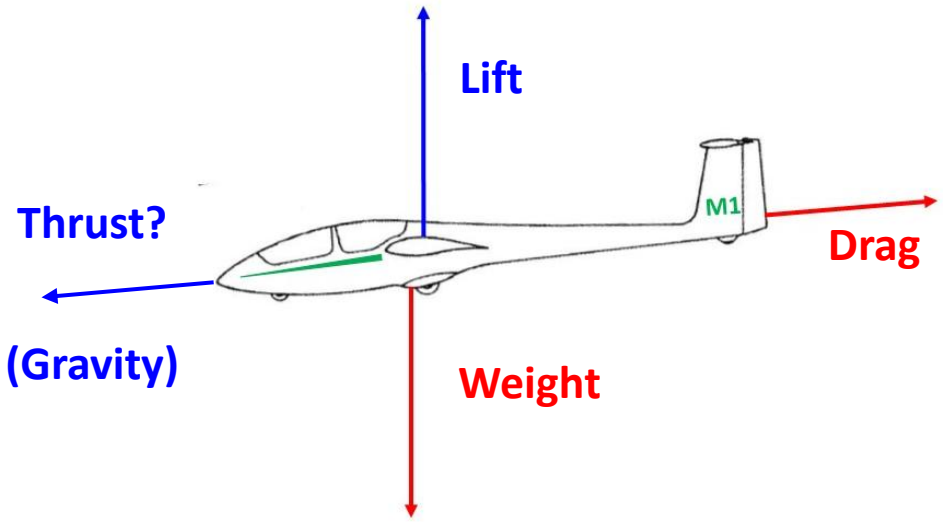
Sailplane Stall and Spin Awareness Training

Objective

- Recognize situations where spins occur so you can avoid inadvertent spins
- Recognize the characteristics of a spin
- Be able to discern the difference between a spin and a spiral dive
- Learn to apply proper recovery techniques

No amount of Spin Recovery training or exceptional skill will save you if altitude required > altitude available

The Basics



$$L = C_L V^2 (\rho/2) S$$

$$D = C_d ((\rho V^2)/2) S$$

L = Lift

D= Drag

C_L = Coefficient of lift

Cd = Coefficient of drag

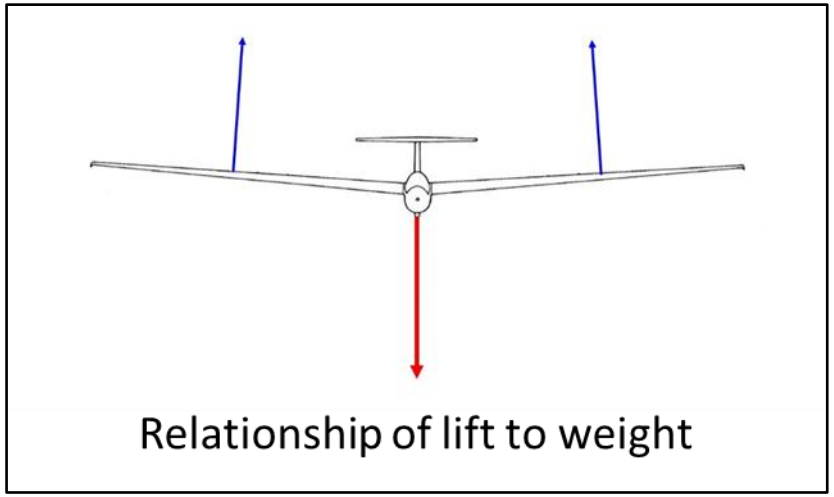
V = Velocity (feet per second)

ρ = Air density (Slugs per cubic foot)

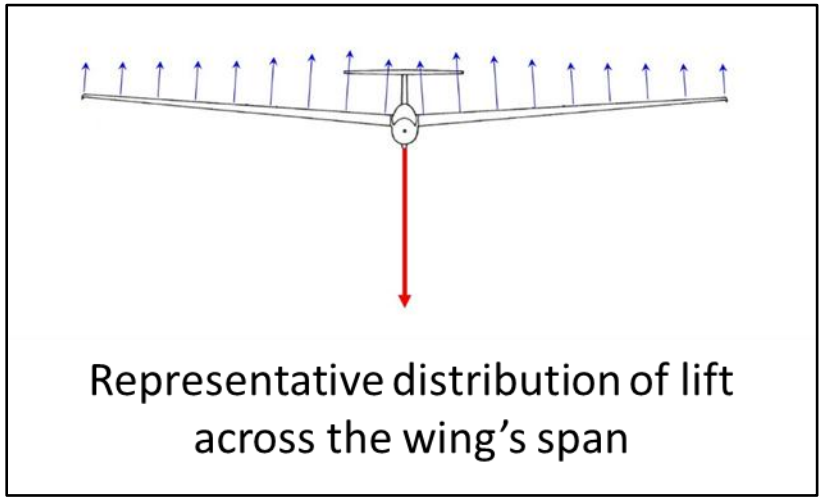
S = Wing surface area (Square feet)

