SOARING ASSOCIATION OF CANADA

Preparatory Ground Instruction Notes For SAC Instructor Course

June 2021
Third Edition

First prepared by the Flight Training and Safety Committee, 2015 April 01

SOARING ASSOCIATION OF CANADA
L'ASSOCIATION CANADIENNE du VOL à VOILE

A NON-PROFIT ORGANISATION FOUNDED IN 1945
TO FOSTER MOTORLESS FLIGHT IN CANADA

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RECORD OF AMENDMENTS

Amend no.	Date	Details of Amendment	Page #	Inserted by
1	27-12-15	Version 6 update to include overshoot protection	111	FTSC
2	06-05-20	Second Edition Changes: Stage 9 deleted ref to Steep Turns, running out of elevator pg 66, added side slip to lose height top pg 67, added caution when joining a thermal you may lose height do to sink before lift pg 63. Added "in the circuit" as 7th type of lookout pg 17. Corrected "CISTRSC-O" pg 19. Move SOAR technique to stage 2.	 67 66 63 17 19 18	FTSC
3	07-05-20	Changed "rotation" to "round out" in diagram pg 48. Glider examples given in approach speed calculation pg 49. Added tow plane should have 70% of takeoff speed by ½ runway & glider airborne pg 40. Added to stayin in to look over nose "to horizon" pg 35. Added "release" to 2nd para pg 77. Changed "down" to "along" runway centerline pg 78 forward slip explanation. Changed "runway centerline" to "reference point" pg 78 in first slip method explanation. First line in notes changed "yaw" to "further effects" p 78. Last line of notes added "steep" to slips and "as you try" to raise the nose pg 79. Added to HF first para "or land out safely" pg 81. Added to 2nd diagram pg 84 explanations how to visualize 45° angle. Added "angle to" after enough bank pg 85. Crosswind landings revise text para 1 & 2 for clarification pg 87. Last para added (Pot Pitot). Added diagrams pg 88. First para pg 90 change "vertical" to "lateral" dampening Added "initial" to training under Safety pg 100. Added "release" before "and Wait" pg 100. Added "don't panic fly the airplane" after situational awareness and added "but options before take-off" pg 101. Added "x-"to wind under Safety pg 108 and loss of tow plane power. Stage 21 Added "Practice and review". Stage 20 First Solo renumbered to 21. Added last bullet "look at Dealing with Emergencies presentation on SAC web site.	48 49 40 35 77 78 78 78 79 81 84 85 87 88 90 100 100 101 108 110 112 113	FTSC

4	01-06-21	Added “20 t0 30 sec @ 50kts” for measuring distance to downwind.	69	FTSC
5	03-06-21	Added “turns” after corrections in third bullet of directional or yaw stability.	25	FTSC
6	03-06-21	Added “check air brakes closed” on first bullet of recover from stall indicator.	31	FTSC
7	03-06-21	Added “50% of airbrake effectiveness” to approach funnel concept.	47	FTSC
8	03-06-21	Added “(see AFM).” and “stall speed increases with angle of bank 30° 1.1Vs; 45° 1.2Vs; 60° 1.4Vs.” at page bottom.	29	FTSC
9	03-06-21	Added to Flarm Drills “12. Do not touch antennae …”.	68	FTSC
10	03-06-21	Deleted “flick it” reference to rudder waggle signal for spoilers open.	83	FTSC
11	03-06-21	Added “Tow plane can be placed slightly down wind …” as cross wind takeoff aid.	85	FTSC
12	16-06-21	Changed alcohol requirement from 8 to 12 hrs and added “cannabis not allowed”. Deleted repetition of “Demo Steep Turns and Thermalling” in Stage 9.	18 5 & 63	FTSC
13	19-06-2021	Added normal release procedure for tow and safety procedures for a not normal release in Safety comments.	44 & 50	FTSC
14	07-03-2022	Change Va to $V_{approach}$ Add Defined Minimum Maneuvering Speed (DMMS)	4, 49, 52, 76 52	

Table of Contents

General Explanation

- These notes were written to help Instructors cover the material for Preparatory Ground Instruction. They are not meant for in air flight instruction or formal ground school instruction and instructors should refer to the instructor manual and Pocket books for in air flight instruction.
- This training must be done (CAR 405.31) for each stage(s) and should be not more than 24-48 hrs before the flight lesson.
- When in doubt about the content of these notes, refer to the SAC instructor manuals.
- These notes contain the detail to provide sufficient background information so that the student can focus on the skills to be taught on the flight lesson and minimize confusion during flight time, and reduce airtime required to teach stages.
- Some explanations are brief as the material should be covered in more detail during ground school. However, ground school often follows flight training by many months or post solo, so some material is in more detail.
- Whenever possible instructor explanations should make maximum use of training aids such as the actual aircraft, model glider, white board, simulator, etc. Most diagrams have been kept as simple as possible so that the instructor can replicate them easily on a whiteboard.
- Human Factors and Safety should be integrated into each stage of Preparatory Ground Training, and on each flight lesson pre-flight briefing and post flight briefings. The latter to deal with actual issues that come up during the flight lesson.
- Additional details have been added from experience and other references that have been found useful during instruction that may not be in the SAC instruction manuals.
- For the instructor, think what the student needs to know before the air lesson, not everything that the instructor needs to say or do to teach the lesson. This notebook does not replace the instructor manual or pocketbooks.
- Text explanations should be reinforced with notes (key words or phrases) made on white board to anchor student's memory to visual tags as much as possible.

Preparatory Ground Instruction Notes for the Daily Inspection (DI) (demo on aircraft)

STANDARD

The soaring Association of Canada standard for doing daily inspections is the SAC red daily inspection book. This book contains a list of items to be inspected and a brief description how to carry out the inspection. Some clubs use their own checklists however the SAC Red DI book is the standard.

- Your instructor will show you how to complete a daily inspection on the training glider that you will be using. Once you have been signed off as competent by your instructor, it will be your responsibility to complete a DI on the glider that you will be using at the beginning of each day unless the glider has been inspected by another pilot and signed off.

Who: pilot responsible – sign out aircraft as serviceable (pilots' logbook or pilot training record should be endorsed that this training has been completed for the DI).

What: inspect the aircraft inside and out for serviceability (this is not a walk around before flight- explained later).

Why: to identify correct assembly and defects or snags that may require an aeronautical mechanical engineer (AME) inspection, or to render the glider unserviceable until inspected by an AME.

Note – only an AME can make structural or control repairs and adjustments, and sign that the work has been completed in accordance with airworthiness standards. Unless the aircraft is in the "owner maintenance" category then the owner may sign off maintenance.

– These notes are not an all-inclusive and you must read the pilot operating handbook (POH) for aircraft specific points.

Some documents

1 – DI book/daily inspection sheets

– Checklists (help to prevent missing items. Human factors to forget items)

– Keeps a record of snags/signatures/dates

2 – Journey log

– Indicate major problems/damage that requires AME inspection/resolution

- Indicate assembly/disassembly of the aircraft

- Some clubs only want an instructor or maintenance directors writing in their journey log's, check with the club for their standard operating procedure

3- Maintenance or engine log

-No longer required by CARs for gliders. Some still exist. Gliders with engines may have them.

4- Do not fly tags

-These tags may or may not be in the glider DI book. They are attached to the flight control column to indicate that the aircraft has been grounded. Some clubs ay use a red sock that is placed over the control column and may have lettering “GROUNDED”.

What could be the aim of the daily inspection? - There may be something wrong with this aircraft that could potentially kill me. Can I find it?

Defects are caused by: -wear and tear, -mal adjustment, -careless handling, severe flight loads or bending loads.

Typical Defects will

- Actual failure or a cracked structure. Composite/wood/metal/glue joints/welds/frayed cables/fabric tears/sheared bolts.
- Missing components. Caught up in/safety pins/nuts/other fasteners.
- Deterioration. Rust/rot in wood/fabric/gel coat/paint
- Excessive wear. Loose components (wing pins), lack of lubrication (binding etc.)
- Incorrect assembly/adjustment. Control movement sense/component placement/quick connectors (Hotelier, Jantar, etc.)
- Foreign objects. Nests/insects/tools/passenger items.

The difference between a daily inspection and walk around is that the daily inspection is done once daily and usually takes about 20 to 30 minutes to complete the club aircraft and a walk around is done before each flight, take roughly 1 to 2 minutes to complete. The daily inspection is typically recorded in a DI book that is kept in the glider. The walk around is for the pilot in command’s benefit just before the flight.

Checklists

- They help to cover critical items but are not exhaustive. It’s not practical to look at everything therefore we have annual and periodic inspections by AMEs.

-Used for looking at some critical items in general conditions. Investigate anything suspicious.

- If you find a fault look for a cause to find the full extent of the problem! Before skipping the fault consult with an instructor or AME.

- Watch out for interruptions, use checklist to keep track of items checked backup two steps if you been interrupted and are not sure. Some clubs may have a Red Hat policy, if the pilot is wearing a red hat or

cap, he or she does not want to be interrupted in his inspection. Watch out for merely paying lip service to checklist items, really look at what the item is reminding you to examine.

Positive Control Checks (PCC) – why and how

This is best done by showing on the aircraft with two people.

- The purpose is to confirm that the controls are positively connected to the control surfaces. Most gliders have control linkages that need to be connected during the assembly. It is possible to move the controls and not have the control hookups properly connected and the control services will move as a result. By having someone holding control surfaces gently between their palms on the hand the other pilot can gently move the controls to determine if there is a positive connection.

- You must be careful not to apply too much force that may bend or damage the pushrods and control linkages.

Radio checks

- These confirm that the radio is operational. The reply given to radio check is often 5 x 5. This means the signal strength was five out of five and the clarity was five out of five. 3 x 4 would indicate 3 out of 5 for strength and 4 out of 5 for clarity, etc. See AIP for more detail.

Release checks

-These are performed to ensure that the release mechanism is functioning correctly. Often the release check is done before the glider launch on the flight line. It is more effective to do these as part of the daily inspection to ensure they are not forgotten at the time of launch.

- A proper tow ring is required on a short rope so that some tension can be applied when the release handle was pulled. Typically, this requires two people to complete. It should be done under tension.

- Release checks do cause wear and tear on the release mechanism and the most common “TOST” release mechanism has a life limit on the number of times you can pull the release.

- Minimize the number of times that this check must be completed. TOST life limit is typically 2000 flights (10,000) pulls/releases.

Critical Assembly Checks (CAC)

-It is common after the reassembly of a glider that had been previously disassembled for maintenance or because of a land out that a DI be completed on it. If the DI is completed as part of the assembly process it is common to have a CAC performed by another pilot before the glider is returned to service.

- A CAC is a check of those critical components/connections/safety pins etc. that are required for a safe flight. A glider with automatic hook ups may have as few as three items on the CAC. While a glider of earlier design may have as many as a dozen items to be checked. The pilot completing CAC should be familiar with the type or use a checklist designed specifically for the aircraft.

Some do's and don'ts

-Do not bring a glider to the flight line unless the DI has been completed and is serviceable.

-Do leave the DI book on the seat if the glider is not serviceable and use a do not fly tag or red sock.

-Do you use energy absorbing foam (EAF) cushions to prevent spinal injuries. Do not use soft cushions that may prevent the pilot from reaching the controls properly when the cushions are compressed.

-Do check aircraft documents that are required are valid. Certificate of registration/certificate of airworthiness/radio license (only required if aircraft taken outside Canada)/journey log/proof of insurance documents.

- Do check the glider turtledecks for potential missiles in a crash such as a loose battery.

-Do check that the ballast is secure and correct. The parachutes are serviceable. Navigation equipment's functioning properly.

-Do check with an instructor familiar with the type for any items to check that may be unique to the take a glider you are inspecting. Note that each aircraft has aircraft specific items that need to be checked.

The walk around

- This is not a Daily Inspection but a walk around the aircraft before each flight to determine its serviceability. The glider may have just landed or been left alone after the DI and may have been damaged. The pilot is checking for damage from flight loads or hard landings, mishandling on the ground or with collisions with objects, also known as "hangar rash". The walk around should only take a minute or two and is a look for obvious problems.

- Pay attention to the following (show examples on actual aircraft if possible):

- Damage skins: (loose or popped rivets, crinkled/ buckled/cracked skin surfaces)
- Damaged control surfaces: hinges, (flutter damage) and internal structure damage (tail slides).
- Hard landing damage:

  - Landing gear and welds on gear structure,

  - Cracks near the spoiler boxes,

  -Aileron binding/hinge damage,

  -Lack of symmetry between aileron and flap gaps in the wings,

  -Tail wheel/skid damage,

  -Fuselage bends or crinkles, particularly around wing roots and landing gear,

  - Vertical stabilizer cracks/bends/deformations,

- Horizontal stabilizer cracks/bends/deformations,

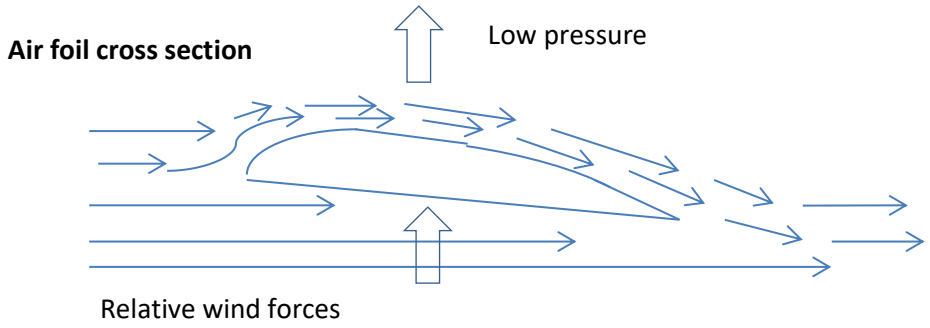
-Cracks under the seat pan inside glider.

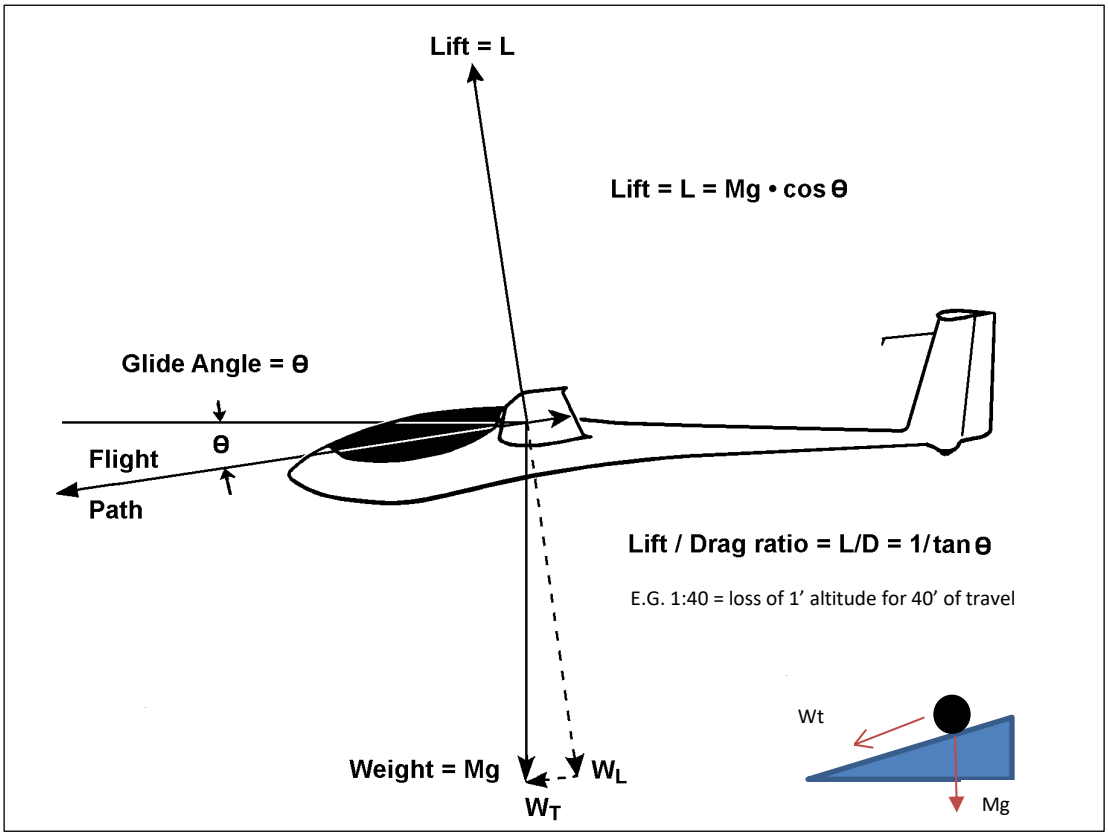
- Is the glider ready for flight – wing dolly off, tail dolly off, ballast correct or removed, tail weights correct or removed. Canopy or pitot covers removed. Weight and balance in C of G, battery charge OK, FLARM on.
- If in doubt ground the aircraft until an AME OK's, the glider or check with an instructor.
- Your instructor will demonstrate the specific things to look at on your training glider.

STAGE I – PRIMARY EFFECTS OF CONTROLS

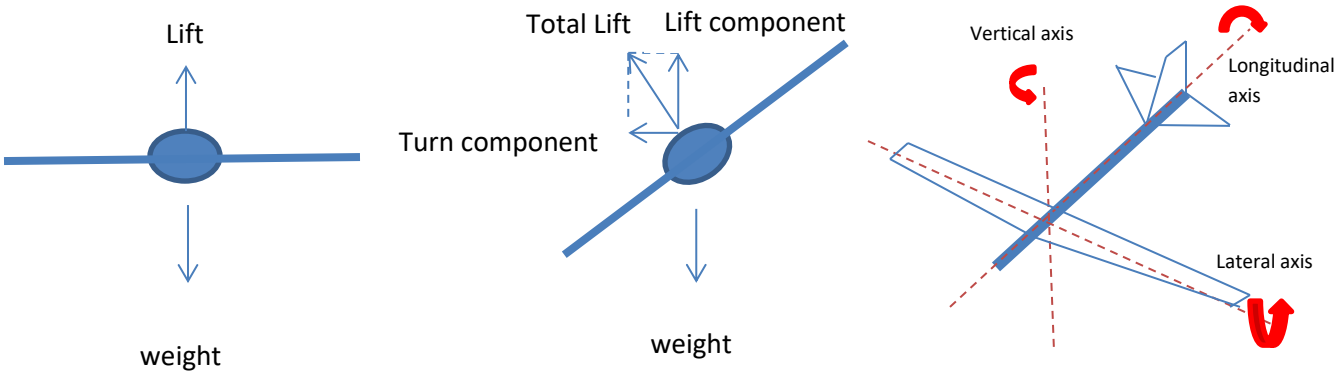
Ref: SOAR Chap 3 pp 24

- Review some basic aerodynamics – Why the glider fly's (white/chalk board and model) start by drawing a cross section of wing and air flow lines. Identify low pressure area in Fluid Dynamics – LIFT: Bernoulli's principle, also lift force created by angle of attack to relative air flow against undersurface of wing. Increasing angle of attack increases lift and drag. Draw diagram below to show forces acting on glider and demonstrate on model glider.



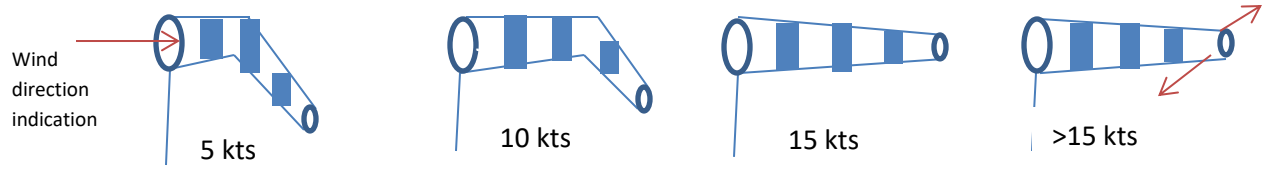


- Show the specific control stick movements on a glider and the corresponding control surface movements. (Go to actual aircraft on ground)
- Pitch – elevator by stick forward/back (movement on lateral axis)
- Roll – ailerons by stick left/right (movement on longitudinal axis)
- Yaw – Rudder pedals left forward/right forward (movement on vertical axis)
- Position of controls neutral or centered (centralize the controls)
- Demonstrate roll, pitch, yaw using model.
- Explain that pitch controls the glider's attitude, and the attitude is what controls the airspeed.
- Explain that the airspeed indicator lags and the need to stabilize the attitude to allow glider to accelerate/decelerate due to inertia.
- Explain chasing the airspeed is when ASI use as primary reference instead of a particular attitude.
- Demonstrate gentle turns with model.
- Explain why roll (bank)turns the glider – use chalk board/white board - ref: page 40 SOAR manual



- Explain use of checklists to prevent any critical check from being missed. Demo in an aircraft not on flight line. CISTRSC-O in detail, SWAFTS and CALL in general as they will be covered again later. Note: POH may have specific checklist for glider.
- Explain options mnemonic "are you ready to WROLL" (Wind, Release, Obstacles, Land able areas, Launch interruptions). On the first flight your instructor will introduce Wind – check windsock for speed and direction and how it will affect approach speed, etc. Each flight there after another element will be discussed in more detail.
- Explain basic sector scan technique and that other different types of lookouts will be explained later throughout the training. E.G., scan before entering a thermal.

- Reading a windsock



Safety

- Explain:

- I have control/You have control.
- PIC-pilot in command – Instructor PIC until you go solo. Important to determine when flying with other pilots.
- Constant lookout for air traffic for collision avoidance, both instructor and student

Sector scan technique for turns

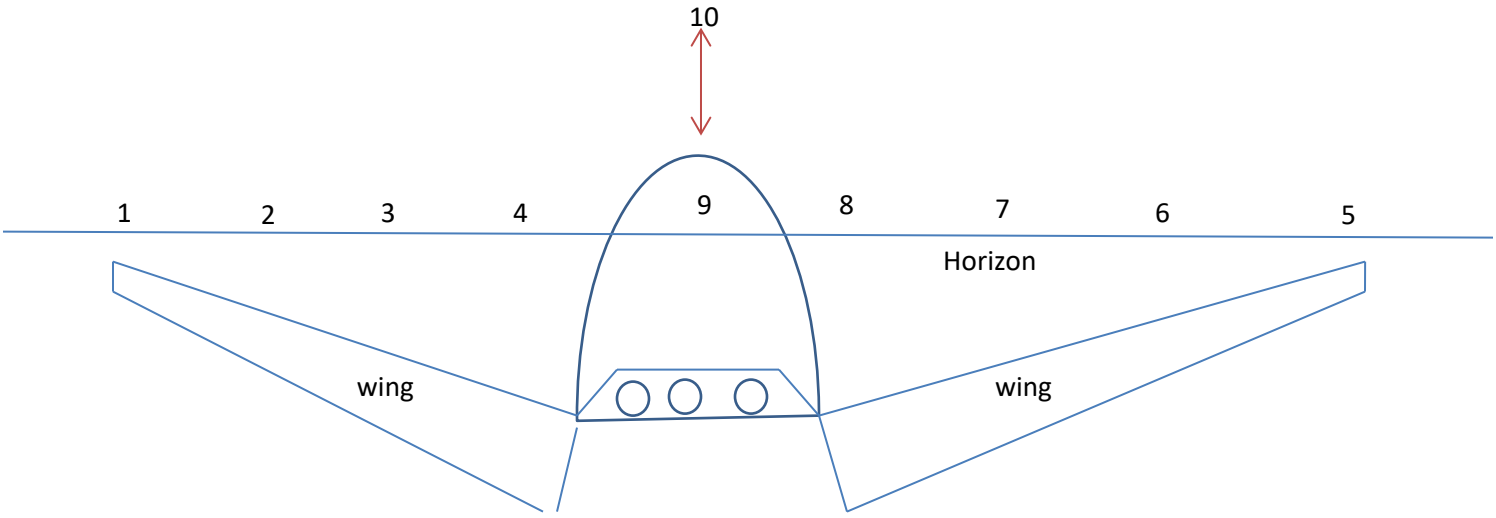
– Instructor will have you practice during the aero tow and before all turns. Sector scanning is designed to mitigate the limitations of human sight. You will get more of this in ground school but for now:

- Near field myopia (eyes at rest focus 4'), permissible scanning rate, being able to detect anything is limited to 10 degrees, only detailed in 2 degrees, blind spots, no relative movement of threats on collision course, threats at same altitude are on horizon, and bright sky myopia (need for sunglasses).

- There are seven types of lookouts. The first is described below and the others will be explained later:

- About to change direction – Sector scan
- In the Circuit
- Climbing to slow in a thermal
- Climbing in a thermal
- Leaving a thermal
- Straight flying
- Height loss maneuvers

- This basic sector scan technique should be demonstrated and discussed on ground then practiced on the ground (preferably in a glider) and in the air during aerotow:



- Start by focusing on wing tip opposite to direction of turn, then slightly behind wing tip towards the horizon and then slightly above and below the horizon, then along horizon pausing each 20 degrees, also checking above and below horizon at each pause.

