA) is the difference or angle between the relative wind and the cord of the aircraft wing. The higher that angle gets the more you will disrupt the airflow over and under the wing.
 - ▶ Aircraft wings may stall at any attitude or any airspeed!
 - ▶ Cord is simply the straight line between the leading edge and the trailing edge.
 - ▶ Flaps and Ailerons change the CORD. Deflected down increases the AoA. Deflecting the Aileron up Decreases wing tip AoA.
- ▶ Increase AoA, Lift increases until reaching Critical AoA
 - ▶ Lift and back pressure (up Elevator) turns the aircraft, not ailerons.

Aerodynamics Relating to LOC



Once the Critical AoA is reached the wing is stalled (Red Line CL Max)

- ▶ Note the Chart, Lift continues beyond Critical AoA
- ▶ The wing root stalls first causing aerodynamic buffet in most GA aircraft
 - ▶ Wing Dihedral roll dampening ceases at critical AoA
 - ▶ Sweptwing aircraft stall wing tip first.
- ▶ Once the stall progresses to the wing tip ailerons are ineffective
 - ▶ Passed Critical AoA ailerons work opposite.
- ▶ If aircraft is yawed allows one wing to be in a greater stalled state than the other wing.

2017 TALKEETNA FLY IN

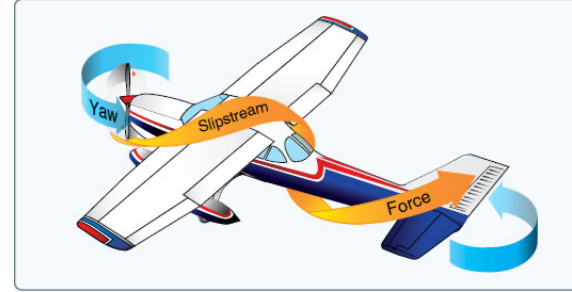
TALKEETNA, ALASKA

Aerodynamics Relating to LOC

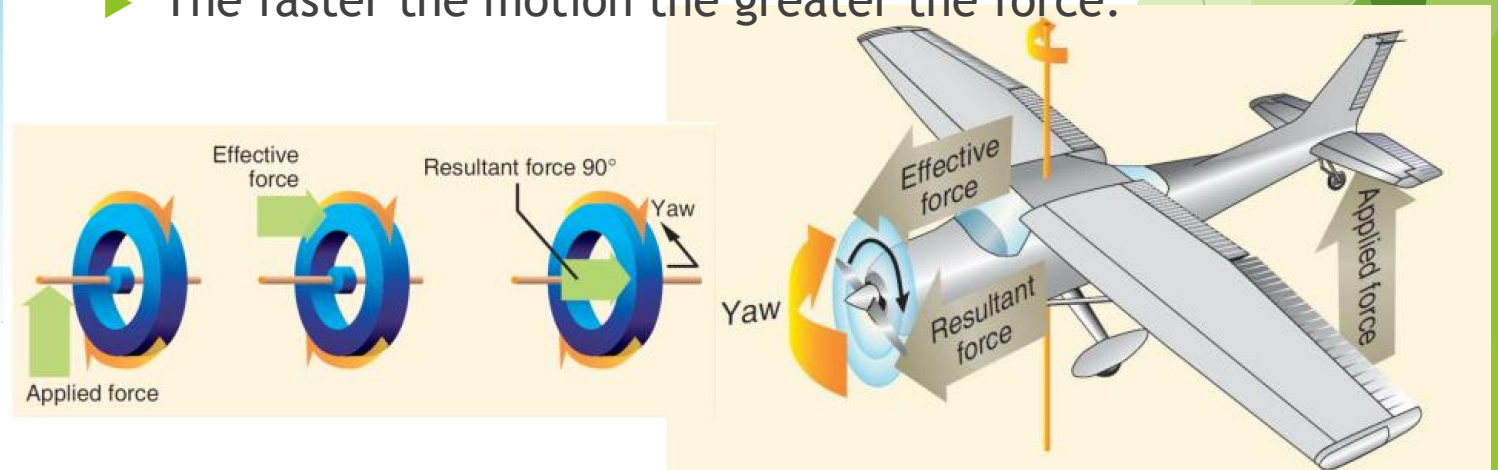
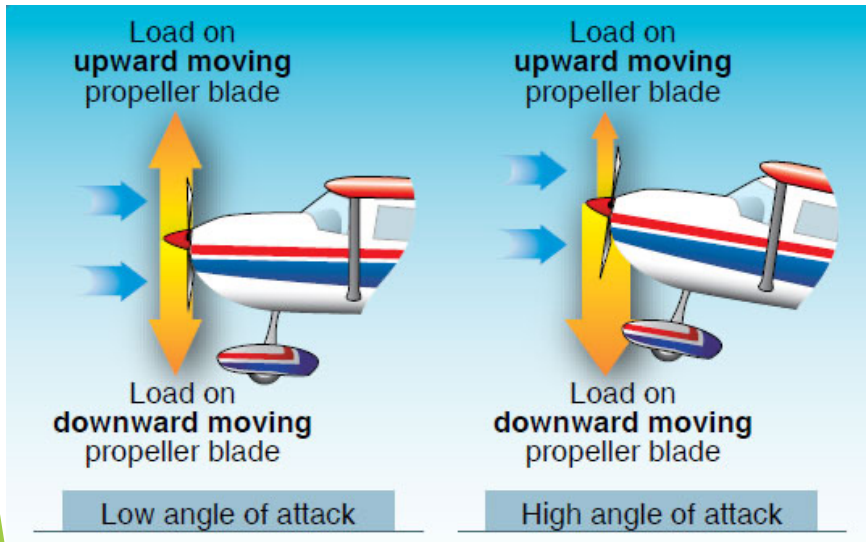
P Factor, Gyroscopic Precession, Slipstream, Torque, = Left yaw