Aerodynamics

- It is all about angle of attack
- Think of airfoils stalling; not wings
  - Your wing is made up of many airfoil segments
  - They may use different “airfoils”
  - The angle of incidence is usually not the same across the span
- Lift and drag is distributed across the span



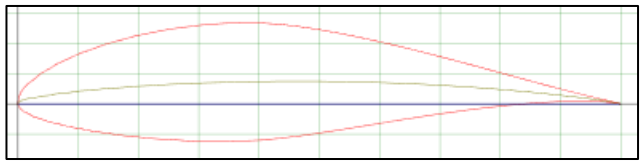
Relationship of lift to weight



Representative distribution of lift across the wing’s span

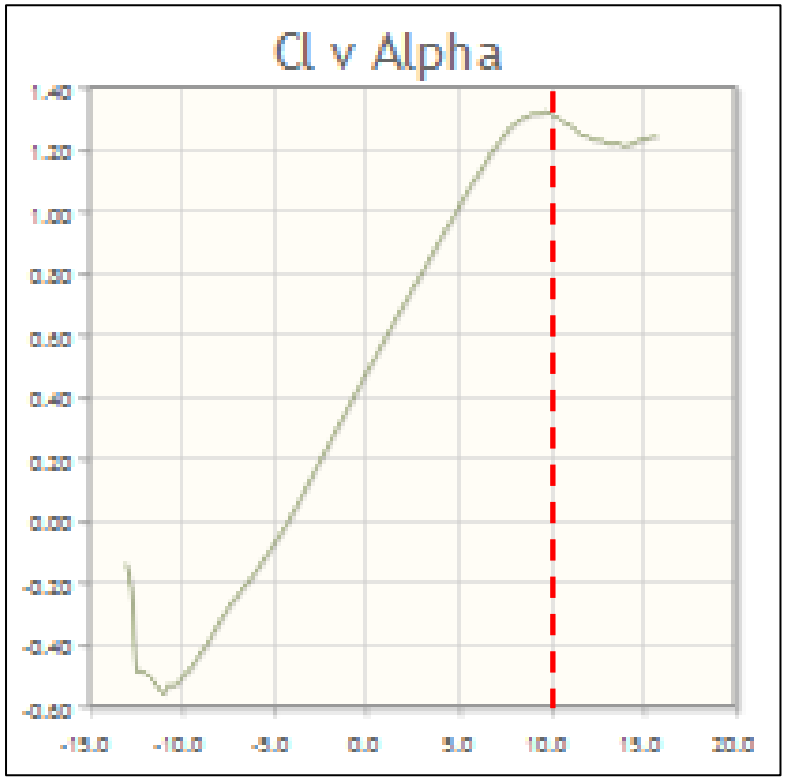
Critical Angle of Attack