- When you reach the nose re-start again by looking at the opposite wing tip, then behind the tip to the horizon and back to the nose, also checking above and below horizon at each pause.

- Check high above, then look over the nose to the horizon to start the turn.

- Be careful not to move the controls when scanning and the scan process should take less than 10 seconds after you have practiced several times. There are other types of scans that will be discussed later as training progresses.

Human Factors

- Discuss IAMSAFE, when in doubt do not fly and/or consult CAME.

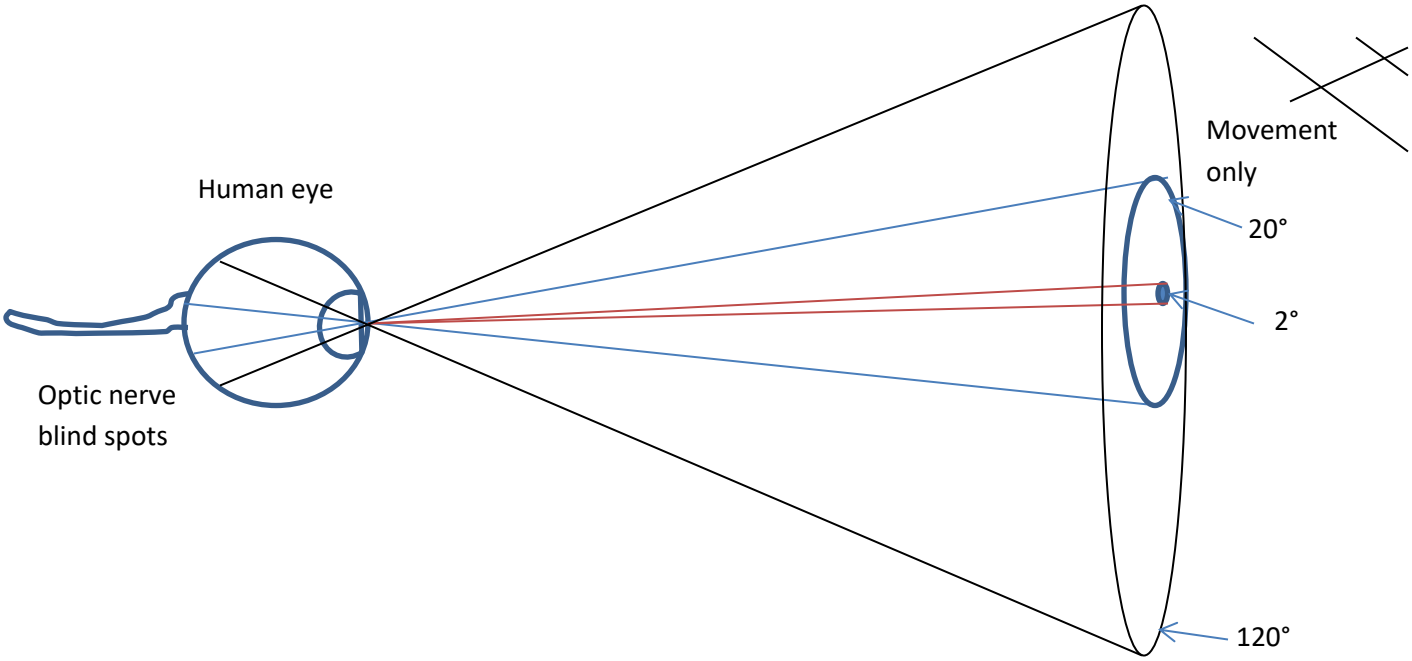
- -Illness, effects ability to function/concentrate & can affect balance/eyesight etc.
- Alimentation (food & water), - low blood sugar or dehydration seriously affects cognitive abilities.
- Medications, - prescription and non-prescription have long list of side effects on pilots.
- Stress, - heat/cold stress affects hydration, motor function, and cognitive ability. Work/social stress effects ability to concentrate.
- Alcohol/ drugs, 12 hrs min for alcohol, 24 to 48 for more than a couple of drinks. Drugs have far greater longer effects. Cannabis not allowed. No place for illicit drugs in soaring!
- Fatigue, lack of sleep or physical fatigue can cause cognitive impairment.
- Emotions. – Longer term effects of loss of family member, divorce, PTSD can last years and may affect concentration and risk management ability.

- Limitations of the eyes (Draw diagram)

- Near vision myopia means eyes focus at rest at only 4’and take a second or two to refocus.
- Blue or bright sky myopia means little contrast causes blindness (wear sunglasses).
- Cone of acuity only 2° for long distance detection therefore to see you must look at a fixed point.
- Saccades is involuntary movement of eye to detect changes in luminance (detection) but beyond 20° FOV eye cannot detect luminance changes only movement, therefore we are blind to aircraft on collision course that has no relative movement and why we sector scan.
- Scan rate only 15°/sec therefore cannot see if we sweep our vision too fast.
- Blind spots at optic nerve or eye damaged areas.
- Brain must be ready to see I.E., if looking for another glider you may not see the helicopter.

- Motion induced blindness is a perceptual illusion where the brain ignores or disregards visual information which may be caused by a moving background.

- More HF detail will be covered in ground school.



- CISTRSC- “O” for options – emphasis here is for having a plan before takeoff to deal with most emergencies. Having a course of action will not prevent you from applying SOAR but if situation happens quickly as it often does, you have predetermined actions to deal with limited time to make decisions.

Stage 2 –Control Effects/ aileron drag/ Turns and SOAR Technique

Review: Q- what turns a glider?

Ref: SOAR Chap 3 pp 30-31

Explain aileron drag (use a model or actual glider)

- When rolling glider into a turn the down going aileron (opposite to direction of intended turn) produces more lift and therefore drag than up-going aileron that reduces lift.

-Long wingspan of glider has a large moment and drag easily yaws glider away from direction of turn on vertical axis.

- Rudder applied in direction of turn co-ordinated with application of aileron will counter adverse yaw

(Some aircraft use differential ailerons, frieze ailerons, or spoilerons to help counter effects).

Practice turns

3 parts – going in, staying in, coming out (Use a model to show steps and where to look). We will build on these basic steps for medium and steep turns later.

Going in

- Complete a sector scan for turn, if clear of traffic conflicts look over nose to horizon, (say "clear left or right" as applicable so you instructor knows)

- Use ailerons and rudder coordinated to roll into gentle turn (about 15-20 degrees bank), then

- Center the ailerons and rudder at the same time

- Then look in the direction of turn along the horizon about 45 degrees ahead of the nose

Staying in

- Look over the nose whenever you make corrections with the controls. The angle of bank and airspeed should remain constant with yaw string straight. Correct, roll, pitch, yaw (most instable to stable) [explain why you look over nose to correct.

- Look in direction of turn again after corrections made.

Coming out

- Look under high wing for traffic and report "clear left or right" as applicable

- Look over the nose to the horizon and use ailerons and rudder coordinated to roll wings level

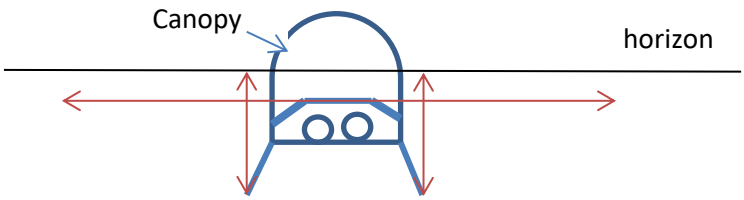
- When wings level center the ailerons and rudder to fly straight

Flying Level (more detail after medium turns as an exercise flying straight)

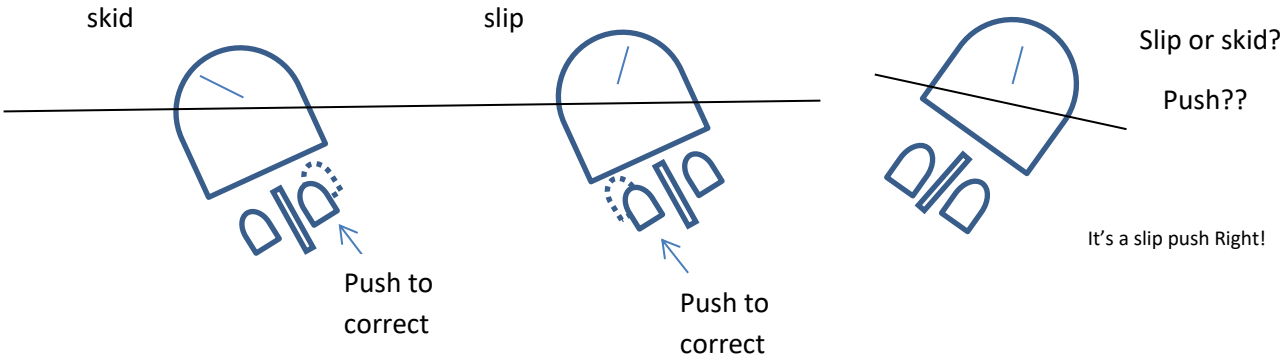
- Pick a reference point on the horizon and fly towards it by leveling the wings when the nose is pointed at it. Make gentle corrections or turns towards the reference point as needed.

How do you tell your wings are level?

- If top of panel is flat or there is a horizontal line on the panel make this parallel to the horizon. If having difficulty confirm by looking at wing tips, they should be both the same distance above the horizon. You can also sense that the canopy side rails are both below the horizon the same amount.



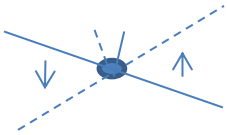
What is the yaw string and how to interpret? (Show on glider how attached)



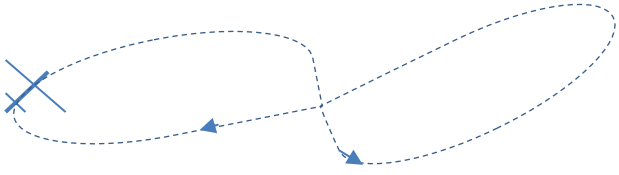
Optional coordination exercises your instructor may use: (demo with a model)

- Linked turns – gentle turns with a heading change of about 20-30 degrees.

- Turning on a point – gentle banking towards a reference point on the horizon. Reverse bank angle before glider yaws from reference point.



- Mild chandelles or lazy 8 using gentle turns.

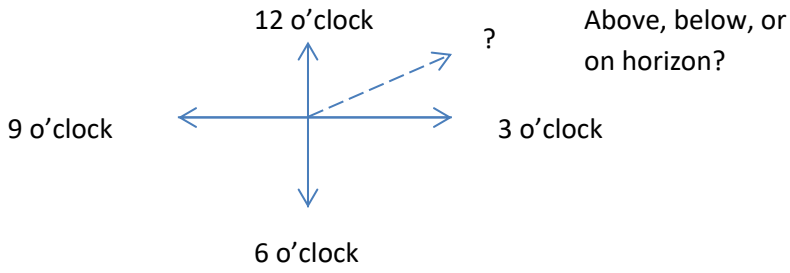


Safety Points

- CISTRSC-O, Options R – release. Review top ten reasons why the pilot might release (will discuss later what action to take when you release):

- lose directional control, wing touches ground, over run rope, slack in rope at all out, towplane/winch loses power, obstacle presents itself, not airborne by normal point, canopy opens while runway available, lose sight of tow plane, **any safety** concern.
- Example: Canopy unlocking during takeoff, fly the airplane and do not let distraction lead to uncontrolled flight, release and land then fix the canopy. Slight side slip into hinged side will help.
- Use trained wing runners to double check dolly off, air brakes closed, canopy closed, tow rope clear in addition to "all clear."

- Identifying aircraft threats for collision Explain clock ray method of identifying traffic and use with your instructor to locate traffic. Four eyes are better than two.



- Basic SOAR technique: cognitive risk management model for logical analysis – Pilot Decision Making (PDM)

S – Situation: awareness or perception of what is going on with the environment, the airplane, or the pilot.

O - Options: what courses of action are available to the pilot and any unintended consequences?

A – Action: decide and take action early enough on best option. Eliminate, accept, or mitigate a risk.

R – Reassess: monitor situation and re-evaluate situation. Further action? Repeat SOAR technique

- Your instructor will be getting you to start working on situational awareness on your first flights and making decisions throughout your training. More details to this basic model will be discussed later. See also SOAR manual.

Human Factors

- Stress reactions: ref is LCol Dave Grossman on "military training" adrenaline and effect on heart rate and mental state.

- 115-145 bpm - increased mental arousal.
- 145 bpm– Motor skills affected, mentally things may appear in slow motion, restricted vision or tunnel vision, possible aggressiveness. SOAR technique may help cognitive impairment.
- 175 bpm- major cognitive skill breakdown, further judgement, and vision restrictions.
- Over 175 bpm – physiological control may not be possible as arteries dilate, cannot physically move or clumsy. Freeze on controls possible effects.

- A way to develop conditioning to stress reactions is repeated experience with the situation that has caused the stress reaction. Your instructor will use Scenario Based Training to create situations to practice reactions and decision making.

- You cannot prepare for all outcomes but dealing with most common and using "Hanger Flying" (discussing scenarios other pilots have learned from) and accident analysis information can help you develop confidence for potential actions. Repeating these exercises with your instructor will help keep your heart rate lower.

- Pilots also under stress tend to push on both rudder pedals (Austrian study) or squeeze the control stick. Learning to look for this and try to relax as it will help lower your heart rate. Regular breathing is important to relax. We tend to hold our breath more when stressed. Under stress you will likely sink to your level of basic training and not rise to your level of perceived skill.

Stage 3 - Stability/Trim & Further Effects of Rudder

Review: What is aileron drag and how do you avoid its effects?

Ref: SOAR Chap 3 pp 32-35

- Indicate on white board and with a model – stability, ball on bowl

Unstable Stable Neutral Stability

- If disturbed object or aircraft returns to original position statically stable

- If disturbed object or aircraft oscillates back to original position – dynamically stable

- Longitudinal or pitch stability – trimmed speed

- Lateral or roll stability – Dihedral

- Directional or yaw stability – weather cocking

- We manoeuvre the glider by disrupting the glider's stability with the controls.
- Gliders are least stable in roll and then pitch and most stable in yaw. Therefore, corrections in turns are made in sequence of roll, pitch, yaw.
- Most stability problems are induced by the pilot (over controlling) glider is designed for inherent stability. (Dihedral, wing sweep, T tail, wash out of wing, etc)

Trim – point out lever in aircraft and demo mechanisms in aircraft (springs and trim tabs)

- Can be aerodynamic or springs in gliders. Trim lever forward for nose down trim, back for nose up trim.

- Use trim to remove fore or aft pressure on control stick required to hold an attitude (attitude controls airspeed)

- Makes glider more stable in pitch at different attitudes and easier to fly, to maintain an airspeed.

Further Effect of Rudder – use model glider to demonstrate.

- Apply rudder a small amount and the glider yaws.

- Apply rudder a large amount and the glider starts to roll. This is due to skid-roll coupling. Several factors are at play. The major factor is that the inside wing moves back producing less lift relative to outside wing. The unbalance lift rolls the glider.

- Useful if used briefly at slow speeds to help level wings when ailerons less effective in take- off or landing phase or in turbulence when roll control difficult.

Further Effect of Bank (or ailerons) – use glider model to demonstrate.

- Difficult to demo in aircraft if air is not stable

- Effect can be seen when glider is banked about 30 degrees then with ailerons neutral, the outside wing moves faster and produces more lift, glider initially yaws away from turn, then weather cocks back into direction of turn. The **Yaw** is the further effect of bank or ailerons.

- Aircraft will start to spiral into the turn as a result.

- Benign spiral uses the further effects of bank to establish a controlled decent when airspeed is trimmed to maintain best L/D in medium turn. Hands and feet must be off controls to work.

- Can be used as an emergency safety decent for hypoxic situations/decent through clouds/medical emergencies where loss of consciousness and control may be possible.

Airbrakes or spoilers' controls

– Explain differences and show on model or aircraft (spoilers spoil lift and are on top of wing only, while airbrakes may be above and below wing and cause more drag and limit speed)

- Used to control rate of decent. Primarily used for approach control or to lose height rapidly. Can increase stall speed by 5 – 10 kts depending on glider.

- Most gliders have an over-center lock to release the airbrakes. Some gliders activate a wheel brake at the end of the air brake throw or a separate control for wheel brake.

Safety

- In the takeoff checklist CISTRSC-O Options the "O" in WROLL is for obstacles. To assess obstacles on the takeoff or emergency landing path assess factors such as trees (location/height), ditches, signs, pedestrians, vehicles, buildings, aircraft, wires, etc. Plan how to avoid/abort/or maneuver around. Release, when in doubt.

Human Factors

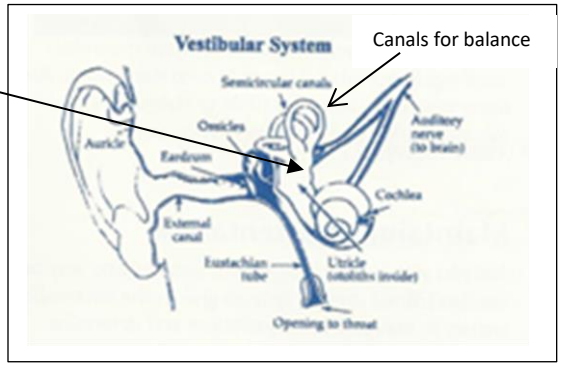
- Effects on the inner ear in turns. This will be covered in ground school in more detail but be aware the circular chambers in the inner ear have fluid that moves to stimulate little hairs in the canals. Tilting head sideways in turns or forward and back can cause fluid to move incorrectly and cause disorientation. Try not to move head too much, except to look around for traffic.

- Otoliths are hair like structures in the inner ear with a mass attached to them at the top.

- The otoliths sense acceleration and deceleration. Tilting head back can also give a sensation of acceleration or deceleration when tilting forward. Over stimulation of the inner ear can lead to disorientation or vertigo.

Otolith

Simplified diagram as Otoliths massed together in inner ear



- Sudden decelerations, such as a quick opening of airbrakes, will create illusion nose has pitched down and pilot may react by pulling back on stick. If flying too slow this may induce a stall.

- Some HF are associated with control movements.

  - Be aware that when you look left or right there may be a tendency to move the control stick left or right also.

  - When you pull back on the airbrake control there is a tendency to leverage the pull by pushing on the control stick and conversely when pushing on the airbrake to close and lock there is a tendency to pull the stick back. Be aware and try to avoid these tendencies.

  - There have been many cases where the intention is to close the airbrakes and they are opened inadvertently. Move them slightly at first and check for the correct effect before making an abrupt change, especially near the ground.

  - Make sure if aircraft is equipped with flaps, that you have the correct handle before operating as they may be in proximity. The handle colour should be blue, and the texture (feel) should be different from the black flaps handle.

  - People have the tendency to make a control movement and expect a certain result. If they do not get the result expected they continue or repeat that action hoping for a different result. E.G. Many cases of person putting brake on in their car and press accelerator instead. They then push harder on accelerator (believing this is the brake) to stop the acceleration and drive into a store window! When you get a reaction not expected stop and re-evaluate your last input.

Stage 4 – Un-Accelerated Stalls/Recovery/Slow Flying

Review: Explain what is the further effects of rudder and when you might use this control?

Ref: SOAR Chap 3 pp 36-38

Reduced g

- Sit in a chair and the pressure you feel in your "seat of the pants" is 1g or the gravitational pull of the earth. Accelerations against gravity can make you feel heavier, or decelerations can make you feel lighter. When we jump off a height, we feel a sense of falling or reduced g, as our bodies (somatosensory) tell us we are not experiencing normal gravitational pressures. Because flying involves accelerations in three dimensions, we can confuse reduced g with a falling sensation when we may not be falling.

Instructor will demo reduced g sensation so not to be confused with a stall. Sensation of falling (reduced g) is possible from air movements or control movements but the glider can be fully controllable and is not stalled.

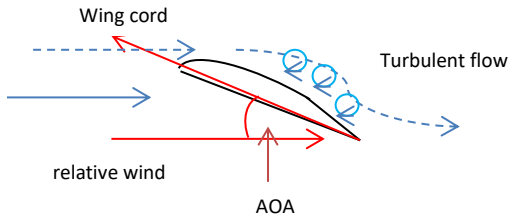
- Demo with a model. The glider will be accelerated slightly then pulled up into a slight climb and then the nose will be lowered. The speed will always be maintained above the 1g stall speed (35 kts?) for your glider. You will feel less than 1 g (falling sensation). Note the ASI. The instructor will roll the wings to demonstrate controllability and then level the glider and give you the opportunity to try the same. If you feel too uncomfortable let your instructor know. Many find the sensation pleasant, but you must not associate it necessarily with the aerodynamic stall, where you may also feel reduced g.

What is a stall – Draw diagram of airfoil and air flow.

- Aerodynamic Stall is when the wing does not provide enough lift to support the mass of the aircraft.

- Angle of attack increases to a critical angle around 16 degrees to relative wind or airflow (most gliders).

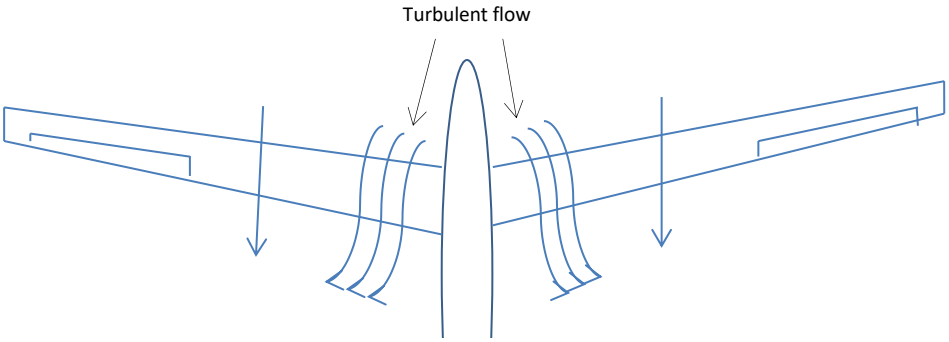
- Center if lift moves forward as air flow separates and becomes turbulent over the wing (drag also increases)



- Eventually lift moves too far forward on wing to support weight of glider and wing stalls. The 1 g stall speed is around 32 kts -36 kts for most training gliders. The design of the airfoil, weight (mass) of the glider, and wing loading caused by increased g, also determine at what speed the glider will stall (see AFM). Stall speed increases with angle of bank: 30° 1.1Vs; 45° 1.2Vs; 60° 1.4Vs.

- The glider will always stall whenever the critical angle of attack for that airfoil is achieved regardless of airspeed or attitude. Therefore, the glider will stall at higher speeds when wing loading is higher (more weight or higher g)

- Wash out (twist in the wing reduces angle of attack towards tips) and forward sweep of glider wings help the wing tips stall later than the inboard wing and help maintain aileron control near the stall. The inboard wing stalls first creating turbulence warning (shaking the glider) so the pilot has more indication of impending stall (see diagram below). Unfortunately, this can occur quickly at higher g loadings and may not be noticed and will be taught later.



Indicators of an approaching stall (use model)

- Your instructor will use slow flight to demo, slowing to 2-3 kts above stall speed

- Airspeed will get slower near stall.
- Nose higher attitude.
- Control-stick back.
- Getting quieter.
- Controls feeling lighter/sloppy.
- Pre stall buffeting.

- It is important to learn to feel if the airfoil is flying or stalled. Hint: ailerons feel and buffeting.

- Instructor will ask student to recover from a stall indicator. It is important not to do stalls first but recovery from slow flight for approaching stall.

- When student senses one of the indicators of an approaching stall commence a recovery:

Recovery From Stall Indicator (use model)

- Lower the nose (use the elevator to reduce the angle of attack and regain air speed) and check air brake closed.
- Check ASI (confirm that the airspeed is 5-10 kts above the stall speed).
- Look up and forward to the Horizon (find the horizon, level the wings normally if necessary).
- Pull out of the dive (raise the nose smoothly back to the normal gliding attitude).

Sharp stall (use model)

- The nose is held slightly above the horizon and glider allowed to decelerate quickly. The control stick must be eventually brought back smoothly to the control stop to prevent the nose from dropping and increase the angle of attack. The wing will reach critical angle of attack and stall allowing the nose to drop significantly.

- Recovery is the same as for the stall indicator. Lower the nose slightly, check ASI, look up at horizon, and pull out of dive. Nose will likely be more significantly below horizon.

Wing Drop Stall (use model).

- A wing drop may occur at the sharp stall and the recovery is the same. The wings may have to be leveled before the pull up. Instructor will induce a wing drop stall later if it does not occur naturally to practice the student.