- ▶ Engines turn Props clockwise.
 - ▶ Downward prop is at greater AoA nose high
 - ▶ Yaw to left, apply right rudder

Slipstream causes left yaw

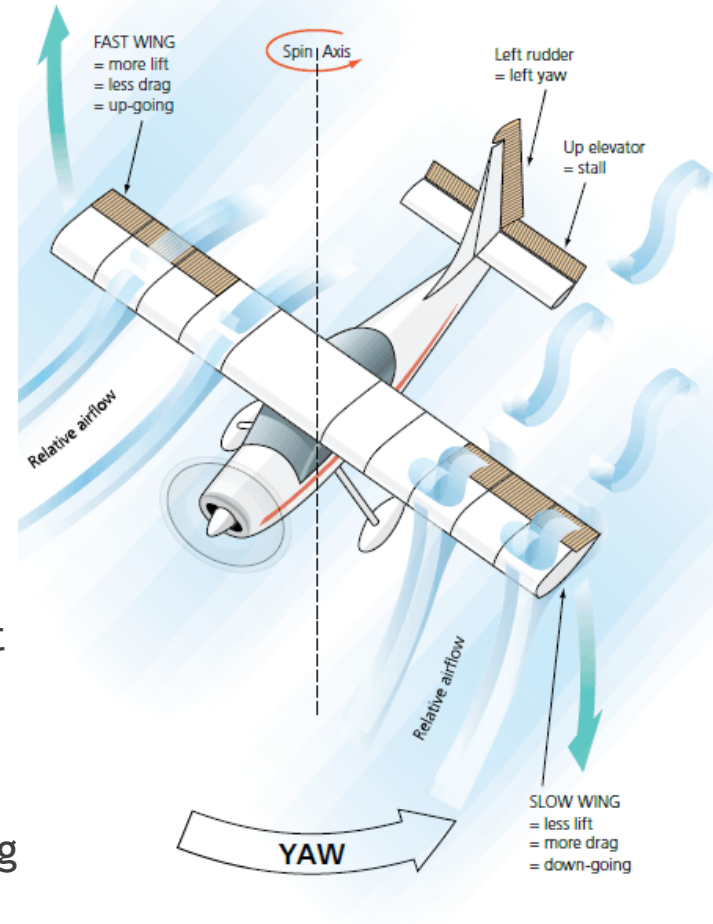


- ▶ Gyro Precession means that the force acts 90 degrees to where it was applied.
 - ▶ Left yaw when pitching down and right when pitching up
 - ▶ The faster the motion the greater the force.



Aerodynamics Relating to LOC

- ▶ The aircraft needs TWO things to Spin:
 - ▶ Stall
 - ▶ Yaw, Yaw allows one wing to reach critical AoA before the other.
 - ▶ Without both you will not spin, but there is always a but, it doesn't take much yaw.
- ▶ The aircraft will not stall at zero g! Ever, Honest.
 - ▶ If you “unload” or move the control forward to cause zero g you make it weightless. What is the opposite of lift?
 - ▶ Therefore with no lift and no weight the wing can not reach the critical AoA
 - ▶ Also, the opposite of Thrust is Drag. With no weight at zero g you get great acceleration. Zoom Zoom.