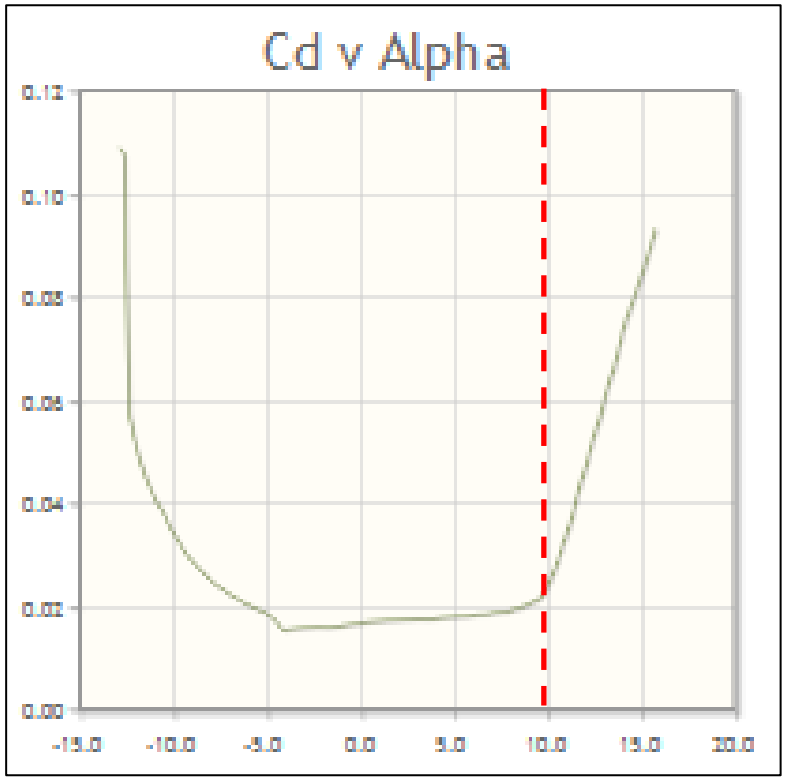
Wortmann FX S02 196 Airfoil
(used for the ASK-21 wing root)



Alpha (α) = Angle of Attack

The Red vertical line highlights the critical Angle of Attack





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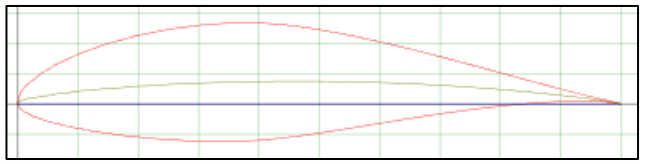

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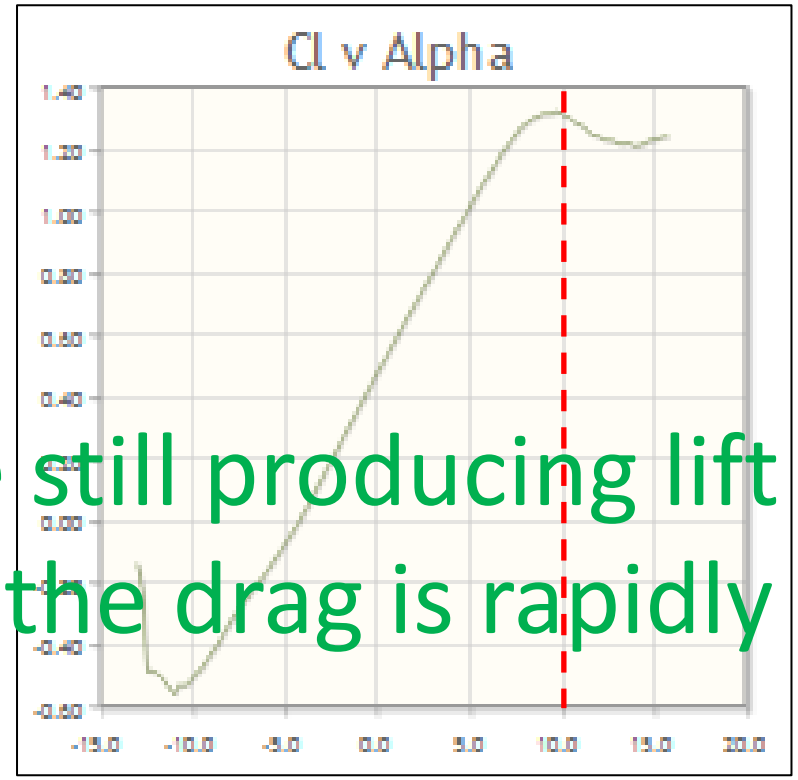
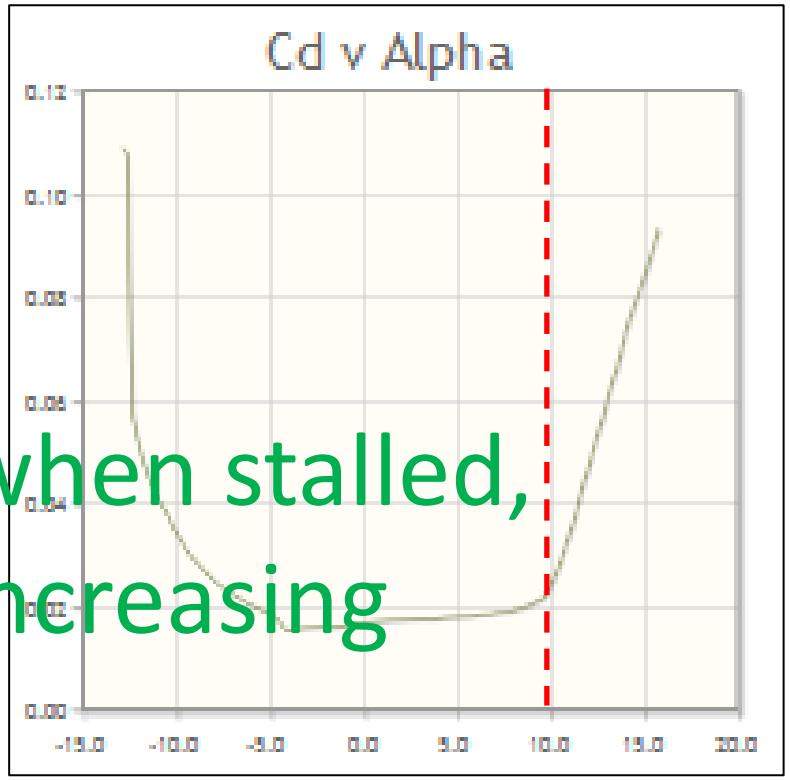
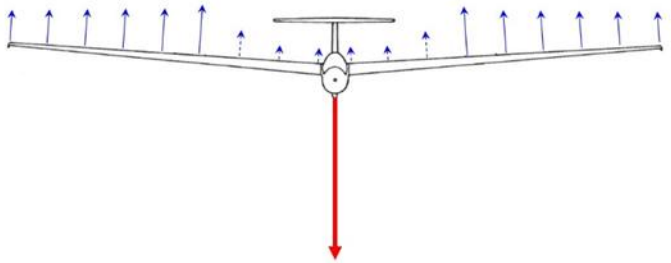