Mushing Stall. (use model)

- A mushing stall is created when the stall is approached much more slowly with respect to the loss of airspeed. The nose is held on the horizon the glider is slowed. As the stick is moved back to hold the nose elevator authority is lost and the nose drops slightly. Airspeed increases slightly then decreases again and the nose drops slightly again. This keeps happening despite the stick all the way back.

- The instructor will have the student note the Vertical speed indicator. It will show 1000 fpm decent or more. This is insidious as it is more difficult to notice the glider is stalling and un-stalling. High rate of descent close to the ground will result in hard landing and damage to crew and aircraft. It easy not to notice the lead into the stall in the approach if the pilot is not vigilant about maintaining proper airspeed.

- In a thermal trying to get the glider to climb better by raising the nose will also lead to mushing stall or wing drop stall. Recovery is the same as for a stall.

Stalls in Turns.

- Instructor will have you practice stalls in turns. One wing will likely drop as one wing stalls sooner. Recovery is the same, lower the nose to un-stall the wing and leveling wings before pulling up may be necessary.

Stalls with Air Brakes Open.

- Same as previous stall recoveries except pilot must close the airbrakes as the nose is lowered. The nose may drop more abruptly as wings producing less lift and airspeed reduces more quickly due to drag.

- Pilots should practice stalls until they feel comfortable, and the recovery is automatic with minimal height loss. The amount to lower the nose will become intuitive.

Safety

- Always complete a **CALL** check before any potential height loss maneuver.

CALL Check:

- **Cockpit** ready, lose gear stored safely, seatbelts/shoulder belt snug, side vent closed, canopy looks properly locked [do not physically touch handle as they have been mistakenly opened] ballast secure.
- **Altitude** sufficient for exercises and safe return to airfield [Minimum 2000' AGL after recovery].
- **Location** airspace suitable for exercise not over population, built up area, or traffic patterns.
- **Lookout** by making medium clearing turns through at least 90 degrees and looking all around and below for traffic conflicts. Announce intentions/location/altitude over radio if clear. (This is one of the seven types of look out)

- In the takeoff checklist CISTRSC-O Options, the first "L" in WROLL is for land able areas. The pilot should assess what areas are suitable for landing if the launch is aborted. Look left, center, right for suitable areas free from obstacles such as fences, posts, trees, or ditches.

- Then consider the land able areas beyond the end of the runway and airport fence again left, center, right. If these are not in view a drive to those areas before going to the airport is necessary or a discussion with pilots familiar with land able areas is in order.

- Recommend the first as you are better prepared if you have seen them yourself.

Human Factors

- Stalls are considered part of the upper air work as you will perform these exercises as part of you training for safety. However, it is easier to become more disoriented or you may feel a little ill. As you get accustomed to the exercises over subsequent flights, they will have less effect on you.

- Queasiness is the body's natural reaction to having eaten something bad (causing dizziness) and the nausea is the method to get it out of your stomach. Some pilots are more sensitive than others. If you do not feel well let your instructor know and the exercises can be postponed until you have your air legs again.

- Things you can do to avoid disorientation or queasiness:

- Look at the horizon (not down the wing or at the ground).
- Minimize head movements. Do not tilt head forward then up.
- Stop any abrupt movements or maneuvers.
- Do not fly with an empty or full stomach, avoid alcohol night before lesson.
- Land ASAP and find a quiet place to rest.
- Note that tolerance can be built up over time and experience.

Vertigo and Spatial Disorientation

- Vertigo is spinning sensation and spatial disorientation is not knowing the aircrafts correct position in space and may not be sensed as dizziness. Coriolis illusions (inner ear canals), somatosensory illusions (body position sensors in tissues, joints), and visual illusion will be discussed more in ground school.

- Can be caused by stimulation of inner ear and other senses and lead to disorientation and control difficulty. It is less common in gliding and more prevalent in instrument/night flying but can occur in low visibility situations in gliders where the horizon is difficult to see.

- Usually a result of severe turbulence, flight in cloud or precipitation, or low light. A pilot must rely more on the accuracy of their instruments than what their internal balance senses tell them.

- Try to re-establish reference to the horizon as this will immediately stop SD as visual reference is dominant to other senses. Land as soon as possible and avoid low visibility conditions or turbulent conditions. Changing altitude may help and stay clear of cloud. SD can result in less than two minutes for the average pilot after entering cloud or low visibility situations.

Sopite Syndrome. A motion induced fatigue. Symptoms include fatigue, drowsiness and nausea. It can decrease cognitive ability by 30%. A person can detect as little as 10 milli Gs, so even small g loading during normal flight can cause this effect.

Stage 5 – Medium Turns and Thermalling

Review: Explain the indicators of an approaching stall and the recovery method?

Ref: SOAR Chap 3 pp 39-46

Medium turns

- Medium turns are between 30 and 45 degrees of bank in gliders and described as a well banked turn.

- Medium turns are used to fly the circuit and thermal (45 degrees being the optimal bank angle).

- As in gentle turns there are three parts to the turn going in, staying in, and coming out with a few additional requirements.

- At greater bank angles the lift component is less, and the turning component is increased. Therefore, there will be a tendency for the nose to drop.

- The outer wing will produce more lift and drag, and adverse yaw will be more pronounced and a tendency to overbank. The pilot must compensate with the controls to make the medium turn smooth.

3 Parts of Turn

Use a model to show steps and where to look. (Differences in medium from gentle turn shown in *Italics*)

Going in

- Complete sector scan for turn, if clear of traffic conflicts look over nose to horizon, (say "clear left or right" as applicable so you instructor knows)

- *Lower the nose slightly (stall speed increases with angle of bank)*

- Use ailerons and rudder coordinated to roll *more briskly* into *medium* turn *(about 30 degrees bank*), then

- *Prevent the nose from dropping by adding back pressure on the stick as necessary*,

- Center the ailerons and rudder at the same time when bank angle is achieved *(re-trim if staying in the turn)*

- Then look in the direction of turn along the horizon about 45 degrees ahead of the nose

Staying in

- Look over the nose to horizon whenever you make corrections with the controls. The angle of bank and airspeed should remain constant with yaw string straight. Correct, roll, pitch, yaw (most unstable to stable).

- *Maintain back pressure to prevent nose dropping or re-trim,*

- Some aileron opposite to direction of turn will be required to prevent over banking,

- Some into turn rudder may be required to keep yaw string straight.

- Look in the direction of turn again after corrections made. *About every 1/3 of turn check roll pitch yaw, then look forward again.*

Coming out

- Look under high wing for traffic and report "clear left or right" as applicable.

- Look over the nose to the horizon and use ailerons and rudder coordinated to roll wings level.

- Relax back pressure on stick to prevent nose from rising as wings level (if re-trimmed you will have to apply forward pressure on stick to keep attitude until re-trimmed).

- When wings level center the ailerons and rudder to fly straight.

Thermal sources (note more reading required to master this subject. Read *Advanced Soaring Made Easy* for post solo study)

- The sun's high angle to the surface and surface heating is what creates thermals or bubbles of rising air. Thermals are narrow near the surface and are wider as they get higher and usually stronger above 1000' agl.

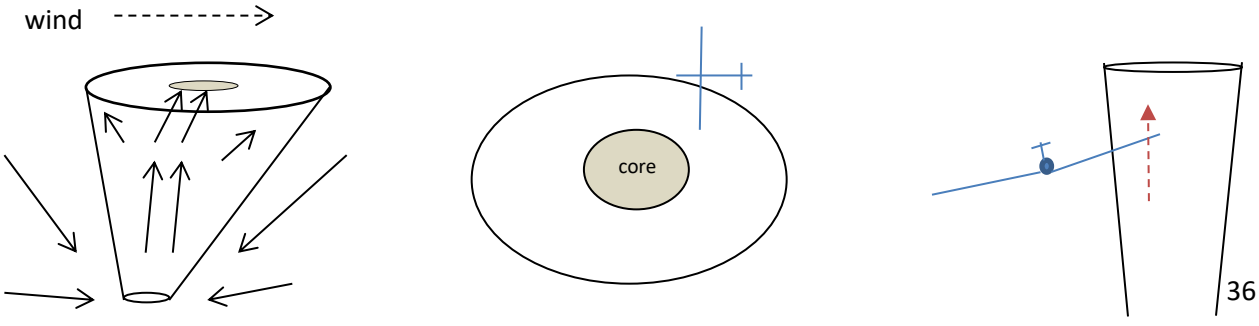
- There are typically altitude bands that the thermals are stronger in. As thermals reach higher altitudes later in the day, they tend to be greater distances between thermals. Thermals drift (tilt) with wind and several may align themselves with the wind (street)

- Thermals usually have stronger cores and weaker lift areas around the core. Often a thermal is surrounded by down going air before the rising air.

- Thermals have cycles and may be active for several minutes then dissipate as cool air enters the base and may start up again several minutes later when the originating area reheats.

- Thermal sources are typically areas of differential heating such as sandy well drained areas or higher ground, rock cropping's, built up areas, sides of hills, auto wrecking lots, etc.

- Thermals usually have a trigger such as tree lines, cliffs, quarries, etc that will start a mechanical updraft.



Side view Top view

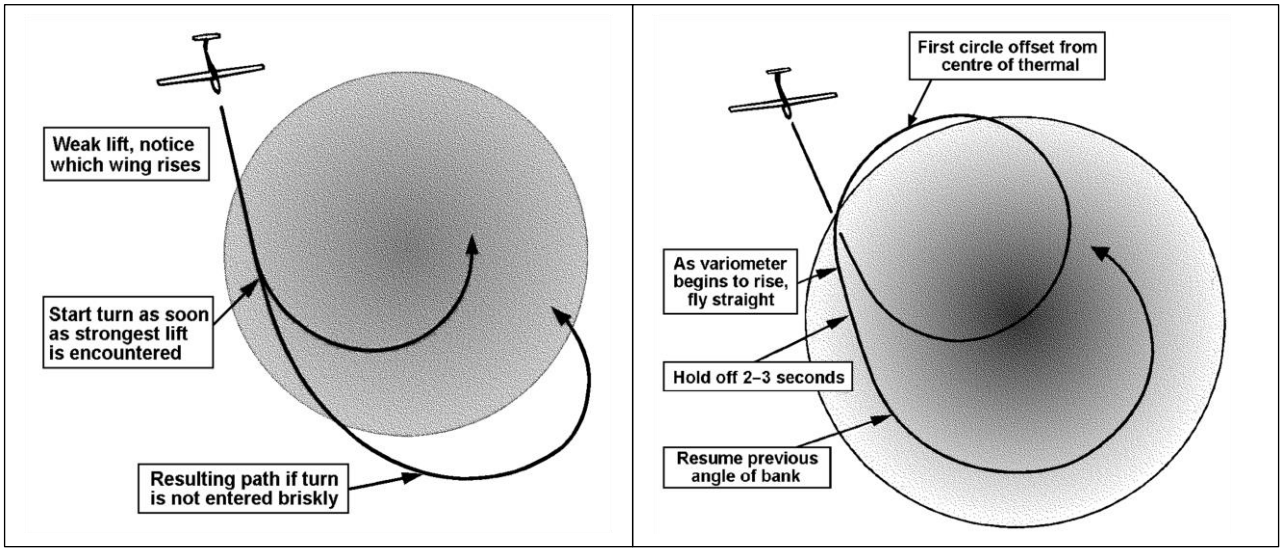
Side view

Lift Indicators

- Thermals are often marked by cumulus clouds with flatter or concave bottoms; or haze domes and or circling gliders in blue thermals (no clouds). The glider will feel like it is being accelerated up (push up in the seat of the pants) when the thermal is entered and the VSI will then indicate the glider is going up in fpm or kts (1 kt ~ 100 fpm). Most variometers lag somewhat so the strongest part of the lift will register likely after you have passed through it. Some varios are compensated so that they sense the air mass raising not just the glider, as in a control stick pull up.

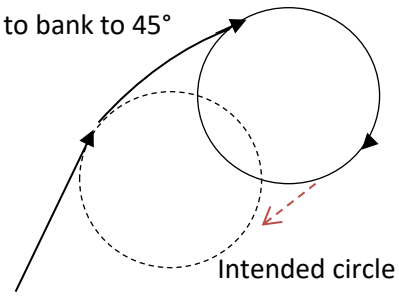
- Good thermalling takes practice so do not get frustrated if you are in and out of lift. Good medium turn technique is critical to map out a thermal and center. Keep imagining the thermal and where you are relative to the core. Often you will feel one wing lift indicating which side the thermal is strongest. Turning in that direction is best. If you do not circle, the thermal will likely bank you away from the lift.

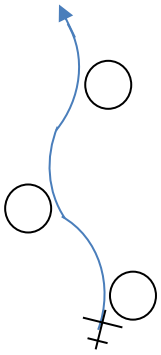
Technique (use whiteboard)



Reality is:

Actual circle due to delay to bank to 45°





Flight path if pilot does not react to thermal lift. Glider turned away from thermals

- Key to good thermal centering is consistent bank angle and speed to map out the lift. If not accurate the pilot will have difficulty centering thermals.

- pick a reference point on horizon as you enter a thermal to help you map the thermal. Try to visualize the thermal as you map it out.

- Goal is to always centre the thermal. Smooth even climb, free of turbulence, indicates that the thermal is centred. Turbulence indicates the edge of a thermal. Move towards smooth air near core.

- When there are no cumulus cloud markers or when at lower altitudes, search for lift over dry fields, gravel pits, parking lots, cut hayfields and other potential hot spots. Circling soaring birds such as eagles, hawks, gulls, vultures or gliders can indicate lift.

- Never fly through bad air twice and always shift your circle towards the stronger part of thermal.

Thermal Joins and departures

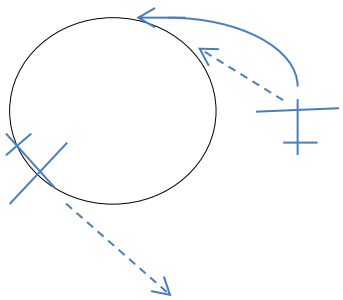
- Gliders already in the thermal should be given the right of way. The joining glider must also turn in the same direction. First glider to reach a thermal sets direction of turn.

- It is best to join another glider in a thermal from the outside of a thermal in the same turn direction outside the first glider's turn radius and on a tangent so the other pilot(s) can see you approach. Then adjust your speed and turn radius so that you are on the opposite side of the thermal. You can also enter at on a direct tangent if you can time your entry to be on the opposite side of the thermal so the other pilot can see you joining. Radio calls are normal to warn other gliders you are joining/departing their thermal.

- If you lose sight of the other glider you must exit. Stay where the other glider can see you. The glider originally in the thermal determines the shape of the turn and centering required, the joining glider conforms to the turn shape. Look out for other gliders also joining.

- To leave the thermal with another glider, level the wings after a scan to ensure no conflicts and selecting a reference point to fly towards. Fly straight ahead with no turns until well clear (1/2-1 km). Collision hazard is high if you circle again after just leaving.

- If no other gliders at same altitude you can exit by tightening turn and flying through the core and increasing speed as you will fly through some sink after passing through core.



Thermal join with other glider at same altitude

- If other gliders are circling in opposite directions in the same thermal conform to the direction of the nearest glider in the thermal.

- Several gliders at different altitudes in the same thermal are called a “gaggle” and can be seen from many kilometers away. Up to 3 gliders are safely possible at the same altitude.

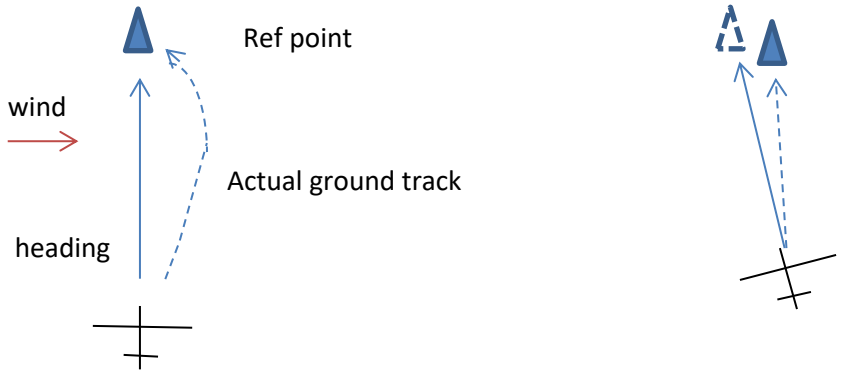
Flying Straight

- Keep wings level and maintain a scan ahead, above and below the horizon and about 45 degrees left and right.

- Pick a reference point near the horizon, if possible, to fly towards and make smaller and smaller shallow turns towards the reference point (or compass heading later in training).

- Regularly widen sector scan to include behind wingtips like a scan for turns. Occasionally check underneath by altering course slightly and banking slightly as you return to course line (most collisions are by overtaking aircraft). Aircraft not apparently moving near the horizon is the highest threat.

- If you are drifting downwind of a ground track towards your point you can select a new reference point a bit more upwind, and your ground track will be straighter towards your original reference point (known as crabbing into wind) this requires a bit of trial and error but with practice you will be able to guess the wind correction angle for drift! (if flying by compass try a 10 degree correction into wind initially and increase by 10 degree increments if a drift is still noticed. If over corrected reduce correction by ½).



Safety (more detail here due to high number of poor thermalling etiquette demonstrated by students)

- Scan technique while in the turn and coming out. A glider circling draws attention of other gliders that you may be in a thermal and they will be drawn to you. You must scan along and above the horizon all

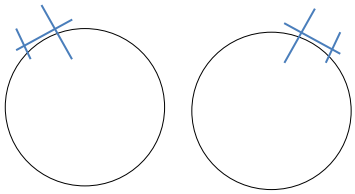
around you to maintain situational awareness as you circle. Be aware who is possibly below you and climbing. And have a good look for glider circling outside your turn or approaching your circle.

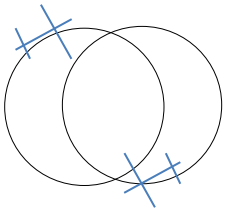
- If others attempt to join you in a thermal, attempt to maintain a constant bank and airspeed so that your circling is predictable, and they can adjust their position to you. You should adjust to the turn shape of the glider in the thermal before you and not cut in to center the core or start circling outside the established circle if you are at the same altitude. Do not climb through another gliders circle unless agreed by radio and no conflict exists.

- If you must look inside the cockpit to attend to something else, leave the shared thermal first to deal with it and return when looking out has your full attention.

- Scan Technique entering a thermal. The key is to have a good look well ahead to your intended area to circle or thermal. Complete a sector scan before the anticipated thermal indicators (1-2 km). Look above and below the horizon. Anticipate that you will lose height approaching the thermal and gliders in the thermal will climb. It is safest to approach other circling glider by an arch or tangent to their turn never directly inside the circle.

Watch for two thermals close by with other gliders circling creating potential conflicts or two gliders in same thermal not centering on same circle!





Two potential conflicts

- **Scan Technique climbing in a thermal**. You will need to look well above and keep situational awareness all around for joining gliders. Keep looking over nose at horizon and correcting turn about every third of the turn for a few seconds with most of the turn looking out along and above the horizon. A glider that will be the greater threat is on or above the horizon and has no relative movement.

- **Scan technique exiting a thermal**. Look especially under the high wing and along the horizon and below horizon in the intended direction of exit. You will lose altitude as you leave the thermal so your greatest threat will be on or below the horizon. Look around for other gliders circling near your thermal and intended direction of departure so that your exit does not create another conflict.

- These techniques will be practiced in later lessons after medium turns are taught.

- In the takeoff checklist CISTRSC-O Options, the last "L" in WROLL pneumonic is for **launch interruptions**. Consider intentional or unintentional low-level releases less than 300'agl, over 300'agl but less than 500'agl, or over 500' agl. Always plan to land on the landing area ahead if possible. More options will be discussed in later stages along with the risks of low-level turns.

Tow plane should have minimum 70% of T/O speed by ½ point and glider airborne.

Human Factors

- Attention fixation. As you are learning more about flying it is human nature to focus on a problem area when it occurs. The pilot's attention is draw to a particular aspect of flight or instrument and all other aspects not related are ignored. Unfortunately, situational awareness is lost. Pilots have stopped flying the airplane as a result.

- The number one job in emergencies is to "fly the airplane" and maintain situational awareness. The secondary responsibility is to deal with situation to resolve it. The pilot reaction in a launch interruption can lead to this fixation and having a plan for contingencies helps to avoid loss of situational awareness.

- Airmanship is built on four pillars of Attitude, Skill, Knowledge, and Responsibility. The latter includes self -discipline. (Discuss with student what each means)

Stage 6 – Demo Takeoff & Aerotow/Winch Launch , Effects of Airbrakes at height, Approach Control using Airbrakes & Overshooting and Undershooting, Demo Landing

Review: Explain three parts of medium turn?

Ref: SOAR Chap 3 pp 67-74

Take Off

- Keep wings level with ailerons and directional control with rudder. Most modern gliders start take off with elevator centered. Gliders with nose skids require back stick initially and gliders with tail skids require forward stick. Consult AFM for correct procedure. Once the elevator has become effective, balance the glider on the main wheel, in the lift-off attitude, with the tail slightly off ground (show student attitudes by lifting tail when they are seated in the glider).

- If the wing tends to drop and aileron does not restore wings level use “secondary effect of rudder” (demo with model). Over controlling with rudder will often lead to roll inputs. Too much yaw in one direction can cause wheel side load and roll in opposite direction depending on C of G position (high).

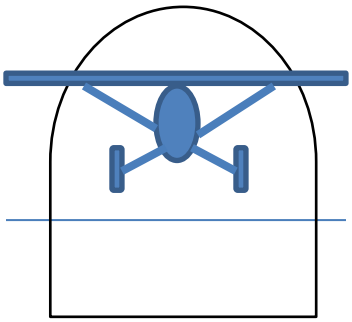
- Let glider lift off by itself, do not coax into air by applying back pressure to stick. Lifting off too early can lead to stall, wing drop or resettling on runway possibly damaging landing gear if side load or cause a pop up and PIO. If you lift tail of tow plane the take-off run will be extended, or not possible and tow plane may release glider.

- About ½ way down average 1000m runway tow plane should have 70% of airspeed (40 mph) and glider should be airborne. Abort the launch early if the take-off acceleration is abnormal.

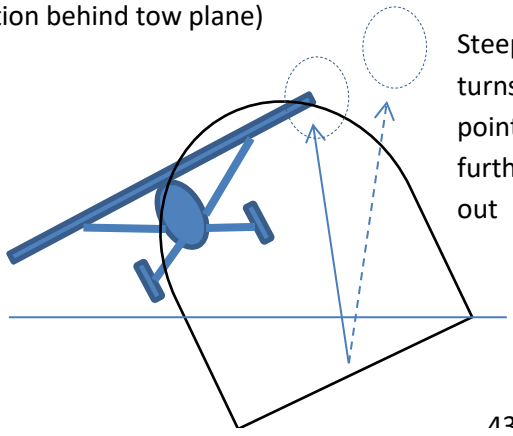
Aerotow

- As tow plane lifts off keep up with the tow plane climb rate. Getting caught low behind the towplane can tempt the pilot to pitch up quickly to gain the vertical displacement. This can lead to tow plane upset. Climb smoothly and avoid a steep pitch up. It is possible if done too quickly to be in a position where full forward stick does not prevent passing up higher than the tow plane lifting the tail causing upset. The effect is worsened if a wind gradient is present.

- Use a model and white board to show station keeping (position behind tow plane)



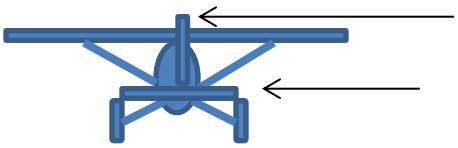
Keep wheels on or above horizon/ distance depends on power of tug



Steeper turns point further out

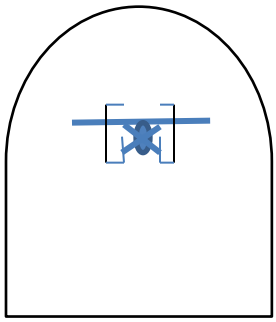
In gentle turns point nose at outside wing tip and bank same as to plane

No horizon Situation



Keep vertical stabilizer in same position above wing

Or Keep horizontal stabilizer in same position center of X



Imaginary gun sight method

- Pressure on the controls greater during aerotow due to higher speeds so controls more effective for less movement (65kts typical).

- Make coordinated turns towards tow plane if you drift out of position but level wings as soon as nose points at tow plane (tug). Glider will then drift back into position. Momentary turn back towards tow plan may be necessary if too much correction was made to prevent crossing extended center line of tow plan.

- Side slipping an option for moving into position behind tow plane after you learn side slips.

- The instructor may demonstrate where the propeller wake (wash) is below the glider from the high tow position. Note how far the tug is above the horizon when you enter the edge of the turbulence.

Release from tow

- Pre-release check. At release altitude the towplane should level wings and fly straight ahead in a normal climb**.** Confirm release area is suitable (height and distance from field OK), Scan for traffic, if clear, visually confirm and pull release once, visually confirm “rope gone” out loud.