Aerodynamics Relating to LOC

- ▶ Rogers' law of Ballistics: Aircraft won't stall at zero g. However "T" (Time) is finite and T at 0g equals H or height above terra-firma divided by the force of g.



- ▶ We will discuss the "Ballistic Method" later but it is a PREVENTION step used to stop Stalls and Spins. In a word "Unloading".

UPRT Philosophy



▶ AVOID (PREVENT)

- ▶ It is always best to avoid conditions which if handled poorly will lead to an upset.

▶ RECOGNIZE

- ▶ You need to face facts, sometimes the hardest thing is admitting you are in an upset. They are not hard to recognize unless you are in a low visibility condition.

▶ RECOVER

- ▶ Take positive and simple steps to recover to straight and level flight then control your direction. Aviate, Navigate, Communicate works.

AVOID - PREVENT

- ▶ WE Are not talking about Avoiding the issue,



- ▶ We want to learn strategies to avoid flight conditions that lead to Upsets. Sooo What are those conditions again?
 - I. Unintended flight into IMC
 - II. Inadvertent stall/spin in traffic pattern
 - III. Low altitude maneuvering
 - IV. Wake Turbulence
 - V. Distractions:
 - System malfunction leading to distraction and loss of SA
 - Automation confusion leading to distraction and loss of SA

AVOID-PREVENT

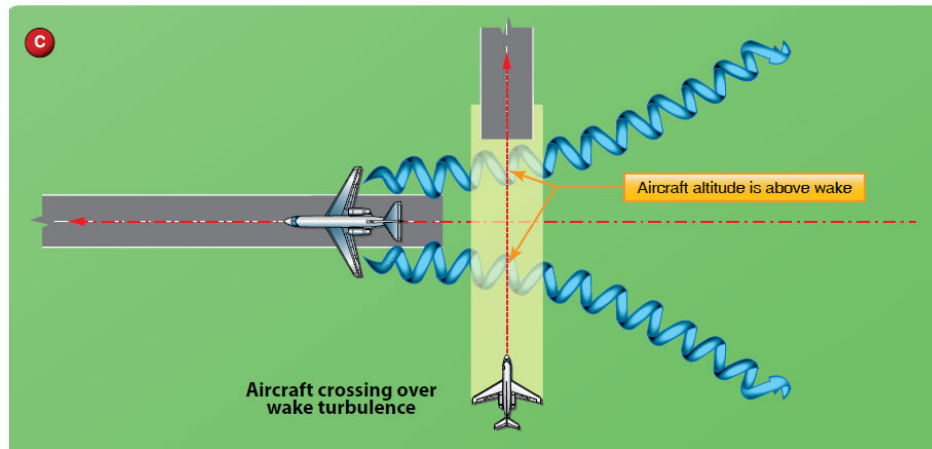
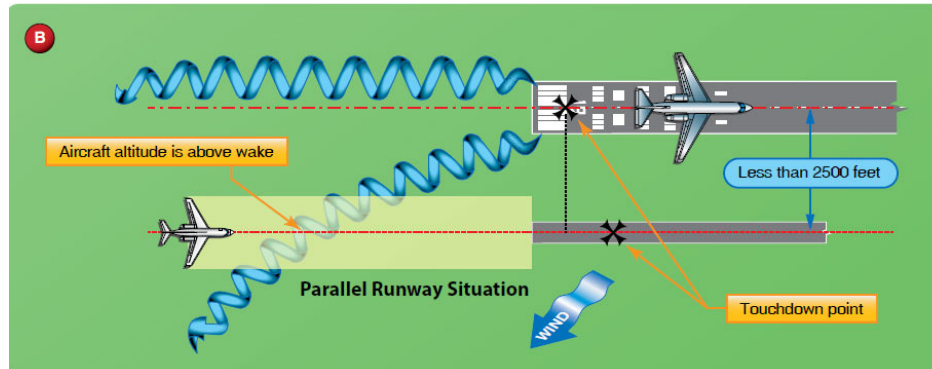
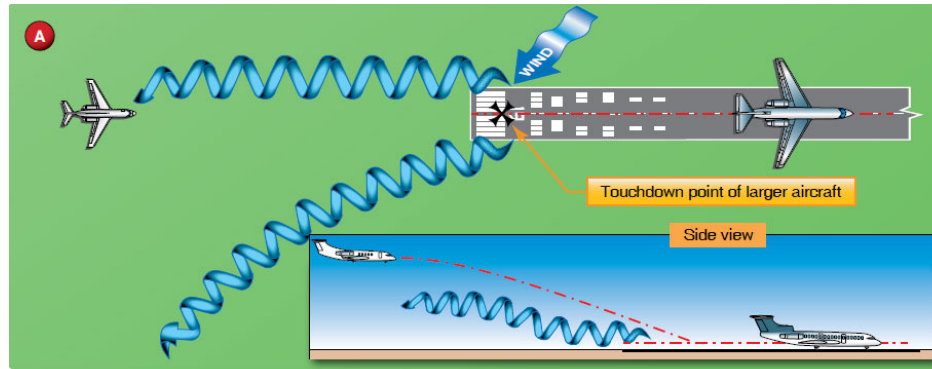