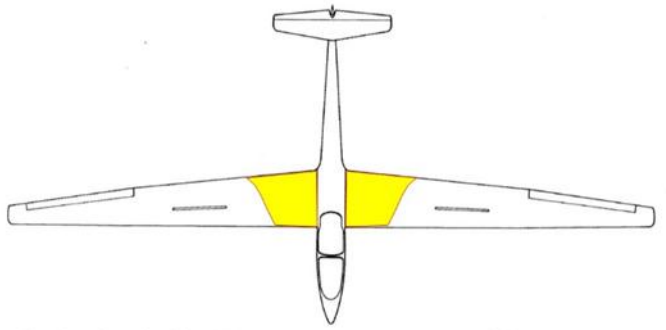
You are still producing lift when stalled,
But the drag is rapidly increasing

The Stall Entry

- An airfoil stalls when it exceeds it's design critical angle of attack
- What can cause it to exceed the critical angle of attack?
  - Pilot input; pitch or yaw changes
  - Airmass movement; lift/sink, shear
- Conventional wing design stalls at the root first and propagates outboard to the tip



Representative redistribution of lift as the stall develops



The region of the wing highlighting the propagation of the stall

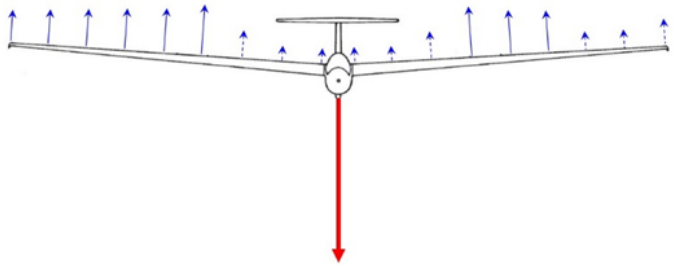
What is a spin?