- **Post release check**. Turn right 90 degrees (tow plane turns left), fly level for a few seconds while slowing to best L/D for separation, locate and confirm clear of tow plane and other traffic, locate airfield, gear up and visually check pictogram of the gear handle position correct, once slowed to best L/D re-trim.

Emergency Release Procedure Safety

Emergency release signal should not be used unless it is an emergency or emergency training. Release immediately, confirm rope gone, look for traffic in direction of turn and avoid conflicts.

Winch Launch (only if this method of launch is being taught for primary lessons)

Three phases of launch

- Take off & Initial climb - glider accelerates to climb speed with controls centered wings level. Controller gives “take up slack” and then “all out” to winch operator, glider climbs to about 150’-200’ agl (see AFM, usually around 50-55 kts or 1.5 Vso)
- Intermediate – commence gentle climb about 20-25° from 150’ to about 300’agl
- Full climb – climb at about 35-40° degree angle after 300’ (lower nose immediately [recovery attitude] if cable breaks or winch loses speed). At the top of the launch airspeed will slow as winch slows and nose of glider must be lowered to maintain best L/D speed, then release.

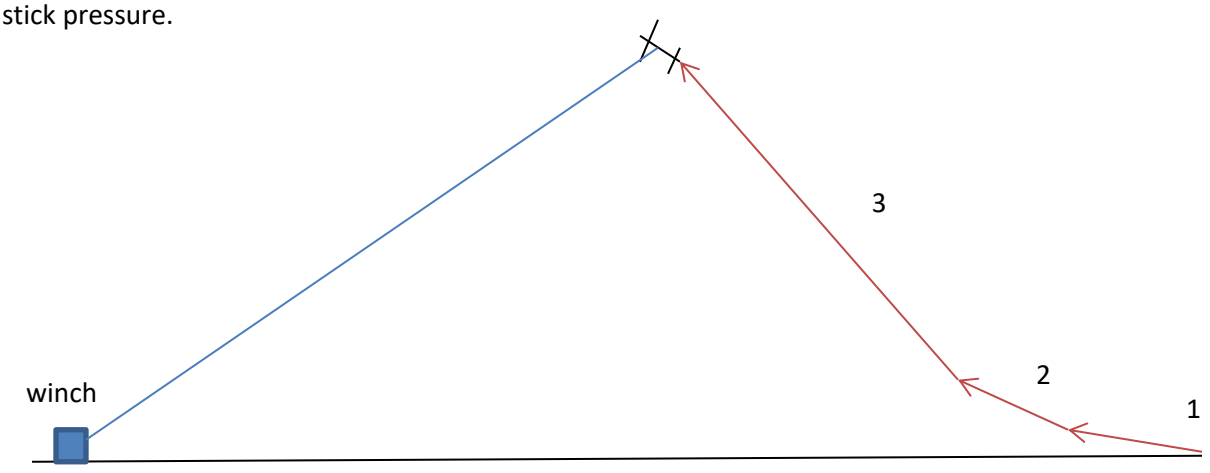
- Modern gliders require almost a neutral stick force and centered control to go through the three phases of winch launch. Some gliders may require forward stick pressure to prevent climb. Older gliders with a more forward C of G hook may require back stick pressure to achieve glide angle in the full climb. Never use an aerotow hook to winch launch. Key is not to exceed a rotation rate greater than 6° per sec from start of launch to maximum climb attitude 35-40° (or not faster than 6 seconds to rotate to a full climb!) to avoid a flick stall and roll.

- Use correct weak link strength in accordance with AFM/POH.

- Keep wing level with ailerons and control offset or crab with rudder to correct for drift and pitch control to maintain minimum launch speed. In stronger cross winds a slight bank into wind (sideslip) and rudder to maintain straight track will be required.

- Should winch launch be interrupted (loss of power, cable break) it is essential to immediately lower nose to recovery attitude and release cable and accelerate to approach speed $V_{approach}$.

- If wing drops towards the ground release immediately. If proposing starts at top of launch relax back stick pressure.



- communicate with winch operator by radio if too fast or too slow but lower nose to maintain airspeed until power comes back up or release. Too fast signal is yawing glider with rudder, too slow signal is lowering nose. If too fast relaxing back pressure or reducing angle of attack will reduce tension on the line and reduce speed slightly. Release if speed is not reduced by winch operator.

- Should a glider release at the top of the winch not be possible (cable should back release) the winch operator will cut the cable and the glider should make a gentle spiral over the winch and land on the reciprocal runway.

Effects of Airbrakes at height

- Most air brakes cause drag so nose must be lowered when used to maintain airspeed. Some increase the stall speed and may require increases in airspeed when used in fully open position. Conversely, when closing airbrakes pitch attitude must be decreased to prevent increase in airspeed as drag is reduced. Instructor will have you practice at height. (Use model to demo)

- Use of air brakes move lifting forces further out from wing root and caution is required at higher g forces, such as in a pull up. (The instructor will have you eventually practice stalls with airbrakes open)

- Once unlocked the pilot should not let the handle go lose. Some airbrakes will be sucked open when unlocked so positive control over the handle is important. Piggott hook has been installed in some new gliders to help prevent this and the hook must be lifted to open the airbrake further.

- Misuse of airbrake near the ground can cause a hard landing. Always move the airbrake handle smoothly and deliberately to the desired opening. Confirm air brake position visually by looking at each wing momentarily.

Approach Control using Airbrakes & Overshooting and Undershooting,

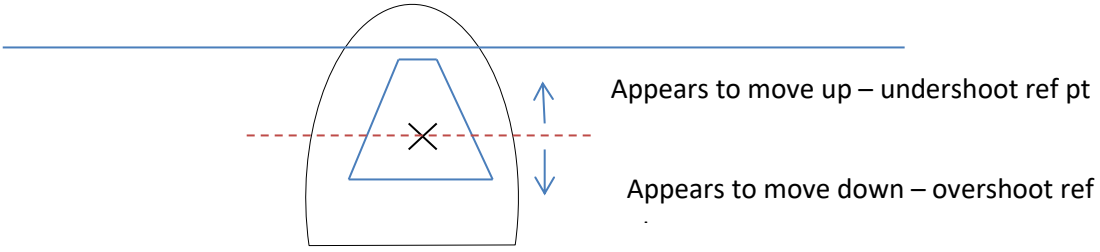
- **Ground exercise** - Demonstrate overshoot and undershoot by having student(s) standing and picking a reference point on the ground 15'-20' ahead. Have them raise their arm towards the point and without moving their arm, walk towards that point. Have them note that the point is moving down in their field or view. They are overshooting that point.

- Next have them repeat the exercise, but on each step have them lower themselves as if they were going down a set of imaginary stairs. The reference point will be moving up in their field of view. They are undershooting that point.

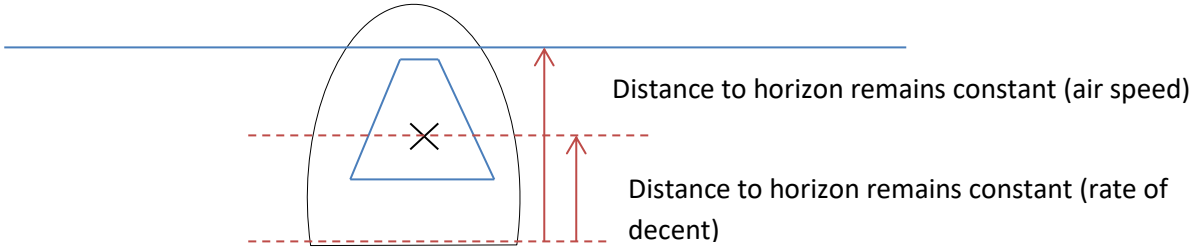
- The instructor will practice air brake use and over/undershoot at a safe height then demo it on final approach to land.

- First establish an overshoot by positive indication the reference point is moving down in field of view, then open enough air brakes to prevent the reference point from moving down. Lower the nose to compensate for the drag and maintain airspeed. Monitor after a few moments that you have enough air brake and if the reference point moves down, open more air brake and maintain airspeed.

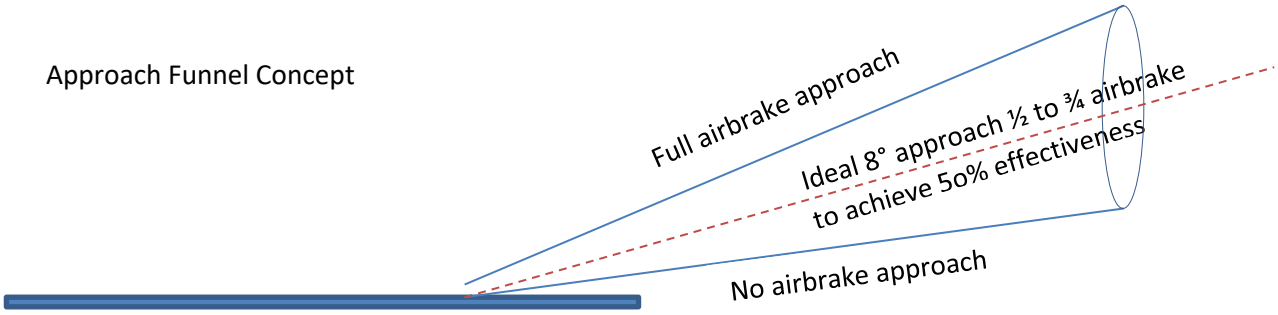
- If an undershoot is detected (ref point moving up) close the airbrakes and re-establish the overshoot and then reopen the airbrakes. This prevents situations where the air brakes are reduced but not enough to prevent an undershoot and short landing. Undershoots can be caused by sink or changes in wind strength on approach.



- A **Stabilized approach** is when the air speed and rate of decent are constant and therefore when the attitude and reference point do not move. Airspeed would be best approach speed and rate of decent about 500'/min giving about 8° glideslope. Ideally, air brakes about ½ to ¾ open to achieve 50% effectiveness.

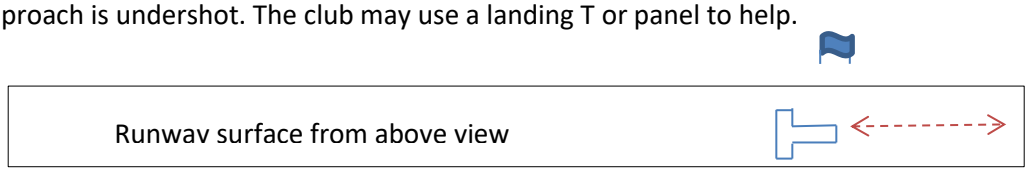


Approach Funnel Concept



Selection of reference point.

- The reference point has to be visible from circuit height and should be on or immediately adjacent the landing area. The point must allow a suitable undershoot area (100m-200m) that is suitable to land if the approach is undershot. The club may use a landing T or panel to help.



Reference point landing T

Landing (Use model to show phases)

- 3 parts of landing Round out or flare, the hold off, and touch down/roll out

- **Round out.** At about 50'-100' agl, confirm that you have about ½ air brakes. This will make the landing more stable and reduce the rate of decent, so the rotation (flare) is manageable. At about 30' (10 m) agl when the pilot notices the start of the ground rush (when surface view including periphery sights starts to expand rapidly and you feel that the ground is getting closer rapidly) **look towards the horizon at the far end of the runway** At around 10'-20' (3-4 m) agl and start the round out by easing back on the control stick until returning to level flight at about 4-6 ft (1-2 m) above the ground.

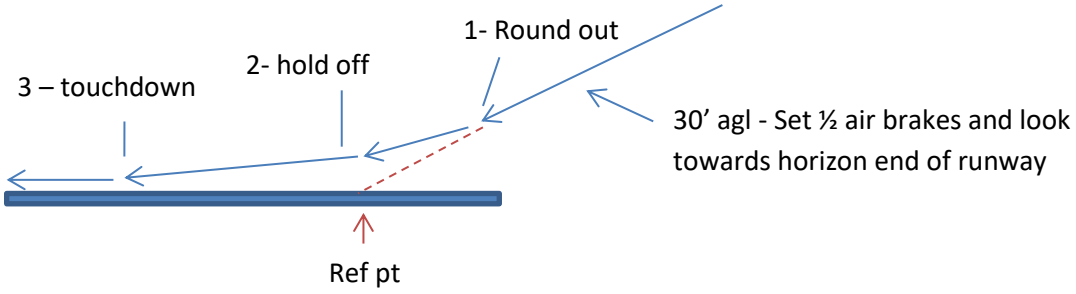
- **Hold off.** After the rotation continue to fly level holding the air brakes steady at about 1/2 to 2/3. The airspeed will decrease, and the lift produced by the wings decreases. As the glider starts to slow, raise the nose slightly towards the landing attitude to prevent the glider from descending and try to maintain 2-3' off the ground.

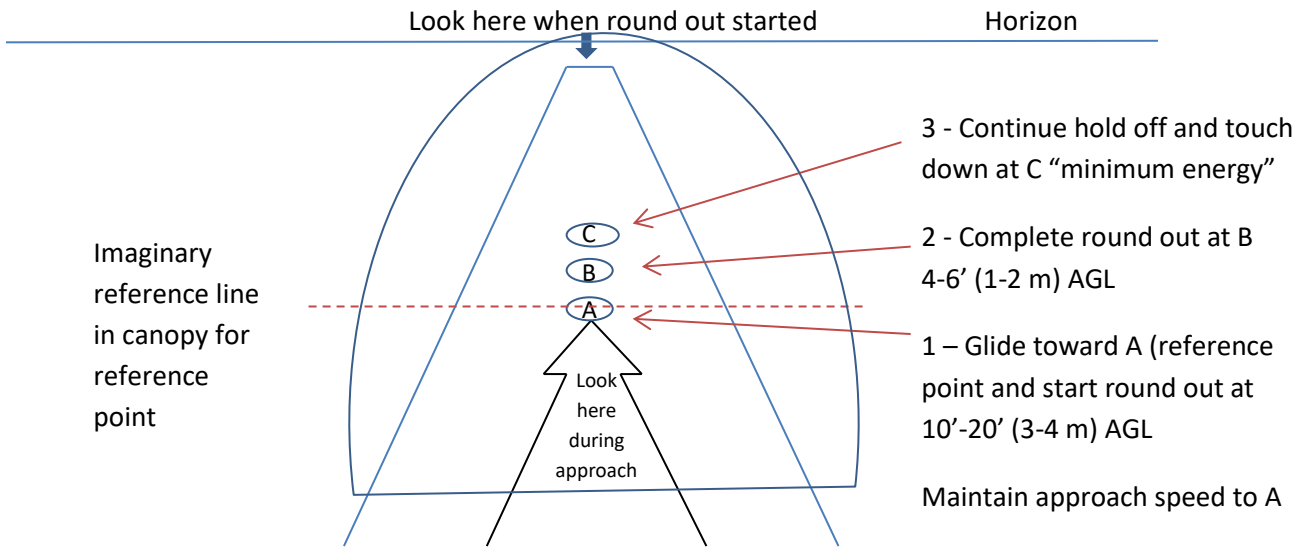
- **Touch Down**. Eventually you will run out of elevator and/or the glider will settle to the ground at minimum flying speed (minimum energy landing). When the main wheel is in contact with the ground open the air brakes fully (careful not to apply the wheel brakes if controlled by the air brake lever) and continue to bring the stick all the way back against the stop and hold it there. This will help prevent the glider from lifting off with a bump on the ground and shorten the roll out. Gliders with nose skid brakes may require lowering nose to effect braking. (C of G normally ahead of wheel)

- Keep wings level with aileron (secondary effect of rudder if necessary) and steer the runway centerline with rudders independently. Apply the wheel brake as required to control the ground roll. Keep flying the glider until it stops, and one wing settles to the ground. Keep the stick back on the stop.

- Attempt to stay in the middle of the runway. After stopping, exit the glider as quickly as possible, secure the canopy, and move it off the runway so that another glider may land (even during off field landings).

- Do not plant the glider on the ground with the control stick by checking it forward or pull the stick back when the wheel touches down until full air brake is opened. Landing with the tail off the ground will lead to ground loops if C of G is on or rear of main wheel.





Approach speed*

- Consult the AFM/POH for the proper approach speed to use for your glider type. For **older** basic glider (2-33, K-13) trainers without a reference speed $V_{approach}$, FTSC has adopted (1.3 x Vs + V_{wind} + gust factor) which works for most training conditions where head wind is less than 20 kts. Modern high-performance gliders (K-21, DG 500/1000) are typically a yellow bug speed $V_{approach}$ of around 1.4 to 1.5 x Vs. Then in windy conditions the approach speed is ($V_{appraoch}$ + ½ V_{wind} + gust factor).

- The approach speed is to compensate for wind gradient effect and possible wind shear and will give more control in turbulent conditions. Approaching too slowly at minimum speed can lead to undershooting in the least, or a stall at the worst. This speed must be checked more frequently on the approach, about every 3 seconds, compared to normal flight instrument scans.

- Approach speed should be maintained until the glider has passed through the wind gradient and turbulence but by the rotation height the speed should be allowed to return to the normal glide speed. A normal held off landing should then be executed. Trying to land the glider with excessive speed can lead to wheel barrowing, bounced landings, or ground loops and potential loss of control. (Demo with model)

- Wind shears should be dealt with by lowering the nose and closing airbrakes to maintain airspeed unless close to the ground. Then re-open the air brakes to ½ and continue a normal landing. If close to the ground and air speed is close to stall, then it is better to hold a level attitude and let the glider settle on the main gear to absorb the energy rather than strike the tail or nose on the ground. If airspeed is not close to the stall speed, then reopen about ½ airbrake to stabilize the glider (reduce chance of PIO) and land normally.

- Similarly bounce landings should be handled by closing the air brakes and returning to a normal gliding attitude. If the height and airspeed is sufficient re-open airbrakes to ½ and land normally. If airspeed is low handle as above for wind shear.

- accelerate to approach speed after launch interruptions before maneuvering unless at round out altitude

- Ground exercise for where to look when landing. Have student stand and look at a point about 6' in front of them on ground and flex their knees down. Then have them look at horizon and flex knees. Ask them to note the difference. Is it not easier to judge one's height or settling down with peripheral vision when looking at horizon at far end of runway?

Safety

- Look out on aerotow. Glider has better visibility than tow pilot. Look for conflicting traffic from glider wingtip to wingtip as there is a tendency to focus on tow plane early in training. Warn tow pilot by radio if you have seen a conflict. Release if conflict not resolved. Glider can steer towplane if no radio communications by a gentle steady lateral pull on the tail (not a jerk- watch for lateral upset).

- Do not get towed where you do not want to go such as too far downwind. Communicate with pilot by radio. Some clubs have release points, routes, height limits, see SOPs. Tow Pilot may reduce climb rate after release altitude if glider does not release. If NORDO tow pilot will assume glider cannot release after reasonable amount of time/altitude and return to the airfield to release glider. If release is not normal radio Tow Pilot that glider has released and locate and confirm tow plane is not in collision conflict. Note tow plane may climb after release. Position reporting may be required to locate tow plane.

For **winch safety** there are some critical points:

- Hook up to correct hook (C of G), release if launch safety in doubt.
- If wing drops on launch release immediately.
- Time for rotation to full climb to prevent a stall should be not less than 6 seconds.
- In all launch interruptions lowering nose to recovery attitude must be immediate without hesitation and glider must be given a few seconds to accelerate to approach speed before manoeuvring.
- Always plan to land straight ahead unless too high to make a safe descent, then consider 180° turn to land downwind or teardrop turn, unless high enough (500'+) or winds too strong, then make a circling approach to land into wind.
- Be prepared for loss of winch power and maintain airspeed by quickly lowering nose and release.
- Release cable if launch interrupted.
- Sensible minimum speeds for the winch launch would be 50 kts for AS-K13 and Blanik types, and 55 kts for glass two-seaters such as ASK-21, Puchacz, Grob 103 Acro, etc. Higher minimums are

required for higher wing loading glass gliders, such as Discus with water ballast really needs 60 kts minimum.

- Multiple launch cables available should have parachutes removed if not in use at launch point.

Discuss SOAR (revisit again and explain)
- SOAR risk assessment and Pilot Decision Making [FTSC] & P^3 (Perceive, Plan, Perform)[FAA]

Situation - What just happened?
What is happening now?
What is going to happen next?
Factors: Pilot, Aircraft, enVironment, External

Options – Consequences, Alternatives, Reality, External factors

Action –: Eliminate risk, Accept it, Mitigate it, Transfer it,

Re-assess the situation.

<u>Human Factors</u>

- Some Illusions:

- fixation: you will fly towards where you look so don't focus on obstacles on the approach or ground but the path that you want to fly.
- Lack of horizon on take-off or landing may be a factor. Use frame of references to tow plane position explained before and for landing more attention to airspeed to confirm attitude.
- Blind spots part of eyesight limitations. Do not fixate vision on reference point or a single point but look at different points in approach area and mostly at far end of runway after rotation.

- Instrument scan

- During the approach, the pilot will have to monitor the airspeed more closely (every 2-3 seconds). Normally you will be looking over the nose to the horizon in the circuit and then over the nose to the reference point in the landing area during the approach. The panel scan is usually left to right and down if necessary.
- In the panel scan you then check the wings are level (top of panel to horizon) or at the desired bank angle, air speed is correct for approach, VSI (normal descent rate), then if yaw string is correct, and back over the nose to the horizon. Making control corrections as required. Do not fixate on an instrument. Looking out is most important. Before the Low Key point is reached check altimeter height is appropriate (500'-600'agl).
- On approach about every 10 seconds also check left and right, above and below to maintain situational awareness of traffic and possible collisions, obstacles and visual reference to altitude by judging height AGL (more important than altimeter once past Low Key point).

- Avoid collisions by maneuvering, avoid conflicts by communicating, avoid distractions by disciplining your task management.

Note

- Approach speed ($V_{approach}$) in aviation is being referred to as Defined Minimum Maneuvering Speed or DMMS.

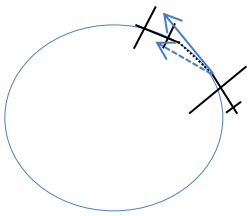
Stage 7 – Practice Takeoff and Tow/Winch launch, Turns; Lookout, Straight Flight; Stalls, Approach and Landing (from high Final Turn), Thermalling

Review: Describe how you would land the glider (phases)?

Ref: Chap 3 pp 60

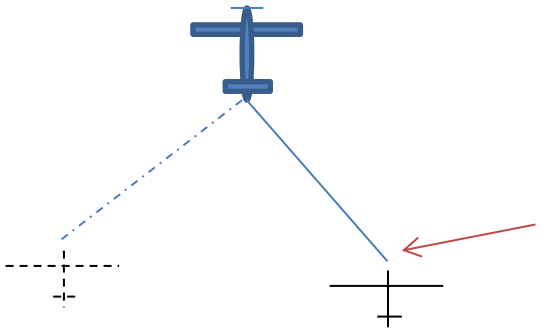
Aerotow turns (practice)

- Glider pilot should see inside of tow plane slightly when pointing at outside wing tip of tow plane.



- A Dutch roll can start if glider pilot does not react positively to control glider. Glider drifts to one side and tension increases on tow rope yawing nose towards tow plane. Yaw action rolls glider towards opposite direction of drift (towards tow plane). If not corrected immediately by leveling wings and using opposite aileron to resist the roll, the glider will turn towards opposite side of tow plane until rope tension yaws glider again in the opposite direction and roll will be more aggressive with each swing back and forth. Usually after 2-3 swings control is lost, tow plane releases glider, or rope breaks.

Top view



If glider pilot does not keep wings level, tension from tow rope will yaw glider and roll it towards tow plane on its own.

- Pressure on controls during tow rather than large control movements when corrections need to be small. When low or high on tow, a correction needs to be made very slowly, by controlling the pressure on the control stick for pitch attitude. A large control movement can lead to tow upset or over corrections and PIO. When high on the tow plane lowering the nose quickly can cause glider to accelerate and cause slack rope.

- Always stabilize the glider in pitch or roll to level flight before correcting back into position. This will help with over controlling.

- If the tugs tail is pulled laterally quickly it is possible to stall the rudder and upset the tow plane. The pilot will likely release the glider.

Turns practice

- You will be asked to practice flying straight to reference points and compass headings or cardinal points.

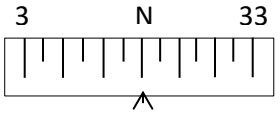
- Roll out of your bank 5-10 degrees before the actual heading when turning northerly. Then roll out 5 - 10 degrees after heading when turning southerly.

- Once established on heading pick a reference point if possible. This allows you to concentrate outside the cockpit.