- I. **INAVERTANT IMC:** The 180 degree straight and level turn is still the most effective maneuver to AVOID inadvertent flight into IMC.
- II. **STALL/SPIN:** The 3 P's: Practice, Practice, and well Proficiency
 - ▶ Annual Practice in the traffic pattern
 - ▶ Practice Slow Flight and flight at minimum control airspeed, Know what it feels like
 - ▶ Practice Steep Turns
 - ▶ Flight Review with a CFI. Does not need to be every two years!
- III. **Maneuvering or SHOWING OFF:** JUST SAY NO, to “low altitude maneuvering” (the polite way of saying you are hot dogging it to show off)

AVOID-PREVENT

IV. Wake Turbulence

- ▶ First know the risk areas.
- ▶ Don't let ATC or yourself put you into potential risk area.
- ▶ Know the weather conditions that increase the danger and allow more spacing.
- ▶ Jet aircraft fly predictable 3 degree flight path
 - ▶ 320 Ft AGL per 1 NM
 - ▶ So Fly at least 4 degree in VMC
- ▶ Takeoff is most dangerous because GA aircraft can't climb above wake turbulence. So Use alternative methods.
 - ▶ Take off Prior
 - ▶ Coordinate with ATC an early turn out



AVOID-PREVENT

DISTRACTIONS



- V. Know thy systems! When they fail, have a back plan.
 - ▶ Make sure you make the effort to understand the maintenance status of your aircraft.
 - ▶ Know how your back-up systems work.
- VI. Do not get so wrapped up in technology that you fail to fly the airplane.
 - ▶ Know how the advanced avionics work and have the SA to recognize when and how to revert to a lower state of technology and fly the airplane.

AVOID-PREVENT DISTRACTIONS

Have you ever been distracted looking for a chart, radio frequency in the AFD, or even a flashlight to see in the cockpit? Ever had a door pop open or the gear not extend during flight?

- ▶ Most **pilots become distracted** when workload is already high, such as the takeoff and landing phases of flight. Becoming task saturated, you may be led to relinquish control of the aircraft in favor of handling the extra tasks.
- ▶ **Preoccupation inside or outside the cockpit** while changing aircraft configuration or trim, maneuvering to avoid other traffic, or clearing hazardous obstacle during takeoff and climb could create a potential stall/spin situation.
- ▶ **Pilots at all skill levels** should be aware of the increased risk of entering an inadvertent stall or spin or losing control of the aircraft while performing tasks that are secondary to controlling the aircraft.



Recognize



Increased technology doesn't increase situational awareness.

Situational Awareness is the ability to identify, process, and comprehend the critical elements of information about what is happening at a given point in time.