- A spin is an aggravated stall resulting in autorotation about the vertical axis due to asymmetric lift/drag
- The 3 phases of a spin are:
  - Entry
  - Incipient
  - Fully developed

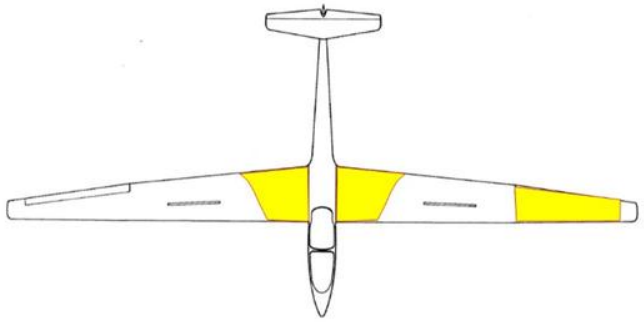
Click here to view the video

The Spin

- A spin results when the aircraft has sufficient asymmetrical lift/drag
  - This asymmetrical lift/drag results in an initial rotational movement
- Many publications state a pilot must introduce rudder (yaw) to cause a spin
  - This is incorrect. Asymmetric lift/drag is the culprit.
  - In training, the easiest way to introduce asymmetry is by using rudder to introduce yaw, but it isn't the only way
- The rotation feeds upon itself with the descending wing at a higher AoA and the rising wing at a lower AoA
  - The spin motion when you transition from the incipient to developed phases will generate yaw which sustains the spin



Representative redistribution of lift at the onset of the spin



Highlighting the propagation of the stall at the spin onset

The Spin

- The Airplane Flying Handbook (FAA-H-8083-3) depicts the spin dynamics better than the PHAK or the Glider Flying Handbook
  - The asymmetrical lift/drag results in a yawing and rotational movement
  - This yawing motion sustains the asymmetrical lift/drag as the aircraft transitions to a fully developed spin