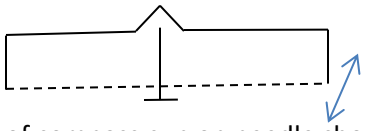
Compass

- Numbers on aviation compass are every 30 degrees with 10 degree indications (large) and 5 degree indications (small)

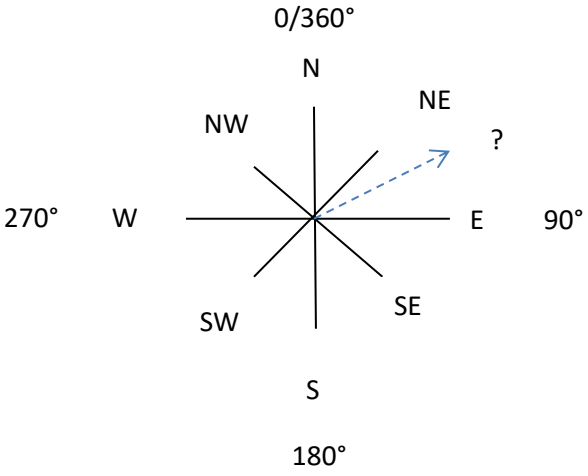
- Compass has turning errors in northern hemisphere due to magnetic poles so there is a lag turning south and a lead turning north. Acceleration and deceleration cause turning errors also. Wait until compass settles for an accurate heading.

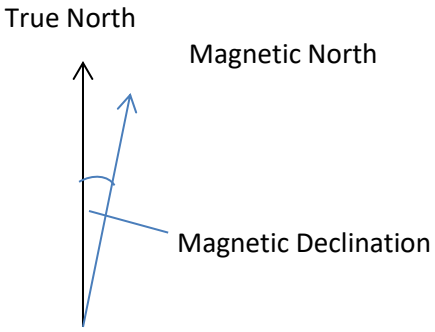


Compass row



Side view of compass cup on needle showing tilt

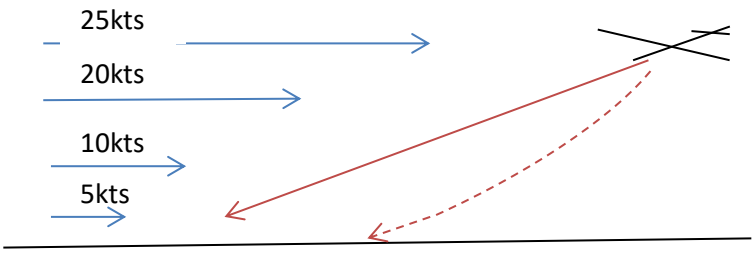




Landing and wind gradients

- The wind causes the air to move over the surface and friction causes the lower levels of air to move slower. This creates a wind gradient in the last 100' agl.

- When the glider descends through the gradient the relatively sudden change in wind speed can lower the gliders airspeed and potentially stall the glider or reduce the lift creating an undershoot situation. This is due to a difference between ground speed (momentum or inertia) vs air speed over the wings. A glider does not accelerate quickly and a quick drop in head wind speed results in lower air speed over the wings. To counter this, add more speed for high wind conditions and monitor airspeed and adjust as needed. Example below wind speed reduces 20 kts and if glider was flying at 45 kts the pilot may find themselves at 25kts and below the 1 g stall speed. If not stalled the glider would likely undershoot.



Safety

- Look out on take off/aerotow/landing higher risk near circuit area.

- Higher risk of collision when thermalling than straight and level. Circling gliders attract other gliders especially at lower altitudes when a climb is most needed. Good look out. Cloud streets and cumulus clouds may have gliders under them.

- Review parachute use. How to DI and use a parachute.

- CALL check must be completed before stall exercises.

Human Factors

- We are prone to other optical illusions when landing on runways we are not familiar with:

- Down sloping runway results in risk of high approach (also down sloping or elevated terrain on approach)
- Up sloping results in risk of low approach (also up sloping terrain or lower terrain on approach)
- Smaller or larger runways with same length to width ratio than what you are used to can affect a lower or higher approach depending on whether you perceive the runway closer or farther.

Also, you may perceive a small runway as further below you and flare later with a possible hard landing.

- Runways with different Length to width ratios can also cause a high approach if the runway is wider and shorter or a too low approach if the runway is narrow and longer.

- Distractions during the approach and landing can take you attention away from the critical task. Like focusing on another aspect, discipline yourself to the primary task of flying the glider and maintaining situational awareness until the aircraft stops. A sterile cockpit principle can help avoid distractions, stow loose gear well before the landing phase, complete checklist items early, minimize discussion not relevant to the flight, and defer noncritical tasks until after you have landed.

- Seating positions have had a significant effect on take-off and landings. Seating too far back has affected ability to get stick forward or operate air brakes properly, too low effects visibility over the nose for the landing and aerotow, and too close can prevent the arm from being able to rest on the lap and lead to PIO in take-off or landing phase. The control stick should be moved with mostly a wrist action and not the full arm movement when only a few feet above the ground. Sort out your seating position well before your flight with your instructor and beware of soft cushions being compressed and effecting your ability to move controls adequately!

- Ballast changes from flight to flight will affect the glider and the distance the control stick will move forward and backward to change the pitch angle. Lighter nose ballast will make glider more pitch sensitive. Consider adding more ballast on first solo to compensate for less weight of instructor.

Stage 8 - Steep Turns & Advanced Thermalling, Demo Circuit Planning, Practice Approach and Landing

Review: Explain the takeoff sequence/steps and how to maneuver behind the tow plane (station keeping)?

Ref: SOAR Chap 3 pp 47

Steep Turns (use model to demonstrate)

- Steep turns are banked angles greater than 45° to 60° of bank. Bank angles beyond this angle are not practical as there is not enough lift component. (See diagram). Steep turns can be used when the thermals are narrow, or in maneuvers where a tight turn is required. Caveat is that your stall speed is higher due to wing loading, and it is easier to stall abruptly as indicators happen much faster.

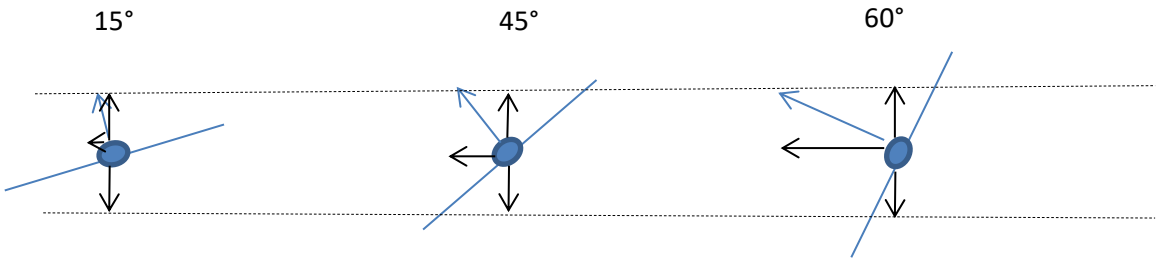
- Steep turns have more component turning the glider than providing lift so as the glider is banked more back pressure must be added to prevent the nose dropping or the glider will likely roll into a spiral dive.

- Three parts of turn same as medium turns except that the nose must be lowered, and glider accelerated beyond 2 g stall speed (usually 50 kts for most trainers).

- The rate of turn will be higher and more trim or back pressure is required. Trimming should be done to stay in the turn.

- A good turn is earmarked by a **smooth sweeping of the nose across the horizon** at a steady rate. Slowing or speeding up of the sweep will be due to poor elevator control.

- A brisk roll rate combined with ample rudder to coordinate the entry and exit is required while adding back pressure on the stick. Conversely when you roll out the back pressure must be smoothly reduced, or substantial forward pressure is needed if glider was trimmed in the turn.



	15°	45°	60°
	1.05 g	1.4 g	2g
Increase in stall speed	10%	20%	40%

- Lift component required to compensate for weight component remains the same throughout but when glider increases bank angle the total lift becomes greater, and the turn component increases (vector diagram). Note at 45° the lift and turn component are equal but greater than 45° the turn component is greater. In fact, the lift component is twice (2g) what is required in level flight.

Advanced thermalling

- Build a mental model of your thermal, feel accelerations of lift vs your VSI and anticipate when you must turn. Areas of lift several thermals joined it may be better to dolphin fly without circling and smaller heading changes to work air mass rising slowing in lift and speeding up in sink.

- It is critical to have consistent turns to map out thermals. Optimum bank is 45° and 50 Kts (or best L/D speed). Minimum sink would seem more logical but extra speed allows better control of glider for turbulence associated with thermals. (See Advanced Soaring Made Easy)

- Thermal heights will indicate distance between thermals in each area. If the thermals are higher, they will be further apart. Distance is 2-3 x convective height. Inversions will cap off thermals.

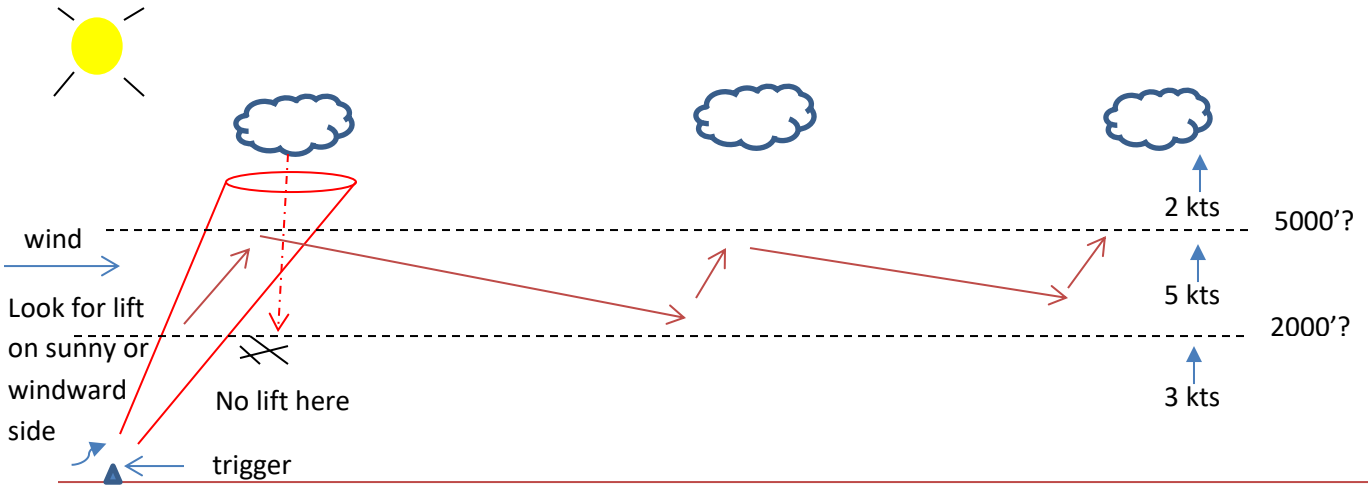
- Thermals will also have a working operating band where the strength of the thermal is optimal. At the lower part of the band the lift is weak and difficult to center as the thermal is less organized. Up higher at the top of the band useful lift start to decrease and not optimal. Trial and error are most often used to determine this operating band, but a rule of thumb is to use the middle 1/3.

- Banking up to 60° may be needed to core a thermal where lift is stronger. Below 1000' agl this can be difficult and dangerous. Lift is more spread out and not consolidated enough and thermal is gustier, less dependable. Sudden direction changes in air movement can stall a wing.

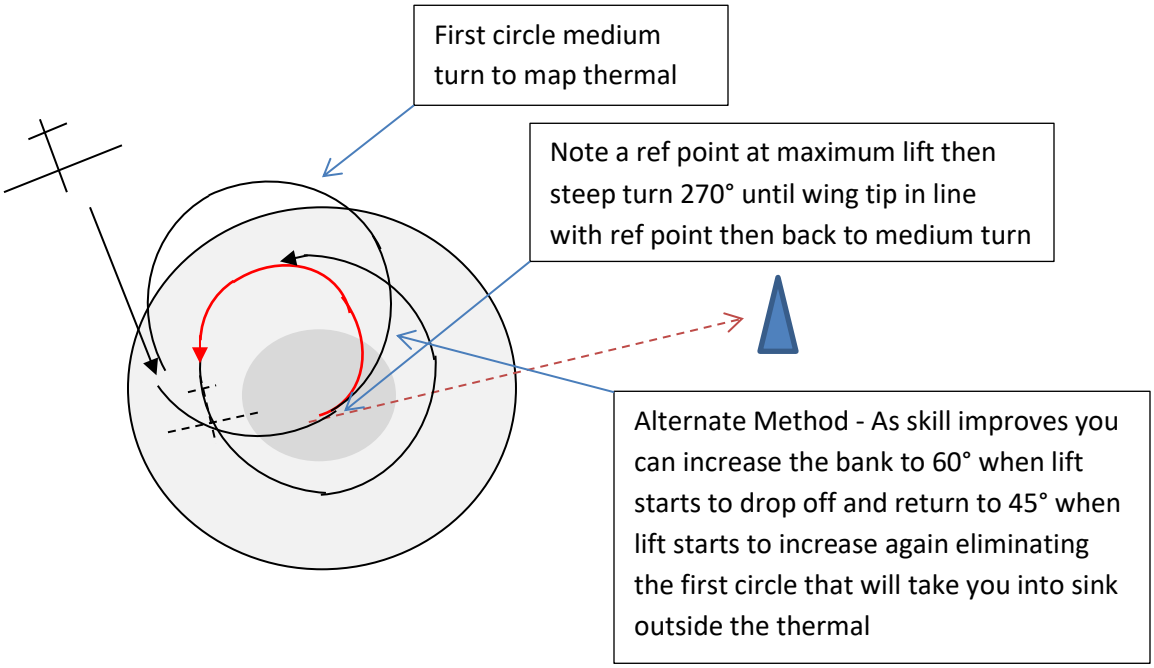
- Try to visualize tilt in thermals due to wind at various height bands. Wind will affect the glider more and tend to blow you downwind of thermal, so if you fall out of lift look for it upwind. Thermals have about a 20-minute cycle as they draw cool air into the bottom. The column of rising air will continue after each cycle but gliders arriving below the column may not find the lift until the air near the surface warms again.

- Turn radius is greater at higher altitudes due to thinner air, caution over high-altitude terrain.

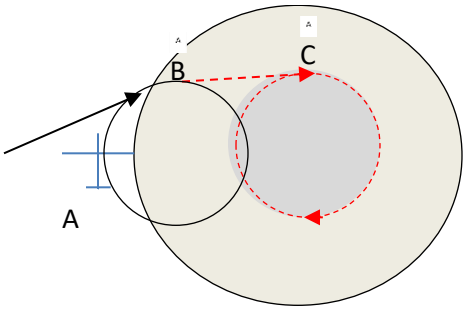
- If too much lag in instruments (VSI) use ref point off nose on horizon when indicating maximum lift and when making second turn level off for a second when inside wing points at reference point instead of nose.



- This technique uses steep turns for approximately ¾ of a full circle. First circle is at medium bank when the glider flies through the strongest lift pick a reference point ahead and increase bank to steep turn. Continue for about 270° until reference point lines up with lower wing tip then resume medium bank angle. Repeat until thermal is centered. Mixing previous technique with this technique may prove more successful.



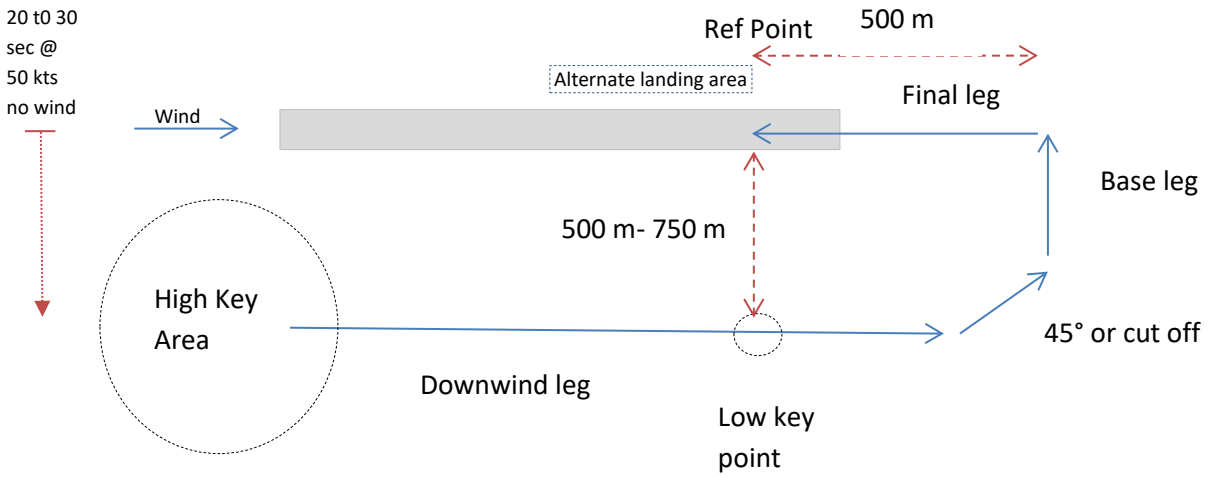
- Worst heading method – At A glider is in highest sink and notes “worst” heading and continues for ¼ turn (90°) then levels out at B for 1-2 seconds and as lift increases at C banks at medium turn again. Similar to basic centering technique in stage 5.



Circuit Planning

- 3 major components a down wind, base leg, and final. Standard circuit is left hand turns, Right hand circuit right turns.

Distance/altitude method (build the diagram on a white board starting with legs, then keys, followed by distances, then goals)



4

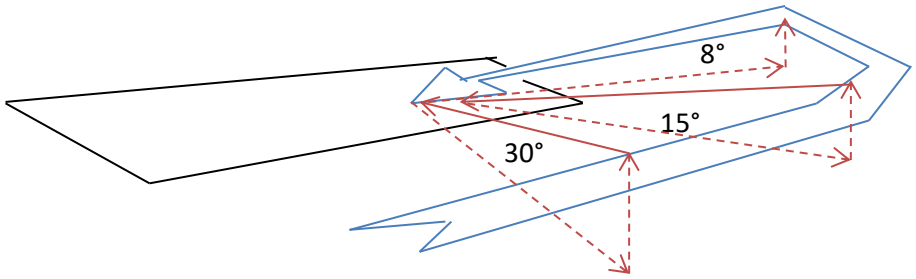
- 500m is about ½ runway length. Low key point is abeam the reference point ½ to one runway length. The cut of or 45° offset should be established before pilot loses sight of the reference point.

- Goal 1 is to depart the high key at 800' agl; and Goal 2 is to depart the low-key point at 500-600' agl; and Goal 3 is the turn to final at 300' agl. Altimeter should be set to airfield elevation or altimeter setting for aerodrome if one is broadcasted.

Distance/Angle Method

- It can be difficult landing off field on terrain where the elevation is not known accurately. By judging the angles from the glider to the field you can estimate the height provided you can estimate the distances fairly accurately.

- Judge angle from horizon down to reference point. Base of triangle 500m or ½ runway length.



Safety

- Steep turns require the nose to be lowered and confirming you are above the 2g stall speed. Banking below this speed can lead to stall and or spin. Maintaining the correct approach speed will help to prevent stall/spin, wind gradient effects and wind shear effects. Increasing G load by increasing AoA in the turn can also cause a stall.

- When thermalling increasing bank angle to steep turns must be done with correct airspeed margin.

- Look out is required in circuit so eyes must be out of the cockpit (sterile cockpit helps). Most mid-air collisions occur at circuit height.

- Caution, if fully trimmed in steep turns for thermals it is easier to pull back too much to tighten turn and stall.

Human Factors

- Illusions closer to ground. Without the base leg offset the pilot's perspective to the reference point will have a decreasing aspect ratio until the base leg where the aspect ratio will increase until air brakes are opened.

- The offset angle on base keeps the aspect ratio more evenly decreasing until established on final. In addition, pilots have lost visual reference to the reference point on downwind particularly during off field landings and have not been able to re-acquire the reference point after turning base leading to landing accidents.

- There is a tendency to not to want to be too far from runway and crowd your circuit. This is especially prevalent in first off field landings. Maintaining proper distances will allow you to adjust the circuit downwind and base legs being critical for wind conditions.

Stage 9 - Demo and Practice Collision Avoidance, Flying the Circuit (normal Final Turn Height); Use of Radio

Review: What are the elements of planning the circuit? And angles?

Ref: SOAR Chap 3 pp 49-60

Collision avoidance (use model to demo)

- Aircraft at same altitude but not appearing to move but getting larger are on collision course with you. Action must be immediate as you will have no time once it grows rapidly in size (blossom effect).

- Basic rules of the air CARs is that all pilots must take action to avoid a collision and give way to aircraft that are in an emergency.

- Aircraft approaching approximately at the same altitude from the right have right of way, and aircraft are to alter course to the right to avoid a conflict. (Fastest way to get separation is descending. A good look out is required to detect a threat, then ensure the turn is clear as you start to initiate the bank, then look underneath the gliders altered path that it will also be clear below).

- Aircraft under power give way to airships, gliders and balloons. Airships give way to gliders and balloons. Gliders, who give way to balloons. (Note glider pilot should not use this rule to force aircraft under power to maneuver unnecessarily). Aircraft giving way shall not pass over, under, or cross ahead of the other aircraft. Overtaking aircraft must stay clear of overtaken aircraft.

- Powered aircraft are to give way to other powered aircraft towing gliders or other objects including slung loads.

- Aircraft landing is to give way to aircraft below them landing. Aircraft landing have right of way over aircraft on the surface maneuvering for takeoff. Aircraft in the circuit have the right of way over aircraft entering the circuit.

- The circuit area is high risk so watch for traffic in critical areas (see below flying the circuit). Most risk is of a glider behind and above you are descending or vice versa. Caution on long glides, bank and look below occasionally and above. Along cloud streets, around and on ridges, over taking another aircraft, and thermals are higher risk.

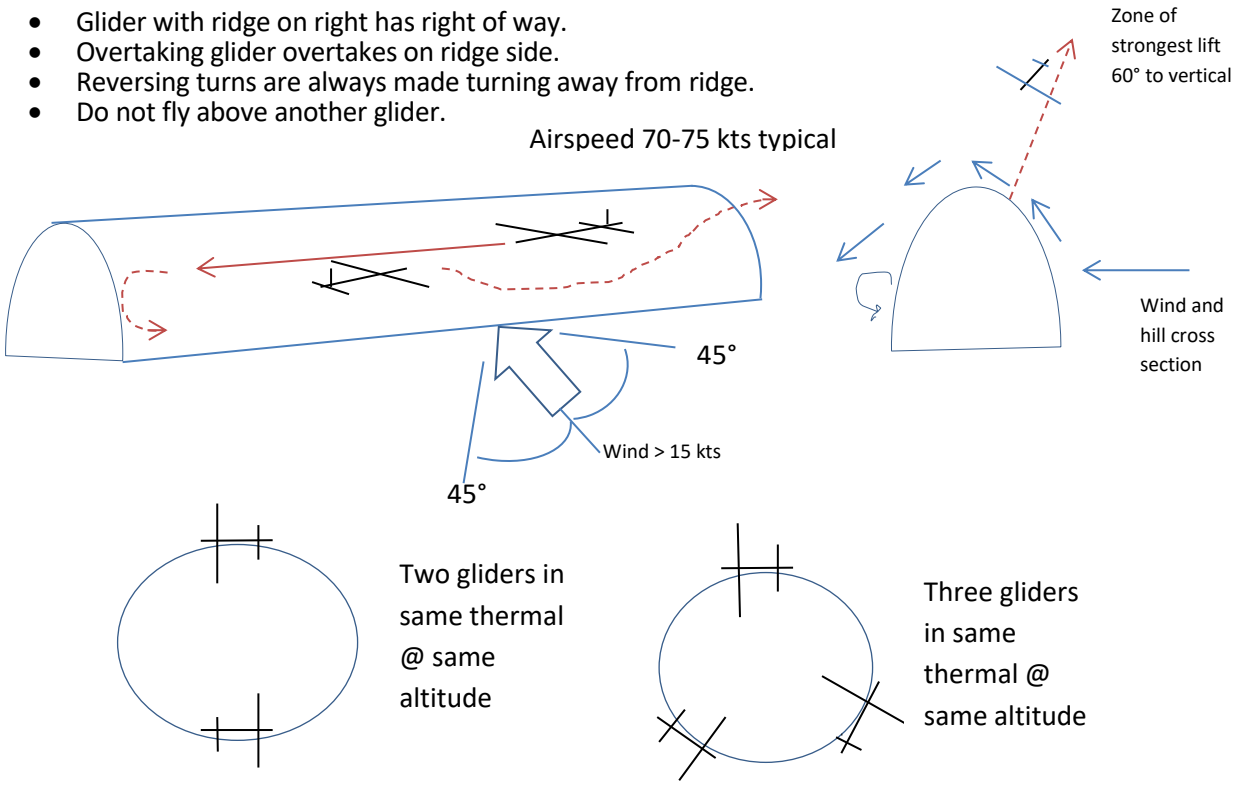
- in thermals the etiquette is that gliders established in the thermal should be given right of way, direction of turn is established by first glider in the thermal and joining gliders should turn in same direction. Water ballast should not be dumped in thermals on other gliders. Joining should be don at lower or higher altitude than glider in the thermal but caution as there will be sink approaching the thermal.