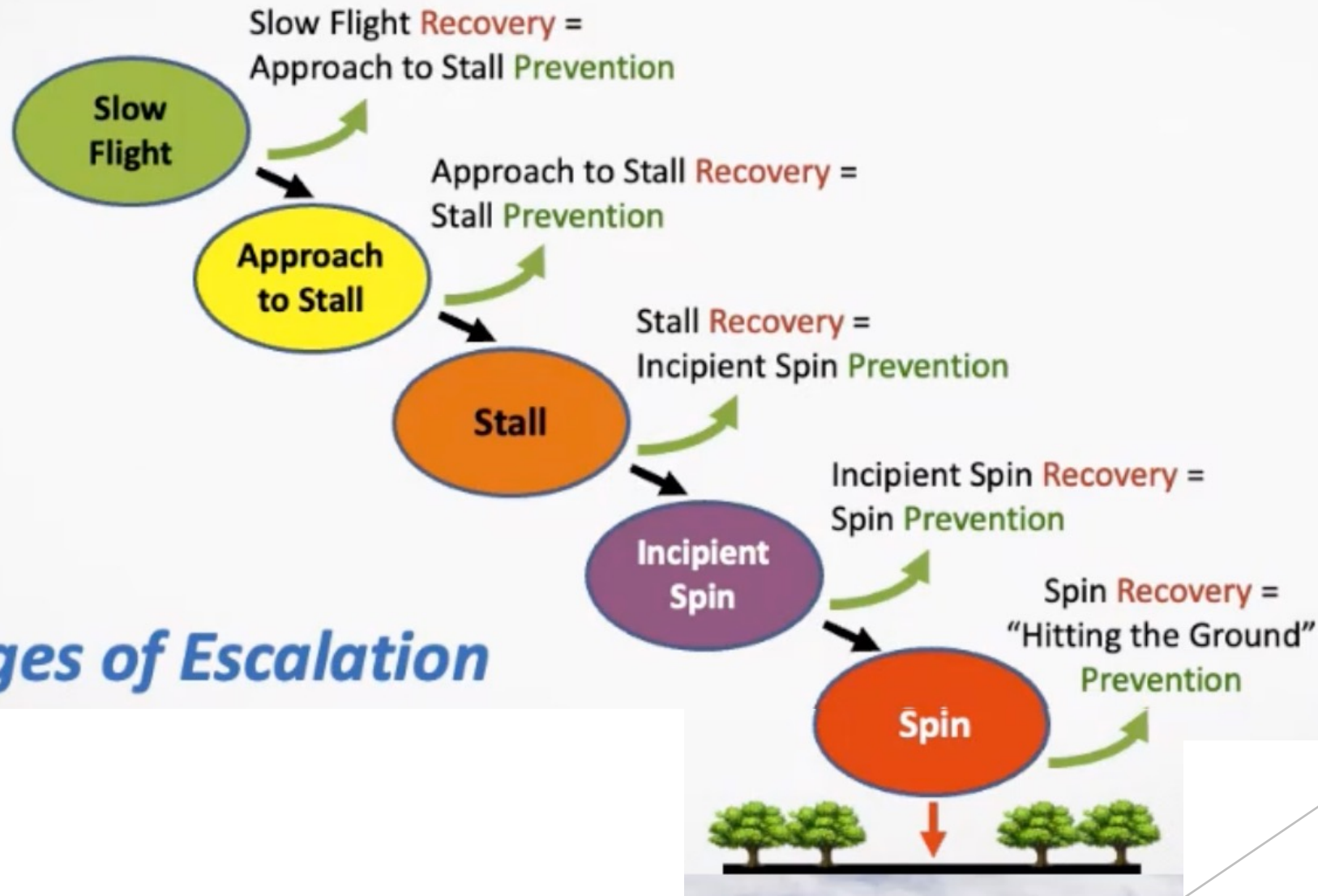
- ▶ Situational Awareness - SA, is often discussed in fighter pilot lounges and debriefings. Its even a graded item during military flight training.
- ▶ SA is your ability to recognize the entire situation around you and understand what you need to do to correct an undesired state of the aircraft.
- ▶ Recognition comes easier if you have been there before. Thus Upset flight training.
- ▶ We lose SA because of distractions, Inattention, and **stress**.

Recognize



- ▶ We know what normal is don't we?
 - ▶ We know the difference between 10, even 30 degrees of bank and 60 to 90 degrees of bank?
 - ▶ One is an unusual attitude the other is an upset.
- ▶ When you get scared it's not normal! I Hope.
- ▶ When the aircraft is in a state beyond normal corrections, it's time to abandon all pretense of navigating and communicating. It's time for *Aviating*.
- ▶ Simple solutions are the only ones you will remember or be able to implement.
 - ▶ Prevention can save more lives than well executed recoveries!