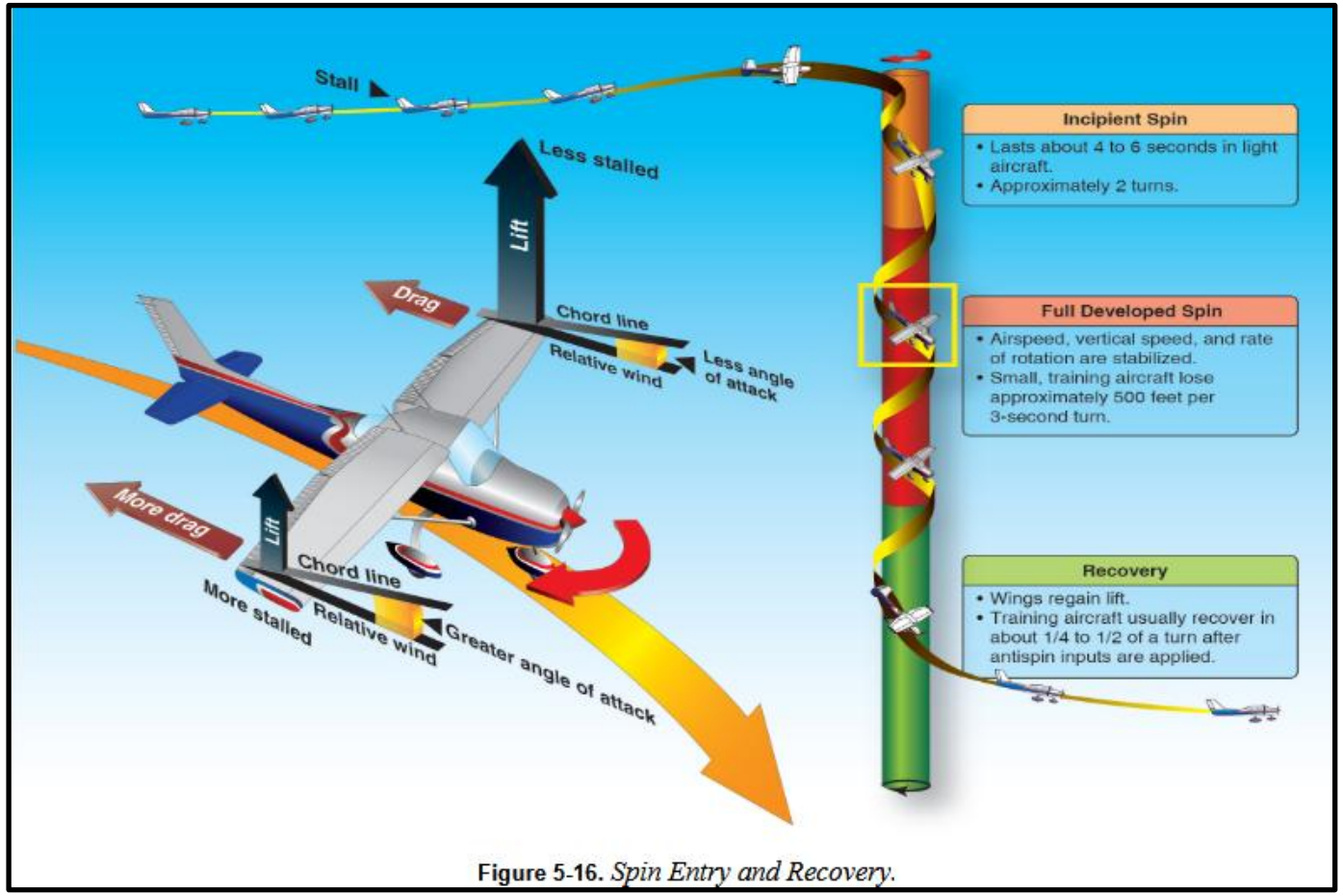


Figure 5-16. *Spin Entry and Recovery.*

Spinning the ASK 21

Spin Characteristics

Low and fluctuating airspeed

No increase in “G” forces

Rapid rotation, unstable, pitch, roll and yaw

High rate of decent

Ensure you thoroughly clear the area

Click here to view the video

Spin Recovery

Follow the procedure outlined in your specific glider's Flight Manual

Alexander Schleicher ASK 21 Example

1. Full opposite rudder
2. Ailerons neutral
3. Pause (1/2 turn)
4. Move stick forward until rotation stops
5. Neutralize rudder
6. Recover from the dive

Spins vs Spiral Dives

- The characteristics of a spin are distinctly different than those of a spiral dive
- The recovery procedures are also different
- Regardless spin or a spiral dive; at low altitude the outcome is usually the same

The Spiral Dive

Spiral Dive Characteristics

Rapidly increasing airspeed

“G” forces increasing

Slower rate of rotation

Heavy controls

Ensure you thoroughly clear the area

Click here to view the video

Spiral Dive Recovery

Roll wings level

Recover from dive

Conducting Safe Stall & Spin Awareness Training

Your Insurance Policy

- The Emergency Parachute
  - Parachute Inspection Requirement
  - Parachute Preflight
  - Proper fitting of the Parachute
    - Standard fixed harness
      - Leg straps
      - Chest strap
    - Fully adjustable harness
      - Leg straps
      - Main lift web vertical straps
      - Horizontal back strap
      - Chest strap
    - Fold and stow all strap ends

- Bailout Procedure
  - Bailout, bailout, bailout

    ASK 21 Front Seat Example

    1. **Move red lever left**
    2. **Push Canopy up**
    3. **Unbuckle seat belt**
    4. **Get up and bail out**
  - Once clear of the glider

    (2-3 seconds)

    5. **<u>Look</u> at the Rip cord**
    6. **<u>Reach</u> over and grab the rip cord with BOTH hands**
    7. **<u>Pull</u> – Fully extend both arms**

Your Insurance Policy

- The Emergency Parachute
  - Parachute Inspection Requirement
  - Parachute Preflight
  - Proper fitting of the Parachute
    - **The SSF recommends wearing an emergency parachute as an added safety precaution!**
    - Fully adjustable harness
      - Leg straps
      - Main lift web vertical straps
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    - Fold and stow all strap ends

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Rules of Engagement

- Perform a HASSLL check prior to all spins
  - **H**eight – Do you have the appropriate altitude for the task?
  - **A**irframe – Is the aircraft sound and certified for the maneuver?
  - **S**traps – Are you secure?
  - **S**ecurity – Secure all loose items.
  - **L**ocation – Are you over high terrain, can you get back?
  - **L**ookout – perform a clearing turn and consider a radio call.
- If you are uncomfortable; speak up
- If you are unsure; speak up
- If you want to see something again; speak up

Suggested Profile

- Two to Three Flights
  - Clear the area
    - Clearing turns
    - Radio usage
  - Minimum altitudes
    - 4500’ AGL for a 3-turn spin
    - 3500’ AGL for a single turn spin

Wrap Up

- There is nothing sinister about spins provided you understand them and are prepared
- No amount of training will prepare you to recover from a low altitude spin

The **Altitude Available** must always be greater than the **Altitude Needed**!

- Know when you are vulnerable and mitigate your risk
- Now let's go fly and have some FUN!

Testing Knowledge

Click the link below to access the short quiz

You will be asked to provide your name and email address as well as the email address for the instructor you will be flying with to complete this flight activity.

Sailplane Stall & Spin Awareness Training quiz