- If two gliders at same altitude, stagger on opposite sides of thermal and if three space 1/3 apart. If you lose sight of other gliders at same altitude in thermal leave the thermal immediately.

- If PowerFLARM equipped, FLARM drills etiquette should be reviewed below in SAFETY section.

Ridge / Slope flying Rules (etiquette):

- Glider with ridge on right has right of way.
- Overtaking glider overtakes on ridge side.
- Reversing turns are always made turning away from ridge.
- Do not fly above another glider.



Flying the circuit (see diagram and build for student one step at a time)

- Now that you have mastered planning the circuit, this is how you fly the circuit.

- A: Approach to the circuit is normally made from the up wind of the aerodrome at about 1000’ agl or from the inactive side of the runway in a crosswind leg at mid field. A good look out for other traffic at these entry points is required including checking for aircraft in a right-hand circuit. Look for the windsock to get direction and speed to calculate your approach speed. Confirm your circuit plan for the wind direction. If you can identify potential obstacles, reference point and alternate landing area plan to confirm on downwind again.

- B: Fly at best L/D and get the pre landing checks completed before entering the high key so you can concentrate on traffic lookout and proper positioning. Crab for wind drift so you pattern is correct and use a point on the horizon to fly towards on your downwind, otherwise you will likely “crowd the circuit” by flying on an angle towards the runway centerline.

- C: Plan to leave the high key area at 800’ agl. If you are too high losing the height well before you enter the high key (no circling in the circuit area). Make your downwind traffic call on the radio (E.G. Big Sport traffic, glider XYZ is left downwind runway 25) as you leave the High Key.

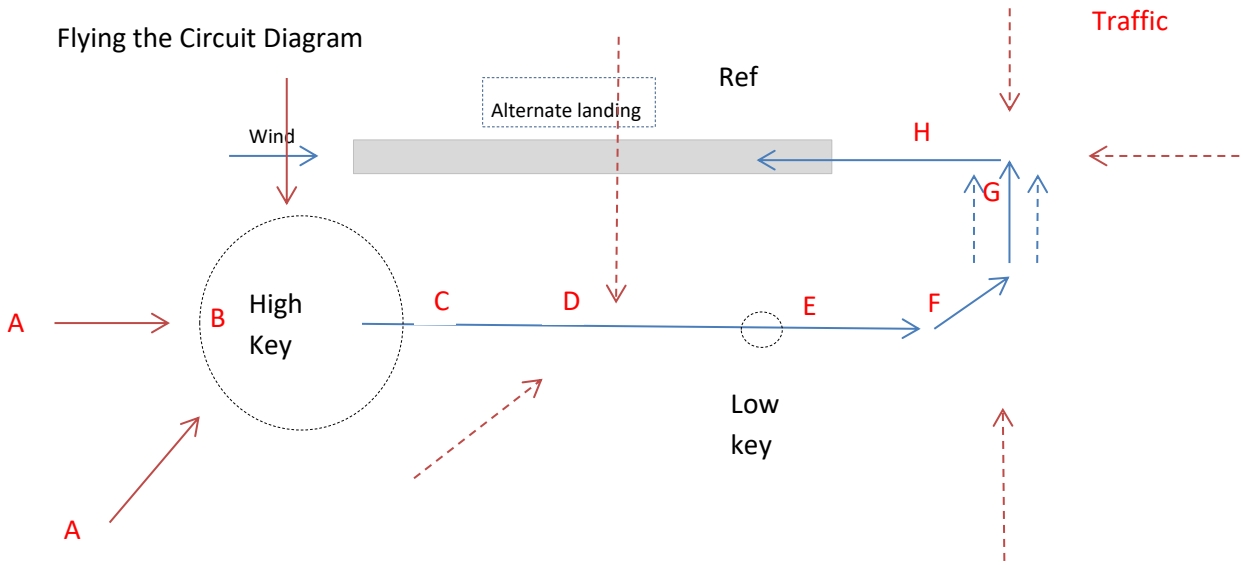
- D: Check mid field for a cross wind join by other aircraft (be prepared for aircraft not on radio). Control rate of decent so you reach the Low Key point at 500-600' agl abeam the reference point. Have a look below the gilders path for traffic lower in the circuit (slight S-turns may help). Confirm your reference point, alternate landing area, obstacles on approach or field, and check the windsock to confirm the direction and speed.

- E: At the Low Key point, accelerate to your calculated approach speed (review with student), start to check airspeed more frequently every 2-3 seconds. Keep flying towards a reference point on the horizon you had selected at the High Key (crabbing as necessary for cross winds) but do not lose sight of the landing Reference Point.

- F: The landing Reference point will become difficult to see as it moves under you inside wing, start a slight turn towards the base leg but not more than 45° (based on no wind). As you approach the point for your turn to base (judge 500 m downwind from landing Reference Point or ½ runway length) commence your turn for base leg. These turns on the cut off are also good opportunities to look below the gliders path. Have a good look out to clear your turns but do not lose sight of reference point. Turns in the circuit should be well banked as they are less likely to be skidded.

- G: As you approach the extended center line have a look downwind for approaching aircraft on a long final or approaching on a right base. Plan to turn slightly before the extended center line. If using airbrakes to reach the target height of goal #3, close them for the turn to final. If not using airbrake lower nose slightly to make well banked medium turn. Skidded turns can lead to stall/spin, keep yaw string straight. If too high extend downwind or angle base leg away from runway, if too low you have option to turn base leg sooner.

- H: On final check airspeed every 3-4 seconds, confirm no changes on the windsock, and the landing area and approach will clear obstacles. Be prepared to close the airbrakes and fly to your alternate landing area(s) if obstacle is on runway. Establish an overshoot and then open enough air brake to establish you glide slope.



Use of Radio basics (ref AIM) (show how to tune radio frequency, set squelch, adjust volume etc, operate mike)

- Radio calls should be made to inform traffic of your location at critical points. Some airports have Mandatory Frequency (MF) requirements other gliding clubs want minimal reports. Check Operations procedures. Radio is VHF and line of sight for the most part.

- First steps are to determine if you are on correct frequency then monitor so you do not transmit over another broadcast (step on). Plan what you want to say before you transmit.

- make sure the mike is close enough to your mouth and then press the transmit button on the control stick for a second or two before talking.

- Start by saying who you are calling, then who you are. A blind broad cast would be to "traffic" that might be listening to the aerodrome traffic frequency (ATF). Give your position by giving your distance in nautical miles and a cardinal point from the airport or navigation aid, your altitude (thousands and hundreds) feet, and your direction (PAD – position, altitude, direction or intensions). Do not use reference points that itinerant traffic may not be familiar with.

- E.G., a blind transmission could be "Any town traffic, glider ABC, 5 miles north at three thousand five hundred heading south".

-MF position reports are usually given when returning to the airfield to land when within 5 nm; when crossing midfield and/ or joining downwind (at C above); on final at (H above) and when clearing the active runway. At your field it is good to get in the habit of doing these reports although not mandatory. E.G. "Anytown traffic, glider ABC is left downwind three two". (Altitude and intention are understood).

- ATC will have different requirements and procedures as set out in the AIM. At some clubs they only want a downwind call. Phonetics are in accordance with reference.

- UNICOM frequency refers to Private Advisory Station such as 122.8 Mhz , 123.3 and 123.0 Mhz are the most common at uncontrolled airports (see VFR Supplement). RAC 1.2.1 AIM.

Safety

- A well banked turn in the circuit brings less chance of skidding and stalling high aspect ratio glider wings in the circuit. Well banked turns also give the opportunity to see below for collision avoidance. (Note power pilots may have difficulty initially as they are trained to make shallow banked rate one turns (15°).

- Closing air brakes before turn to final is a safety measure as their use raises the stall speed. As you gain experience holding minimum airspeed and fly faster approach speeds for windy conditions, closing may not be necessary if air speed is 10 kts over stall speed. (Note some gliders such as L-33 have stall speed increased by 9 kts when full airbrakes used)

- Get into the habit of selecting alternate landing area when planning and flying the circuit.

- Low final turns are dangerous as the outside glider wing is moving faster in stronger wind than the inside and it may be difficult to un-bank the glider in a wind gradient. (also in steep side slips to lose height)

- **FLARM DRILLS**:

1. Never assume FLARM gives the full situational awareness as other glider/aircraft may have their FLARM signal masked by carbon fibre in the aircraft, turned off, not functional, and/or not installed. Also never assume you are visible to other aircraft. Third glider trap!
2. In gaggle flying, as in any other mode of flying, keep a constant look out and avoid looking at the FLARM for separation information.
3. To maintain situational awareness, remember PowerFLARM is a tool/aide to help and does not replace the principle of "see and avoid", scanning techniques, radio position reporting on aerodrome traffic frequencies and 126.7 VFR enroute reporting frequency, and using a transponder in "Transponder Airspace" or near congested "controlled airspace". Try to find threats visually before your FLARM does.
4. FLARM displays a threat relative to gliders position (clock ray, 12 o'clock being straight ahead) and angle above/below or on the horizon based on your altitude. When the glider is banked the threat is still relative to the earth's horizon not to the horizontal plane of the banked glider.
5. Descending provides the most rapid separation from a same altitude conflict if no other traffic is below. Caution is needed if both FLARM equipped pilots descend. Visual contact should be established first if possible before maneuvering to maintain situational awareness. However, note that 85% of collisions occur from behind one of the gliders wings, often in decent or climb of at least one or both aircraft. Visual contact may be difficult.
6. If turning (right) away from a conflict aircraft, do not bank so much that you cannot maintain visual separation. Turning the belly of your aircraft to an imminent threat will put it in your blind spot and you cannot judge the separation. Do not underestimate how fast conflicts can close.
7. Transponders in gliders during gaggle flying will give many warning alarms due to proximity as FLARM is less accurate for mode C transponders (range is based on signal strength – this feature can be manually shut off on PowerFLARM). Reduce volume if too distracting, but do not shut off the FLARM unit. Increase volume when leaving the gaggle. In a gaggle, if visual contact cannot be made after an alarm and traffic above or below does not permit vertical separation, tightening the turn may help to reduce chance of impact for a threat closing behind you in the same turn direction, turning to the right may create a greater conflict in left turns.
8. Do not assume altimeter readouts are always 100% accurate although GPS altitude is used, and errors should be uniform for other nearby FLARM units. Pilots are noting on the FLARM readout that the altitude difference is absolute and assuming the separation is adequate and dismissing the fact that relative altimeter errors are possible with any device. Also, the heading of actual threat may differ from display as it is based on GPS track. (Professional pilots using expensive TCAS systems in airliners do not rely solely on the accuracy of their equipment; pilot flying follows TCAS and pilot not flying attempts visual confirmation if possible).
9. When a potential threat activates an "alert", note the location, direction/ altitude differences and start a sector scan in the area to find the threat. Do not ignore the rest of the airspace or your situational awareness as you search for the conflict. Other non- FLARM threats may be present and imminent.
10. When an "alarm" is given of a potential collision your eyes will be drawn to the FLARM device, quickly note the position and look out in the direction indicated in the device to avoid the

collision. If conflict is not seen make another quick glance to the PowerFLARM readout for location, then lookout in that sector again. Take appropriate collision avoidance action. As the alarm intensity increases, your current direction and speed is partly causing the conflict, so some change is required. If appropriate, start a descent and alter course slightly and keep looking out in the required sector - after checking quickly on the FLARM – alternating between sector and FLARM until the threat is gone. The FLARM display should be positioned in your normal field of view.

11. Do not deliberately create a FLARM alarm situation. It is discourteous to the other pilot unless previous agreement/radio contact has been made to fly towards another glider to create an alarm.
12. Do not touch antennae or let canopy touch as static discharge can damage circuits.

Human Factors

- Communication errors. Non-standard communications have led to misunderstanding. It is important to use standard aviation conventions for communication of numbers, altitudes, and positions. Pilot's minds are trained to receive information in standard packets and sequences. Follow these protocols. Keep transmissions brief and to the point, without unnecessary information. Idle chit chat has no place on ATFs. Switch briefly to 123.4 MHz for gliding discussions about lift, weather, x-country intensions, etc. unless this is the ATF.

- When position reporting, look down to the ground beside glider, so you know your position on the ground, not over the nose towards a point that may be several minutes away. Always refer positions to known points that pilots unfamiliar with the airport or area can identify such as towns, airports, navigation aids.

Stage 10 - Spiral Dives and Benign Spiral, Zigzag in Downwind exercise (optional)

Review: Close your eyes and visualize flying the circuit and describe actions you will take?

Spiral Dives and Recovery (demonstrate with model)

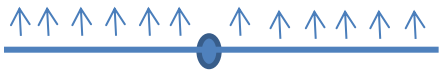
- spiral dives are dangerous if not corrected quickly as airspeed and g loading can build up (sometimes referred to as graveyard spiral in IFR flying) and it is possible to overstress the airframe. They are easily corrected and can be detected by an increase in airspeed vs stalled speed and rotation or quickly changing heading.

- Demonstration or practice is started from an overbanked turn at thermalling airspeed (45-50 kts) and letting the nose drop in the turn. As the bank exceeds 60° attempting to raise the nose by pulling back on the stick will only tighten the spiral and increase the airspeed and g loading. The stick may be against the back stop. Recover promptly before exceeding maneuvering speed Va.

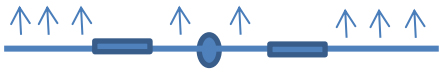
- **Recovery**. Relax the back pressure on the control stick and look up towards the horizon and level the wings with coordinated use of ailerons and rudder. Pull out of the dive smoothly (not jerking on the controls) and return to the normal gliding attitude.

- Spiral dive can also be entered from spin entry where elevator back pressure is relaxed after wing drop. Explained in spins next stage.

- Opening air brakes/spoilers can be speed limiting but not recommended in recovery. Lift on wing is disrupted by open air brakes thereby moving the lifting pressure primarily to the wing tips weakening the performance of the wing at higher g loads.



Lift distributed evenly with no air brakes



Reduced strength with airbrakes

Benign Spiral

- We can use the spiral to serve a purpose also. A benign spiral can be set up to allow the glider to circle and lose altitude under speed control by setting up a trimmed turn and allowing the further effect of bank to yaw the glider into a spiral.

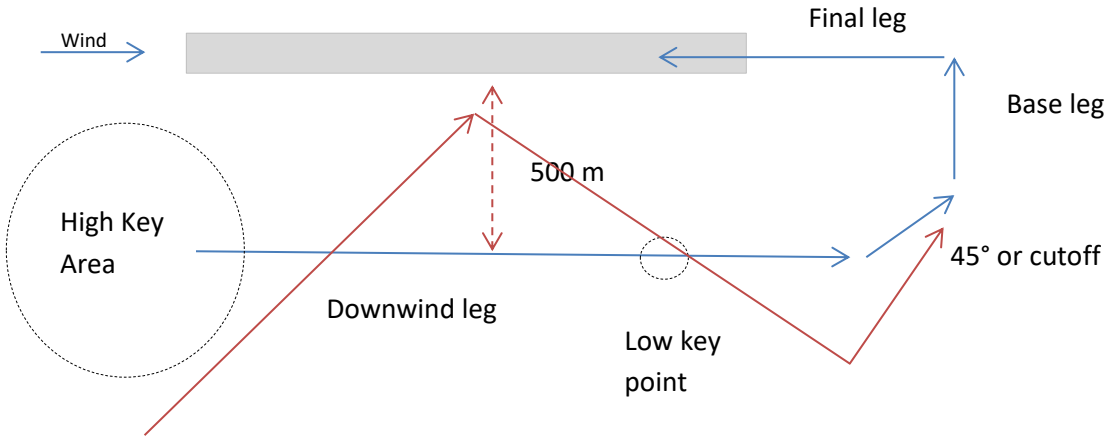
- benign spiral can be used in an emergency to lose height through cloud decks if trapped above or if loss of consciousness is anticipated due to hypoxia or medical emergency.

- Enter a gentle to medium turn (approximately 20° bank) and let a spiral develop by letting the nose drop slightly but hold the airspeed around 45-50 kts by trimming back. Remove feet and hands from the controls and let glider spiral. Adjust only the trim to hold speed once spiral stabilizes.

ZIG ZAG Circuit (optional circuit if student having difficult judging distance from field for downwind)

- Instructor will approach high key from a 45-degree angle upwind and ask student to identify when to turn on downwind leg. Student needs to judge 500m or ½ runway length from circuit height.

- if not correctly identified instructor will turn back 90 degrees towards low key and give student a second chance to identify distance. If not identified after passing low key instructor will establish glider on base leg an let student land.



Safety

- Parachutes are often worn for spiral or spin exercises. Recovery should be made by 2000' agl

- Hypoxia can occur at above 10, 000 ft without supplemental oxygen. In Canada flight to 13,000 ft is legal if less than 30 mins without oxygen. Above 10,000 ft if flight is over 30 min without oxygen. Hypoxia can occur at lower altitudes depending on health and smoking.

- Pull up at excessive speed must be done smoothly otherwise the aircraft can be damaged. It is better to pull 3-4 g at low airspeed than at higher airspeed when you get a greater change in attitude that will limit speed build up. Use the g meter in the aircraft if you have one.

Human Factors

- Some pilot experience anxiety with spirals and spin exercises. These are normal flight training exercises to build confidence and skill at handling the glider in an unusual attitude. Your instructor will show you how to do them safely. If you are apprehensive let your instructor know. They will limit the exercise and progress as you feel comfortable. As a competent pilot you will eventually feel comfortable with all these exercises. Using the simulator is a good way to build confidence before the air exercises.

Stage 11 - Boxing the Slipstream; Low Tow; High Tow, Further Stalling exercises (Climbing, Descending and in a Turn)

Review: Describe how you would recognize a spiral dive and recover? Why is prompt action?

Ref: no SOAR manual content

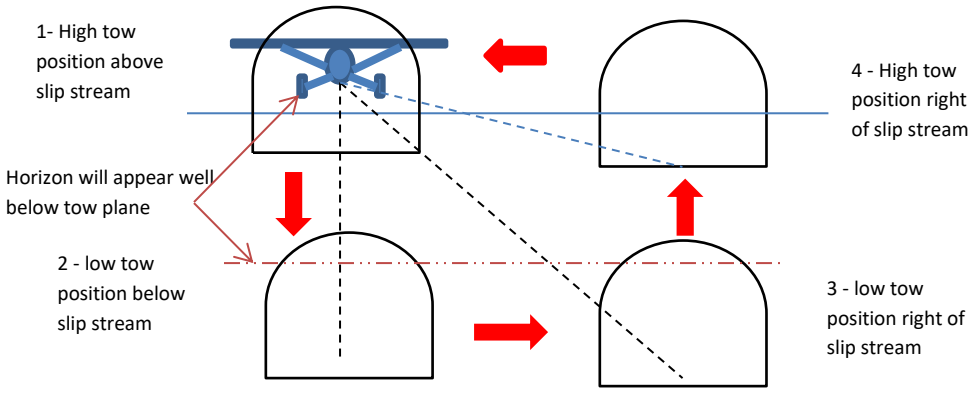
Boxing the slip stream (use model to demonstrate with tow plane drawn on white board)

- This is a coordination exercise to practice /demonstrate control and identify low and high tow positions. You will use this control later in executing emergency signal “glider cannot release”.

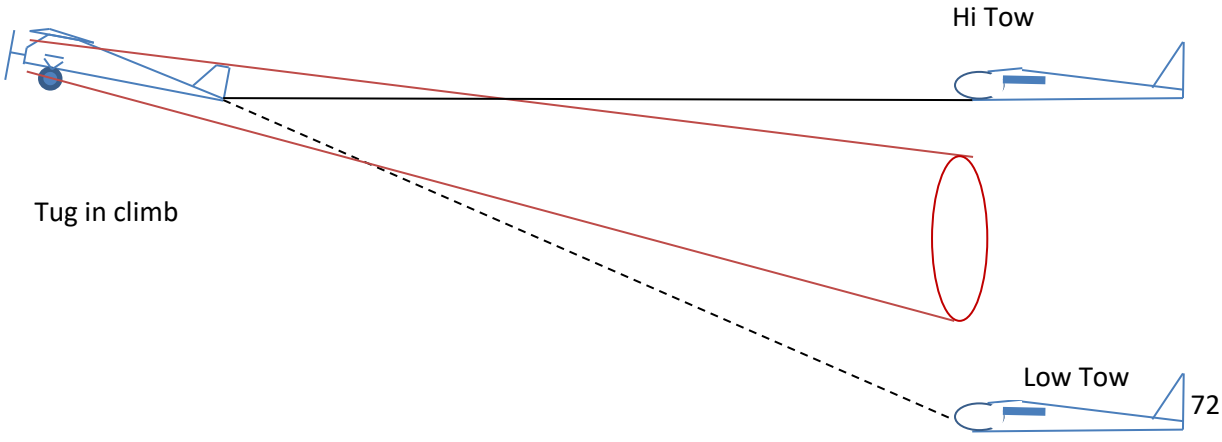
- High tow position is the normal tow position above the slipstream (tow plane wheels appear above the horizon). In the low tow position below the slipstream the wheels will appear well above the horizon.

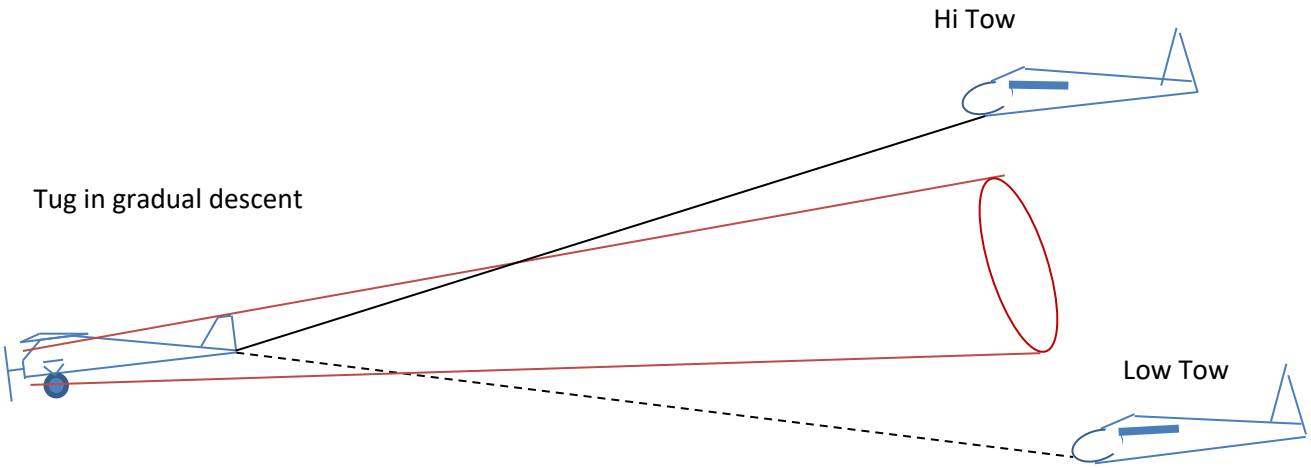
- Glider is lowered through slip stream slowly until in clear air below slipstream at (2), stop and stabilize glider. Bank slightly to right coordinated with rudder and stop stabilized at (3). Right rudder will be required to counter yawing force of tow rope on nose. Raise nose slowly to go back to high tow position at (4). You must clear the glider wing tip from the slipstream turbulence (see 4 th diagram below). Maintain right rudder force to prevent yaw to left. Once stabilized slowly bank towards the tow plane and relax rudder pressure to coordinate turn back to high tow position behind tug at (1). Exercise can be repeated on left side of tug to fully box wake.

After learning sideslips this exercise can be repeated using sideslips.