Upset Prevention Vs Recovery Paradox



Stages of Escalation

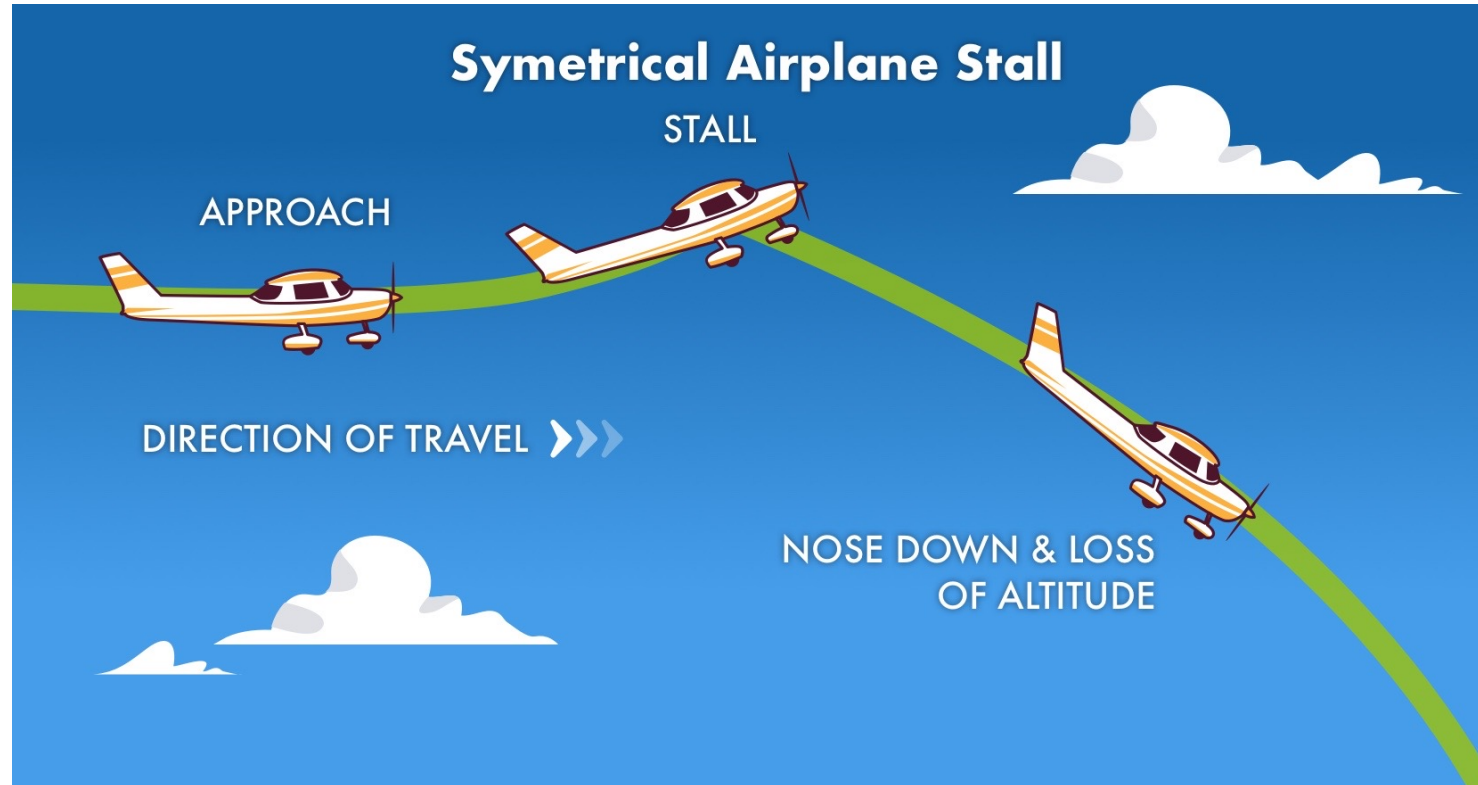
Recovery

- ▶ Inadvertent Flight into IMC, Low Altitude Maneuvering, Wake Turbulence and Distractions Once recognized.
 - ▶ Immediate positive steps to fix the problem
 - ▶ FLY the Airplane, use passengers to help with tasks
- ▶ Upset
 - ▶ Discover Speed and nose position
 - ▶ Are you slow or fast?
 - ▶ Are you nose high or low?
 - ▶ Throttle as required
 - ▶ Only retard throttle if you are fast otherwise leave it alone.
 - ▶ Roll to the nearest horizon
 - ▶ Rolling G discussion
 - ▶ Recover to level flight
 - ▶ If in a dive Roll first then Pull to recover to level flight
 - ▶ Once nose is on the horizon you may have to roll to upright
 - ▶ STAY COORDINATED, USE RUDDER to assist roll and keep nose tracking the way you want.