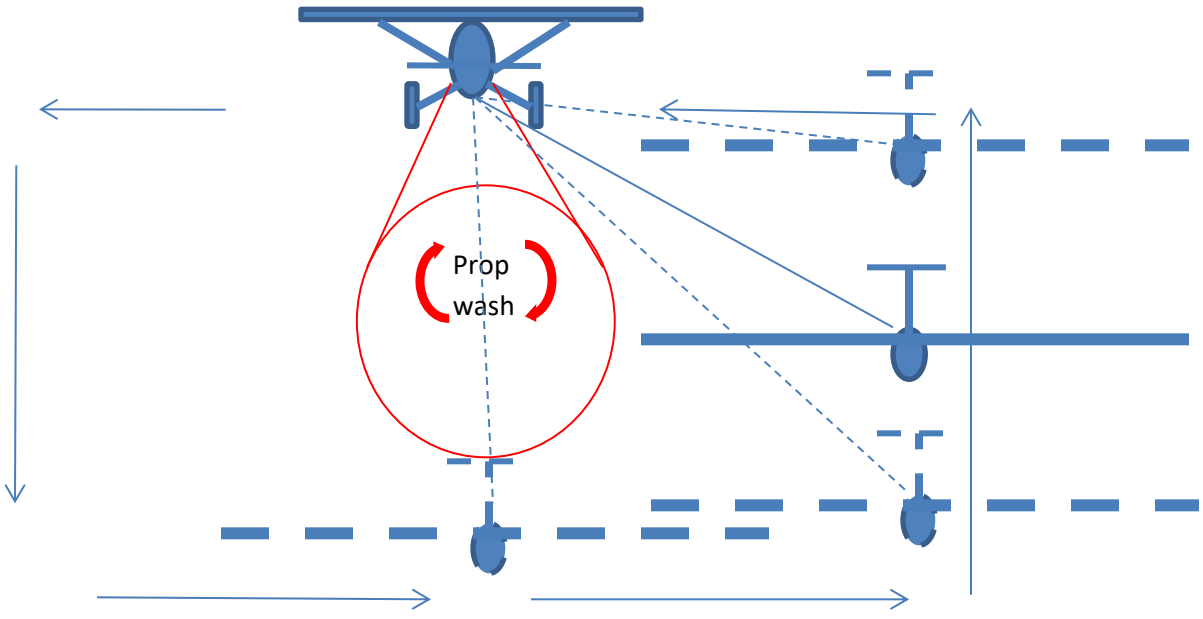


- [see below] position of slipstream changes whether the tow plane is climbing, level or descending. Low tow position is used for descending on tow or for long cross-country flights where it is less likely to get slack in tow rope from turbulence or thermic conditions.





Glider wing must clear propeller wash



Stalls In turns (climbing or descending in turns)

- Review stalls and recovery procedures. In turns one wing will likely drop before the other due to differences in angle of attack to relative wind caused by outside wing moving faster than inside wing.

Rudder position at the stall will also increase this effect. Prompt recovery as per wing drop stall in stage 4 (page 20). Failure to recover promptly may lead to spin as explained later stage.

Safety

- Before box the wake exercise, inform the tow pilot, otherwise the tow pilot may assume glider is in difficulty and release from tow plane end. If control is lost or tow plane goes out of site, release immediately.

- Do not make the box the wake exercise one continuous motion as this increases your chances of difficulty. Purpose of exercise is to demonstrate control.

- If tow plane is descending on tow rapidly and glider is in high tow position it will be difficult not to get slack rope as glider will accelerate towards tow plane as glider will be much higher position to keep clear of slipstream. Low tow position is safer and more manageable if tug is descending.

- CALL check before stalls and importance of maintaining a good look out. Always plan for enough height to return to field if an inadvertent spin should occur.

Human Factors

- Illusions created by the position of the tow plane relative to the horizon in low tow on descent may confuse you with where the tow plane slip stream will be compared to a normal high tow position in a climb. You will have to move the glider up slowly to find the slipstream if descending on tow. This position may appear similar to high tow (tug wheels on horizon) if the tug is descending fairly rapidly.

Stage 12 - Rope/Cable Break Recovery Technique at altitude & Effect of Angle of Bank on Stall Speed

Review: Describe how to execute the boxing the wake exercise?

Ref: SOAR Chap 3 pp 75-78

Rope /cable Break Recovery (Demonstrate with model)

- The critical factor is allowing the glider to recover to the approach speed before maneuvering. Attempting a turn after without sufficient airspeed can lead to a stall/spin. The air exercise is to demonstrate the time it will take to accelerate to maneuvering speed and the altitude lost to complete a 180-degree turn. This exercise is demonstrated then practiced by student at a safe altitude.

- After the release at a safe altitude and when the tow plane has cleared the area, the glider will be maintained in a simulated tow attitude with nose above horizon. The instructor will give the cue to recover after a typical student delay on a rope break where it is a pre stall indicator that usually prompts student action. Instructor will ask you to note the altitude on the altimeter and count the number of seconds it takes to accelerate to approach speed (Vapproach or DMMS). Approach speed is used because in a low-level recovery below 500' agl the glider may be susceptible to wind gradients or wind shears. (See stage 6 for approach speed rational)

- When the instructor says "recover" they will demonstrate the recovery by lowering the nose below the normal gliding attitude to recovery attitude (- 25-30°) to accelerate the glider and ask you to count the number of seconds to accelerate to approach speed (depending on wind and glider this may take several seconds). When reaching Vapproach the attitude will be reduced to the new attitude to hold this speed.

- Once glider is at Vapproach and it has been determined there are no suitable options to land ahead and sufficient altitude remains for a return to the field a well banked medium turn is executed to return to the field. After completing 180 degrees turn to the runway reciprocal the wings will be leveled and the instructor will ask for the new altitude.

- The difference between the start and finish altitude is the minimum height required for the worst-case scenario for a return to the field behind you (often your first real rope break).

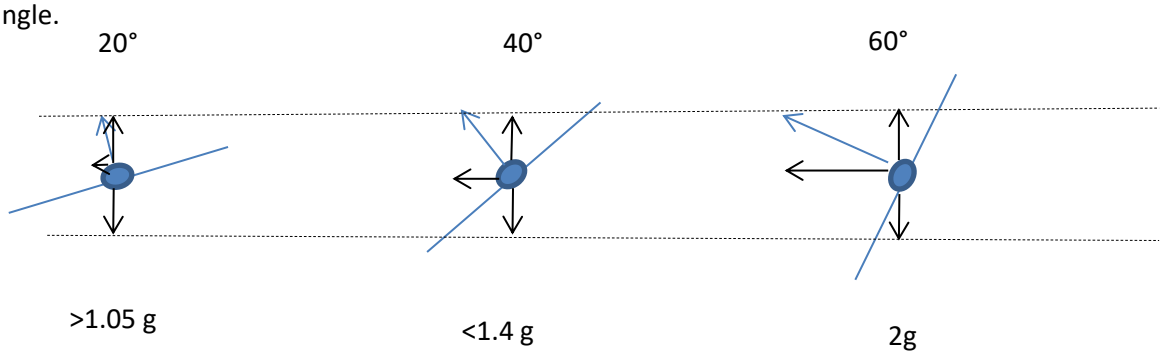
- If winch is being used this exercise can be repeated for simulated winch launch failures with a pull up to 35-40° nose up winch angle.

Effect of Angle of Bank on Stall Speed (use model to demonstrate)

- Purpose of this demonstration is to show student that increase in stall speed is affected by the angle of bank.

- Instructor will demonstrate the 1 g stall wings level just to the point of pre-stall buffeting and will not actually stall glider. Student asked to note stall speed.

- Instructor will repeat pre stall buffeting for bank angles of 20°, 40°, 60° and ask student to note airspeed for the pre-stall buffeting. Student will be asked for conclusions about airspeed vs bank angle.



Safety

- From this exercise you have seen that with a typical delay the glider will lose several hundreds of feet in altitude and the acceleration to maneuvering speed takes several seconds in the worst-case scenario.

- In reduced "G" when lowering the nose in a rope/cable break it reduces the glider stall speed and the glider may seem it is flying, but as soon as a turn is attempted without accelerating or the nose is raised the glider will increase g loading and will be below the stall speed.

- If a rope break occurs at low altitude the best option is to land straight ahead or slightly left or right to avoid obstacles. Actual rope breaks will be practiced in later stages. These heights will be different for various types of aircraft based on their glide ratios and drag. All pilots need to know these numbers including power pilots for the different aircraft you fly. As your skills progress and your ability to recognize airspeed and manage energy improve, you will be able to adjust this altitude for the types of aircraft you fly and wind conditions. But it is always best to know what the worst-case scenario is so you can plan safety margins for contingencies.

- For the bank angle exercise, you should see that it is necessary to lower the nose before increasing bank angle and that for steep turns you must accelerate above the 2g stall speed before banking. If adding back pressure in a banked turn and exceeding the 2g it is possible to induce a high g stall. This is often forgotten for some reason for cable breaks. See below HF.

Human Factors

- Typically, the first time you have an unexpected rope break you will likely take a few seconds to realize what has happened and in disbelief it will likely be the approaching stall that triggers you into action. The glider will be at a critical slow airspeed. Many accidents have resulted for turns at too slow an airspeed as bank angle effects stall speed. Often, we tend to plan on our optimal performance and optimistic outlook on our piloting skills but the reality from accidents statistics is that we should apply ample safety margins for performing at our worst. Always plan to land straight ahead in an emergency if there is an option to do so safely. Indecisiveness (no plan of action before takeoff) reduces safe options and promotes riskier alternatives.

- Pilots can be affected by heart rate increases in emergencies (adrenaline) and this may affect their ability to recognize their situation adequately. Typically, there can be a strong desire to turn back to the field in low level emergencies and the pilot may not realize low airspeed and be aggressive on pulling back on the stick to tighten the turn leading to stall/spin below recovery height.

Stage 13 - Slack Rope on Aerotow; Rope/Cable Break Recovery practice at altitude, Side slipping at altitude exercises, Abbreviated Circuit

Review: describe the recovery procedure for a rope break? Why is this so important in a winch launch?

Ref: SOAR Chap 3 & 4 pp 78-91

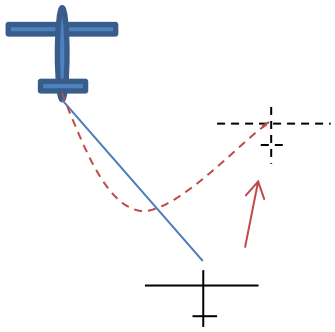
Slack Rope Recovery –lateral (show with model and string)

- If too much of a swing out is allowed or turbulence can cause some slack in rope to occur. The glider can be yawed away from the tow plane with rudder to create more drag and slow the glider eliminating the slack. When the slack is gone and glider is not accelerated, correct back into position behind the tow plane with a coordinated turn towards the tow plane then level wings again.

- If not corrected soon enough too much slack could develop and go behind glider wing. A turn towards the tow plane before slack is removed could cause rope to wrap around glider wing! Release if this happens!

- airbrakes can be used cautiously (tendency to suck full open) to remove slack but it is easy to use too much and slow the glider breaking the weak link. Not recommended for gliders with very effective air brakes. Gliders with spoilers which may be less drag can be used if yaw does not work. Be prepared to close quickly in any case if airspeed decreases too quickly.

Top view

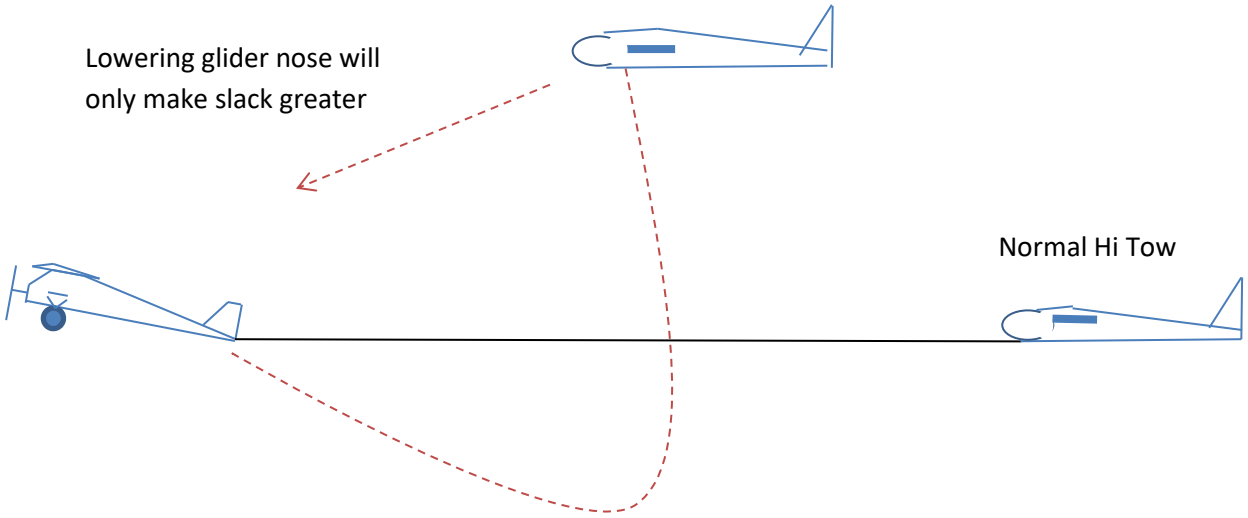


glider accelerates in turn or turbulence and creates loop in tow rope. Glider must yaw away from tug to create drag or rope may loop over wing or back release.

Slack Rope Recovery –vertical (show with model and string)

- if too high on tow plane lowering nose will accelerate glider too much and create more slack. Yawing glider with rudder will increase drag and nose can be lowered gently to return to high tow position. If more slack develops stop lowering nose and hold position until drag eliminates slack while yaw input held. Then resume descent gradually.

- in turbulent conditions tow plan can drop quickly when glider is in high tow and a sideslip method can be used when lowering nose to have a faster rate of descent without creating more slack. This method can be practiced once side slips have been taught as indicated below.



Side slips (Demo with model)

- These demos and practice will be done at safe altitude.

- Sideslip is method to move the glider laterally in space. It does create more drag and increase rate of descent. Sideslips can be used for correcting for wind drift on final approach, station keeping behind tow plane, slack rope recoveries, in turns to lose height in the circuit, to control glideslope by losing height on final.

- A "forward slip" is an offset side slip to lose height on approach or for slack rope recovery when too high on tow plane. Heading is offset 20-30° in one direction and banked in the opposite direction. Resulting slip vector or line of travel is along the reference point. Increasing or decreasing angle of bank while holding offset heading increases or decreases the rate of descent.

- two basic methods will be taught to enter side slip.

- Select a reference point on the horizon over the nose. Initiate a shallow coordinated turn (10-15° bank or one wingtip on horizon the other is above horizon). When yaw starts to move nose apply opposite rudder against direction of turn to hold the nose of glider on the reference point. Direction of turn determines direction of slip. Yaw string will indicate slip towards lower wing. Maintain same pitch attitude.
- Select reference point over nose on horizon and apply bank in direction of intended slip and opposite rudder at same time. Maintain pitch attitude.

Notes:

- Some into bank aileron will be required to offset the "further effects" of opposite rudder "cross controlled".

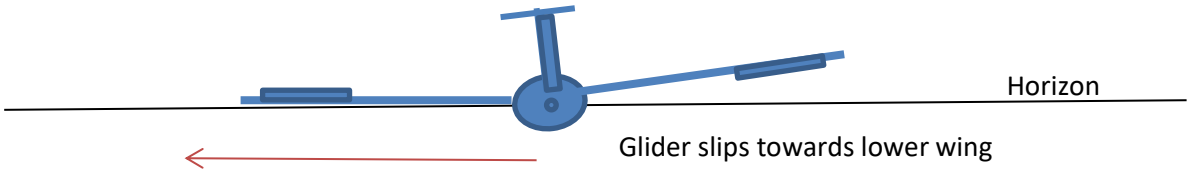
- In steeper slips you may run out of rudder to prevent yaw towards lower wing, then reduce angle of bank. There is a tendency to overbank glider in initial training. Normally putting one wing tip on the horizon and the other is therefore above due to dihedral is enough bank angle. However, if you reduce bank to point of banking in opposite direction you will skid.

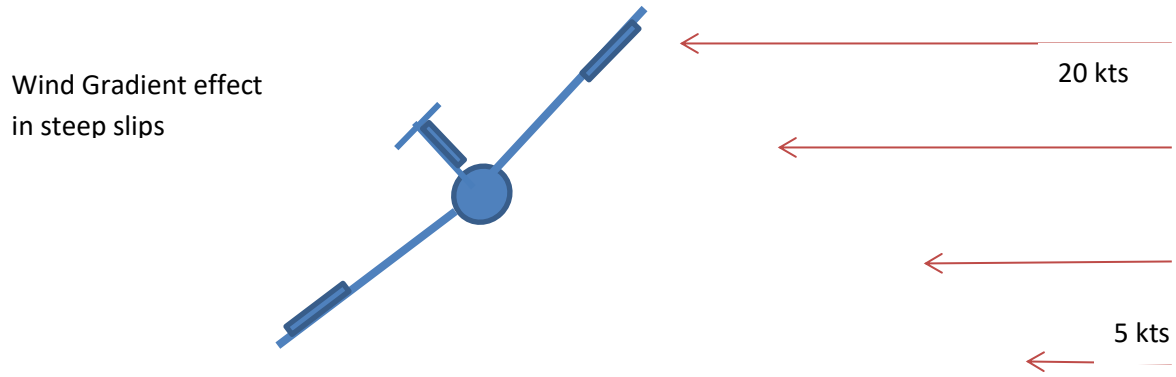
- If using slips for height loss or x-wind correction reduce angle of banks as you get closer to ground.

- Pot pitot type airspeed indicators will indicate lower when side slipping so maintain attitude going in and coming out of side slip. (Some older gliders may require slightly lower attitude correction to maintain airspeed due to increased drag.

- Slips close to ground in strong wind gradients can be hazard as could create difficulty un-banking.

- it is difficult to stall a glider in a steep slip as most gliders will run out of elevator as you try to raise the nose.





Abbreviated circuits

- An abbreviated circuits are conducted whenever there is insufficient height to make a normal circuit or if wind strength or sink requires an earlier turn to base.

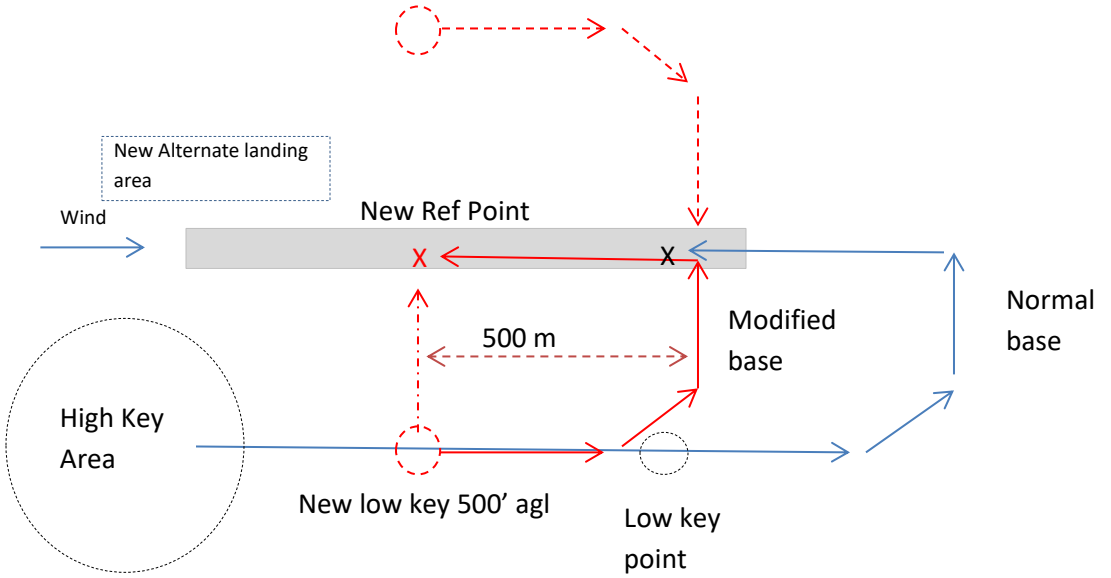
- When reaching a minimum of 500’ in the circuit despite not yet reaching the low key it is necessary to establish a new Low Key point and fly a normal base and final. The new reference point must be selected abeam the new Low Key point.

- In strong winds the base leg may also have to be adjusted closer to the reference point. If head winds approach 20 kts the base leg should be kept inside the airport fence.

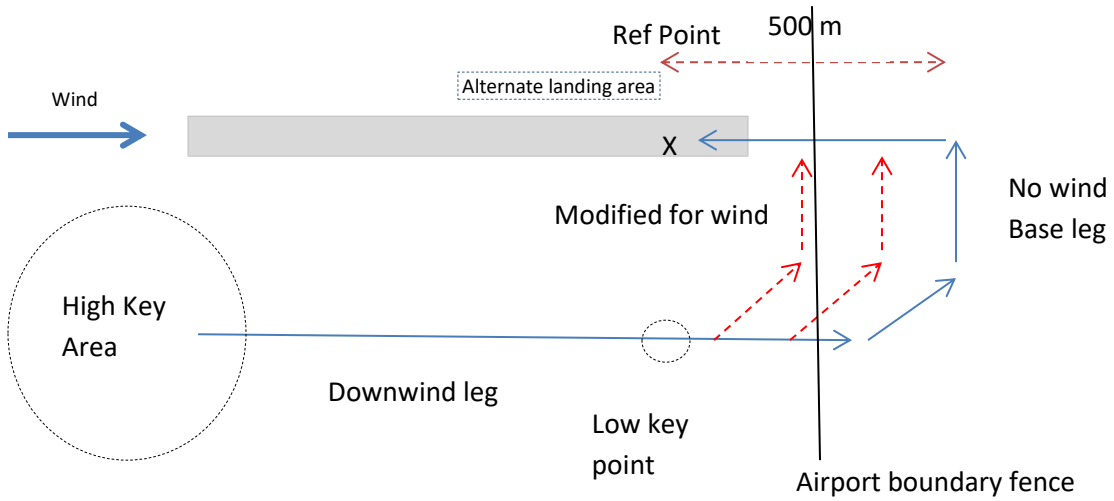
- Modified circuits may also have to be executed from the right-hand circuit or on reciprocal runways depending on position when reaching 500' AGL. Most undershoots occur because the pilot failed to modify the circuit.

- Aggressive slips held to close to ground in wind gradients can lead to wing striking ground. If using slips to lose height recover at least 50' agl. (Later we will show how you can use airbrakes to prevent overshoots)

Abbreviated Circuit for low height (show reciprocals also)



Abbreviated circuit for stronger headwind component



Safety

- On aerotow whenever visual contact to the tow plane is lost the glider pilot must release immediately. A collision with the tow plane is possible as you are formation flying and the separation distance of 200' can be lost in seconds.

- Improper slack rope recoveries have led to the rope being wrapped around the glider wing and damage the glider controls. Yaw away from tug to eliminate slack before moving back into line with tow plane.

- The key for modified circuits is to realize you are too low and plan early enough to compensate for the situation, either by moving the reference point further down the runway, doing a right-hand circuit, or going directly onto a (R or L) base leg skipping the downwind. Landing downwind on reciprocal is also an option if winds are light.

Human Factors

- There is strong internal pressure a pilot puts on themselves to return to the point where they normally land. Be it pride or fear of admonishment, pilots have delayed modifying the circuit to the point of striking a wingtip on the ground during the turn to final, or stall/spin on the base to final turn by trying to extend the glide. Raising the nose does not extend the glide but slows the glider and creates an undershoot situation! Good airmanship is recognizing that a normal circuit is not possible and executing a safe modified circuit or landing out safely with a proper circuit.

- Flying always in benign conditions can lead a pilot to become accustomed to turning base leg over familiar landmarks, subconsciously anchoring on these points. When they must land on a windy day, they can be drawn to the landmarks to judge the base turn and find they are undershooting the runway.

Stage 14 - Towplane Upsets & Emergency Aerotow Procedures, X-Wind Takeoff; Laying Off for Drift on Winch, Sideslipping & Sideslip on Approach, Illusions created by Drift; X-Wind Landing

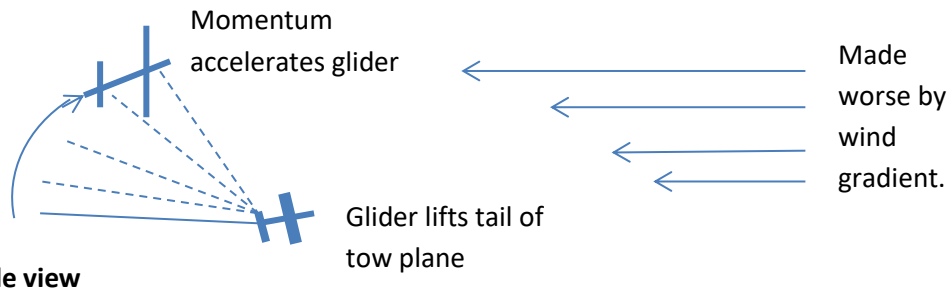
Review: Explain when and how you would abbreviate a circuit.

Ref: SOAR Chap 4 pp 87 – 91 & pp 105 - 108

Towplane Upsets (demo with models)

- When the tow plane lifts off and enters the wind gradient it starts to climb rapidly. If the glider pilot is not paying attention, they may try to catch up rapidly. This swing vertically accelerates the glider quickly and the glider now enters the higher winds above the tow plane. Despite full forward elevator on the glider, it may not be possible to prevent lifting the tug's tail. This reduces the tugs angle of attack to the point lift is lost and the tug enters a stall/spin.

- Towplane upsets can also be caused by turbulence, wind shears, thermal sheers, or wave rotor where the glider swings vertically, usually as the tow plane drops suddenly.