Recovery

- ▶ The Stall Spin Recovery begins with Prevention
 - ▶ Stalls, timely recognition and prevention
 - ▶ Spins, staying coordinated at all times, not letting stall progress
 - ▶ UNLOAD; Use ballistic method to prevent stall from increasing into spin.
 - ▶ You will lose altitude but less than a spin recovery
- ▶ Problem Areas for Stalls and Spins
 - ▶ Departure Stalls
 - ▶ Base to Final Turn

Recovery



▶ Stall

- ▶ Release backpressure. “Unload” the aircraft.
- ▶ **Counter roll with rudder opposite roll, NOT Ailerons**
- ▶ Use ailerons only after stall broke, then to level wings.
- ▶ Recover from the dive.

Recovery

► Spin - P.A.R.E.D.

- Power - idle
- Ailerons - neutral

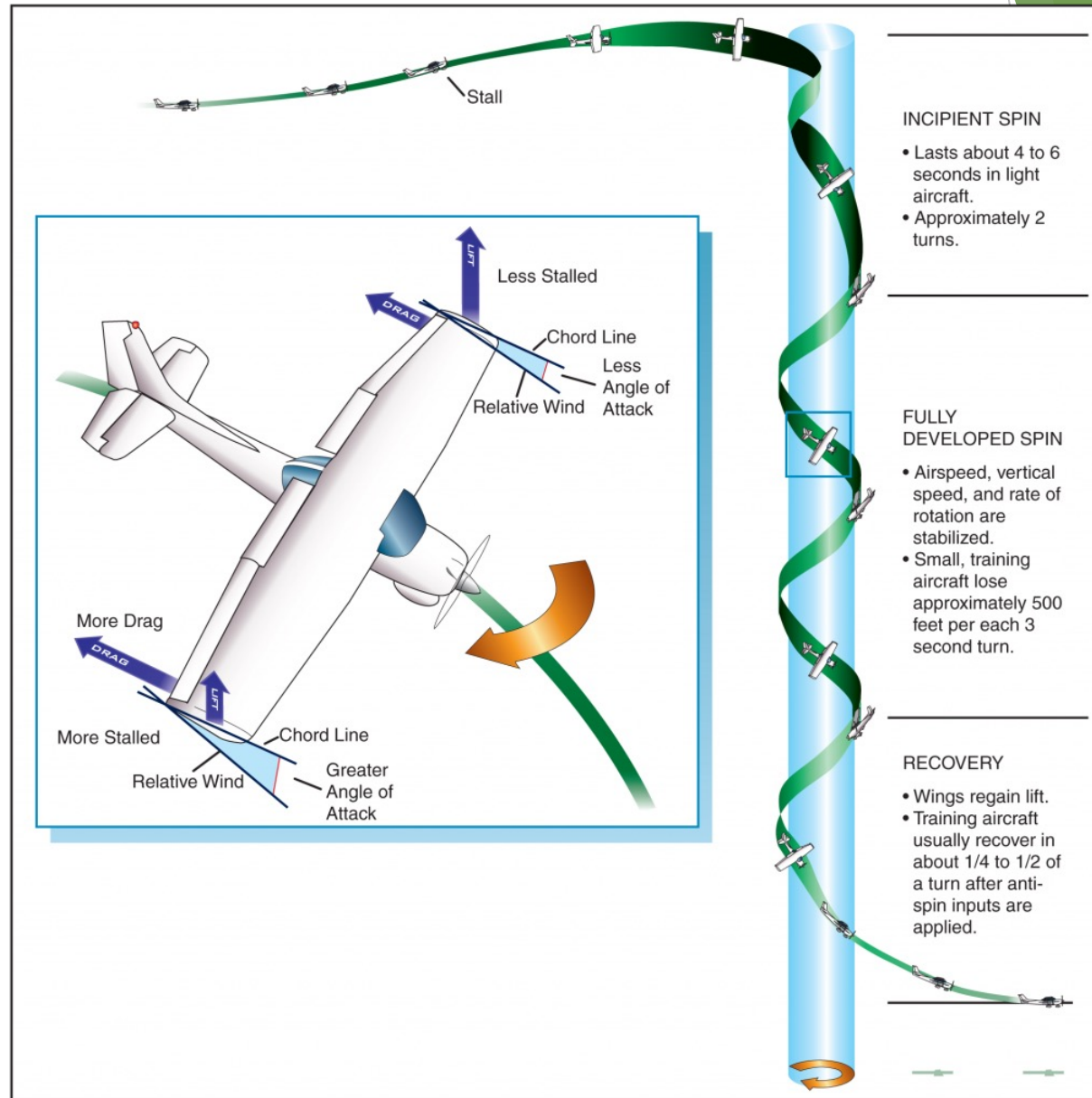
Note 1: Most spin entries in GA you will have the stick/control wheel full aft to enter the spin. This recovery will work even if not full aft. **However holding the control full aft while holding ailerons neutral will slow the spin rate.**

- Rudder - full opposite the spin. If you can't tell look at turn needle (or airplane)

“Needle left, spinning left = Right rudder”

- Stick or control wheel (Elevator) - forward until the spin stops
- Recover from the dive

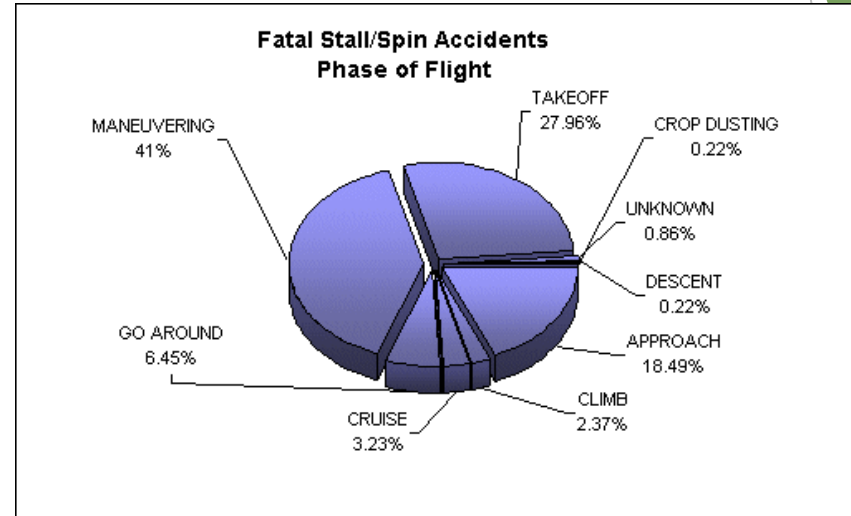
Note 2: This is a standard procedure. The Pilot's Operation Handbook (POH) takes precedence.



Recovery

Problem Areas

- ▶ **Maneuvering, You can't cure Stupid.**
- ▶ Departure Stall
 - ▶ Begins with Distraction
 - ▶ P Factor and Gyro Precession will cause a left wing to dip.
 - ▶ Aileron passed Critical AoA
- ▶ Base to Final Turn
 - ▶ Begins with overshoot
 - ▶ Don't use timely turn to final or too little bank
 - ▶ Use a Go Around if it looks bad!!!!



Manage Your Emotions

- ▶ First, be confident that it can be fixed and you are going to fix it!
- ▶ Startle factor is your mind going through the 5 stages of grief in about 1 second. (denial, anger, bargaining, depression and acceptance)
 - ▶ Skip to Acceptance and react
 - ▶ After you recover the aircraft and are flying again, then you can get excited.
- ▶ Greatest fear reducer is experience.
 - ▶ Completing the Upset Prevention and Recovery Training will ease the fear.
 - ▶ Practice and proficiency will ease the startle factor.



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SUMMARY

- ▶ Putting it all together and Simplifying Flight Upset Recovery

Wrapping it ALL up-So to speak

- ▶ You have the tools to AVOID Wake Turbulence and Distractions
- ▶ You have the tools to prevent Upsets, Stalls, and Spins
 - ▶ Stay proficient, use CFIs to help when you have had a break
 - ▶ Training in Upset Recovery will lessen the Startle and fear factor!
 - ▶ AVOID, RECOGNISE, RECOVER
 - ▶ Use the Ballistic method to avoid spin entry and accelerate.
- ▶ In an Upset:
 - ▶ Throttle
 - ▶ Roll to nearest horizon
 - ▶ Recover to level flight
- ▶ In a Stall
 - ▶ Unload
 - ▶ The ballistic method
- ▶ In a Spin
 - ▶ P.A.R.E.D



Lesson Complete, Questions?