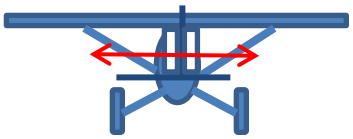
Side view

Emergency Aerotow Procedures (demo with models)

- Visual signals have been developed for communication with tow plane and glider primarily when radios were few in gliders. Now almost all have radios, and our first line of communication is by radio followed up by visual signals. Pilots need to be familiar with the following:

- Tow plane waggles tail with rudder back and forth to indicate there is something wrong with the glider (usually spoilers/ air brakes open). On the radio the pilot will say "spoilers, spoilers, spoilers". If not spoilers (99% of the time) tow plane will state problem on radio. Otherwise assume another issue visible from tow plane such as second tow rope, tail dolly, seat belt outside canopy, etc.

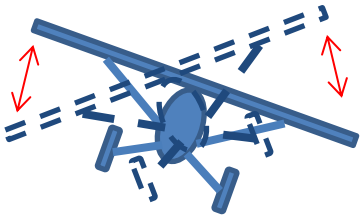
Glider view



Glider pilot action: Close air brakes quickly & visually check locked

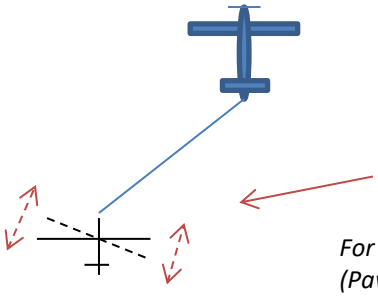
- Tow plane rocks wings (below) for signal for glider to release immediately. Most likely a tow plane emergency (however, have been used to signal height limit on tow). Then tow plane releases rope!

Glider view



- If glider is not able to release after operating release or trying to break weak link with airbrakes. Glider moves to left side of tow plane (below) where pilot can see tug pilot and rocks glider wings. Tug flies back to airport and release glider over field.

Top view



Glider pilot rocks wings with aileron and use left rudder to hold position

For the 45° from the glider view line up tow plane tail wheel (Pawnee) with starboard wheel ,
for a Cessna line up top of fin with starboard wing tip

- If tow plane cannot release and glider cannot release (extremely rare) tow plane will land with glider on tow. Glider should go to low tow position for circuit and touch down before tow plane. Tow plane should touch down and stay left with glider staying right. Glider brakes as necessary to avoid tow plane and tow plane should roll out if possible, with minimal breaking.

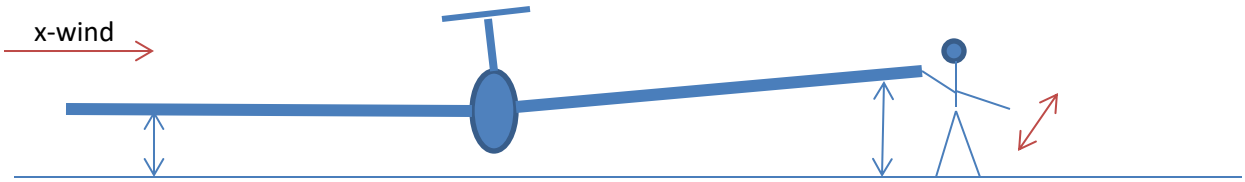
X- Wind Take off (demo with model and practice in a glider if possible before flight)

- check windsock for wind speed and direction. If a crosswind, decide if a takeoff is possible (demonstrated x wind capability of both tug and glider). If in doubt, select another runway/direction to launch or abort flight.

- If within limits, decide correct position for controls and apply maximum rudder and aileron correction while stationary as wind will try to lift wing and yaw glider. X-wind will push rudder down wind, swinging nose into wind. (E.G. Left cross wind requires right rudder and left aileron). As glider gains speed and

controls become effective you will then have to reduce control inputs to maintain directional control and bank.

- start with into wind wing being held level by wing runner. You will have to take charge of this and give directions to wing runner. This will be enough bank angle to usually to deal with most x-winds within aircraft limitations. Holding the into wind wing lower than level with ground, risks tip striking ground and a ground loop. Be prepared to release if this happens.

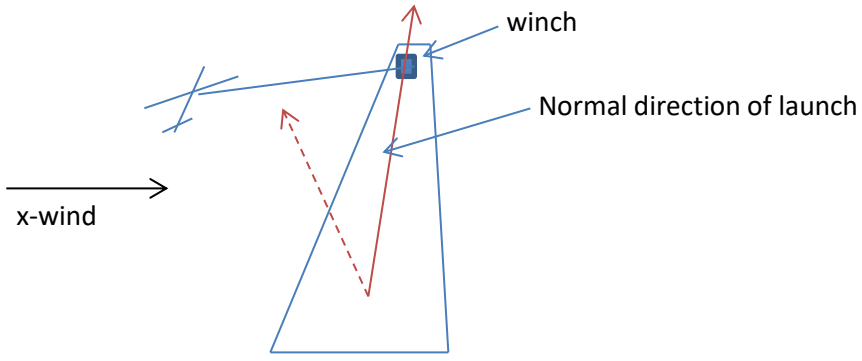


- maintain direction along runway center line including after liftoff with side slip. Once sufficiently high enough off the ground that glider will not settle back down on glider's wheel, pilot can align with tow plane if tow plane switches to a crab method of staying aligned with the extended runway center line.

- Tow plane can also be positioned slightly downwind of glider to prevent weathercocking at the beginning of the take off roll before the glider rudder is fully effective.

Laying Off for Drift on Winch (demo with models)

- Cross wind take off on winch is usually made with into wind wing level as ground run is minimal. Glider pilot should correct for yaw immediately on all out as rudder will quickly become effective. Using a cloud as reference, if possible, pilot must use crab and bank to keep glider slightly up wind of field depending on wind strength so that after release the cable will drift onto runway. It is the pilot's responsibility for the winch cable falling on the runway as the winch operator cannot control the lay off for wind. Pilot will have to look down to confirm laying off is sufficiently up wind before reaching top of launch.

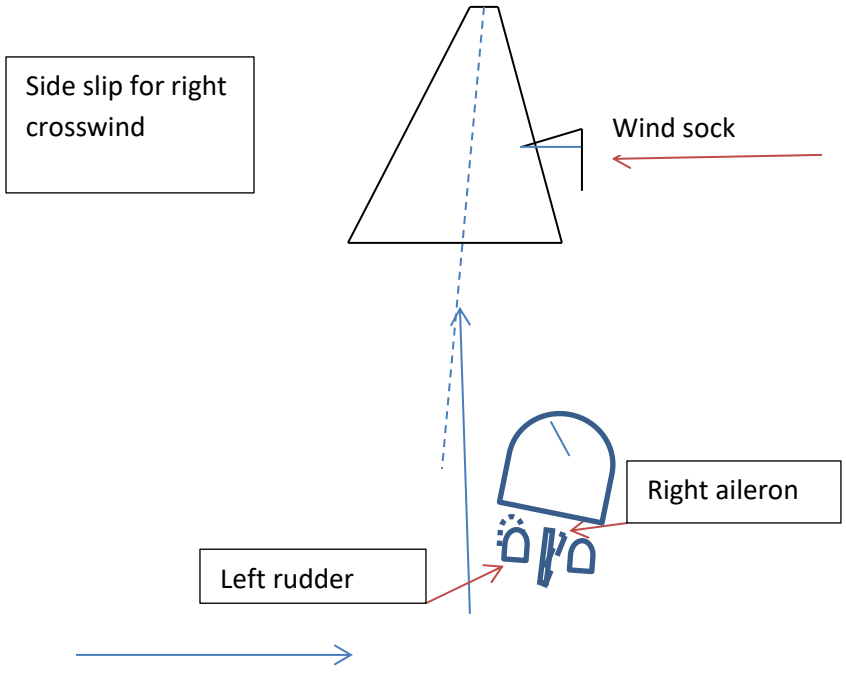


Side slipping & Side slip on Approach (demo with models)

- See side slipping in Stage 13. This exercise will now be carried on approach to correct for wind drift and then again control descent on approach with offset sideslip or “forward slip”.

- Check windsock. Initially finish the turn slightly upwind of runway center line so you have time to establish slip. Bank enough to correct for the wind drift and hold bank on final to maintain runway centerline. Increase or decrease bank to hold runway extended centerline. As you descend through wind gradient you will likely need less bank angle. (In stronger x-winds aloft it may be easier to start with a crab into wind before side slipping if runway heading cannot be maintained with rudder).

- Also, Demo slipping turn and offset or forward slip with model for left and right cross winds and circuit combinations.



Illusions created by Drift (demo with model)

- Illusions are more effective closer to the ground. Turns with an inside x-wind will give the impression of a skidding turn and an outside x-wind will give the impression of a slipping turn. Pilot may subconsciously apply rudder to correct. Maintain a straight yaw string and approach speed will help correct for illusions and keep turns on to base/final safe.

- Headwinds will give illusion of flying too slowly and pilot will be tempted to fly faster which may lead to increased rate of descent.

- Tail winds will give illusion flying too fast and there is danger pilot will slow too much and could lead to stall or a high rate of descent with air brakes.

Crosswind Landing (Demo with model)

- Crab method can be used or sideslip. Crab method is advantageous for stronger winds but has some risk to skidding if done incorrectly (still drifting and closer to stall/spin scenario if slow). The Yaw string must be kept straight, and the offset achieved by a coordinated banking turn into required offset heading for x-wind strength. As the glider descends through wind gradient less crab will be required corrected with gentle coordinated turns. Just before the end of the hold off the glider must be yawed before touch down so the nose is pointing down the runway centerline, to prevent wheel touch down with any crab or cause damage to the gear or make a ground loop more likely. This can be difficult in turbulent conditions to get right. Glider will weather cock or lift wing unless cross controlled once on the ground (that is: Rudder to stay aligned and aileron to keep into wind wing level) or slightly lower).

- Side slip method has less risk for damage to gear and in turbulent conditions easier to alignment to touch down and ground roll as already cross controlled correctly for slip. Wind gradient will require less bank angle closer to ground. In the hold off the into wind wing will likely only have to be held level to ground to maintain enough side slip (within demonstrated x-wind limitation).

- As glider slows during the ground run in both cases rudder and aileron will have to be increased to prevent yaw as the controls become less effective.

- Demo landing with model showing round out hold off and roll out for left and right crosswinds.

(Demo with model) combinations of offset or forward and sideslip combinations to deal with cross wind and loosing height at same time. Degree of offset to heading determines amount of crosswind effect while amount of bank controls rate of descent.

Safety

- Tow plane upset can be more likely with C of G hooks or low hooks on the glider as they are well below and vertically below the C of G and cause a pitch up moment on the tow. Water ballasted gliders can also worsen this effect when the wings bend raising the C of G, to where elevator authority is overpowered by the pitching moment.

- Review your emergency signals mentally before each take off. Some pilots have mistakenly released when the see a rudder waggle for open spoilers (tow pilot yaw may induce some roll!). You are most vulnerable to these types of errors after long lapses (month) in gliding (currency) or not having reviewed your emergency procedures in 30 days.

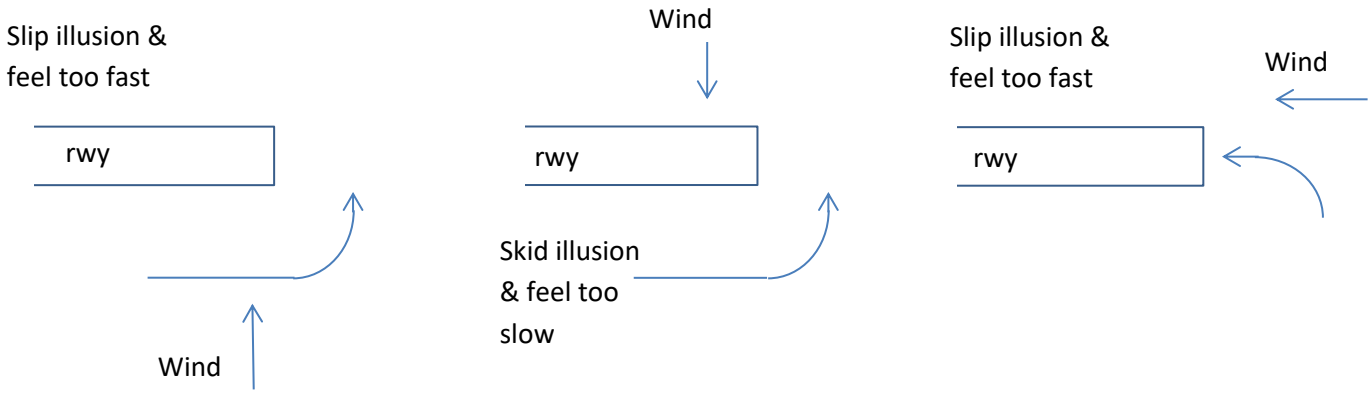
Maximum side slips with airbrakes open has caused turbulence over canopy from the airbrakes that has rattled the canopy hardware loose (Puchacz particularly vulnerable). If slipping left towards opening hardware, side opening canopies may be blown open/off. Slip right towards hinges is better.

- Maintaining airspeed in slips it is critical to fly by attitude and not chase under indicating airspeed error (common in Pot Pitot systems). This is critical if side slipping to lose height on final and arriving in the round out 20 kts over minimum approach speed and defeats the purpose for short landings.

Human Factors

- Drift illusions. With drift illusions it is better to maintain a slight slip as there is less chance for stall/spin. Any skid is dangerous in the circuit especially on final where there is insufficient altitude for recovery from a spin. Runway cross- winds on base turns can give the illusion of skidding when turning low with wind behind or slipping when turning low into wind. Runway tail winds will give the sensation of flying much faster and pilot will be tempted to slow down.

- Head tilting in slips may cause leans or other balance related issues. Pilot may perceive they are overbanking and attempt to counter when no roll is evident.



Stage 15 - Descending on Tow, Spins and Comparison to Spiral Dive, Airbrakes fully open before Circuit exercise

Review: Describe the emergency aerotow procedures.

Ref: SOAR Chap 4 pp 94-105

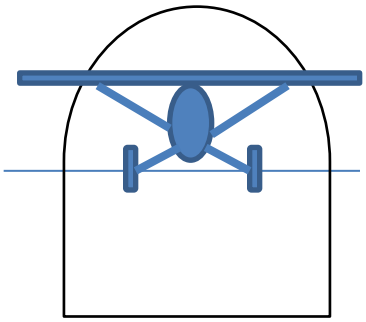
Descending on Tow (demo with model)

- Descending on tow is required for x-country tows for reasons of airspace requirements or weather. It may also be necessary if the tow plane and glider both cannot release the tow rope.

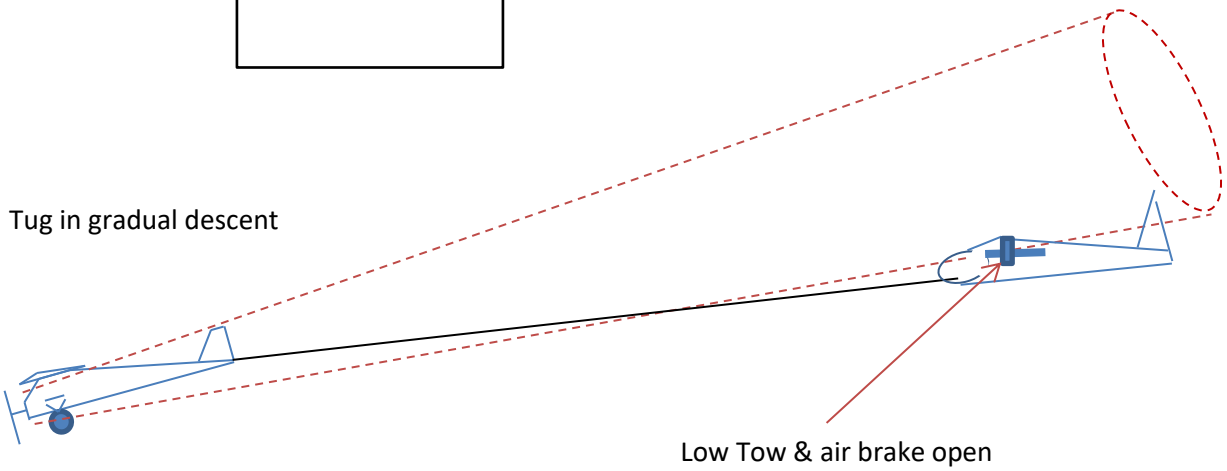
- Glider needs to move down into the low tow position (advise tow pilot) below slip steam. As the tug descends, the slip steam will angle up and the glider may start to accelerate towards tug unless the glider is moved slightly into the slip stream where the turbulence will cause more drag.

- To increase the rate of descent (around 300 fpm) to match the tow plane the glider will have to open some air brake while in the slip steam.

- If tug starts to climb glider should return to high tow position.



wheels may appear near horizon when in low tow position during descent



Spins (demo with model)

- Spin training consists of three elements, **Awareness** of situations that lead to spins, **Avoidance** by recovering from the wing drop before a spin develops, and **Recovery** by understanding the techniques required and developing the skill to return to normal flight from a spin.

- A glider can enter a spin whenever the glider is stalled and if there is a yaw component to start rotation about the vertical axis. This yaw can be slight and if it causes a wing to drop it will start the spin.

- In normal flight when a wing drops down lateral dampening will reduce the drop as increase in angle of attack increases the lift. However, once the wing is stalled lateral dampening is lost. The down going wing is at a higher angle of attack to relative wind and produces more drag and starts to increase yaw in direction of spin. As the wing and nose drops the rotation rate will continue to increase (momentum of mass creates autorotation). The glider begins a rotation about all three axis. After about 6 rotations the spin tends to flatten out and recovery may be slower and mor difficult.

Wing drop stall recovery

- Before the first ½ to ¾ rotation after the wing drop, if nose is lowered further, the wing will be un-stalled, and the spin avoided.

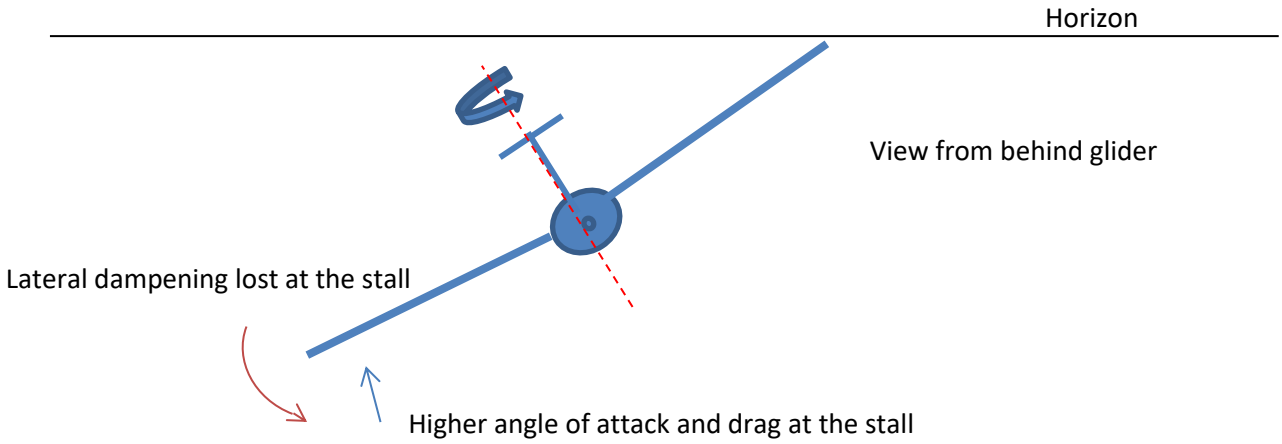
- After the first ¾ to full rotation it is unlikely the glider can be un-stalled in the spin without applying a spin recovery technique described in the Aircraft Flight Manual (AFM) or Pilot Operating Handbook (POH). Should a recovery not be specified, then a standard recovery as per CS 22 should be used.

Spin Recovery

- The standard recovery technique, if none is indicated in the AFM/POH, is:

- Center the ailerons while applying full rudder against the rotation of the spin;
- Pause for a second then steadily move the control stick forward until rotation stops;
- When rotation stops, center the rudder look up to the horizon and smoothly pull out of the dive.

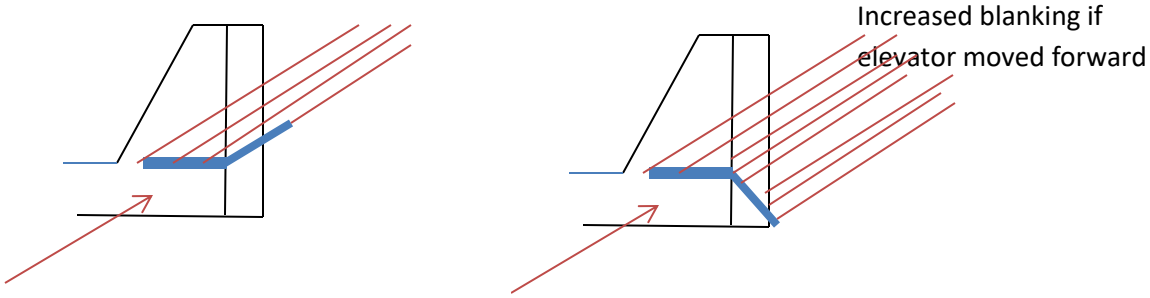
- do not delay the recovery or continue to push the stick forward once the rotation stops. Pulling 3-4g while the airspeed is lower is safer than letting the airspeed increase and attempting to increase g loading at high speed when it is easier to overstress the glider. Opening the air brakes to limit speed can weaken the wing and lead to overstressing the wing and possible wing failure.



- Full Rudder must be applied before moving the control stick forward to prevent elevator blanketing of rudder and is the reason for “pause” in the recovery to ensure this is done but without a significant delay.

- Single seat gliders are more prone to spinning because the C of G is typically closer to the aft limit. For light pilots forward ballast when solo will help make the tandem gliders less susceptible to spins.

Rudder Blanking



Comparison to spiral dive

- In both cases of a spin and spiral dives the horizon appears to be going around quickly. Airspeed is the key element. In the spin the glider is stalled, and airspeed is low. In the spiral the airspeed is increasing rapidly. Firm control feel, wind noise, and ASI will give indications of increasing speed. Recovery technique as appropriate to airspeed for spiral or spin should then be used.

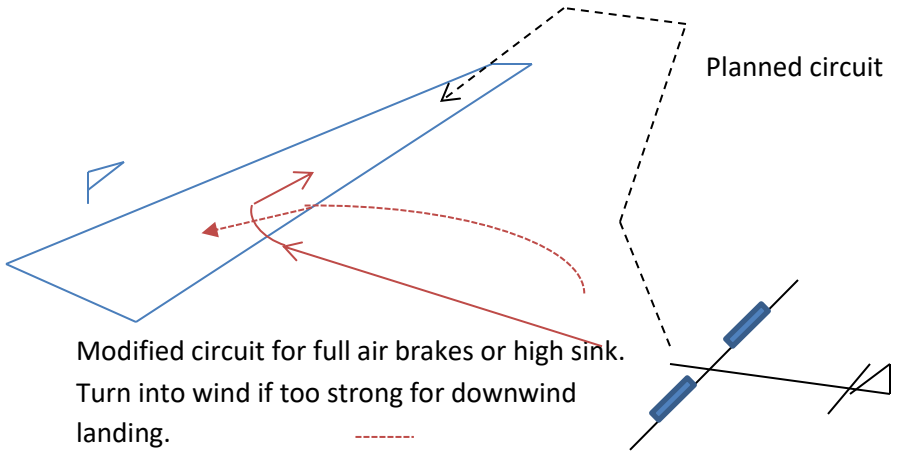
Airbrakes fully open exercise

- In this exercise the air brakes are held fully open to simulate a scenario that they have fully opened and locked due to mechanical failure or the glider is in rapidly descending air mass such as a microburst or wave downwash effect.

- Glide ratio may be reduced to 5:1 and up to 1000 fpm descent rates. Pilot must recognize a normal pattern is not possible and must take immediate action to increase airspeed to the appropriate approach speed and fly directly towards a suitable landing area. In a circuit this would an immediate base leg or short final if possible.

- Attempts to raise the nose to mistakenly stretch a glide may lead to a stall or undershoot. Attempting a downwind leg will likely result in running out of height in the circuit (without enough altitude to make the final turn).

- Should the sink decrease or mechanical problem be resolved the glider can return to a normal approach appropriate to remaining altitude. If airbrake had malfunctioned, slipping to lose height may be more appropriate than re-attempting air brake use.



Note: increasing speed increases descent rate

PREPARATORY GROUND INSTRUCTION NOTES

SAFETY

- Brief the tow pilot before you do these exercises. Communicate with the tow plane to start the exercise. Be in the low tow position before the tow plane descends.

- Releasing from low tow position during a climb or level flight may risk the canopy being struck by the tow ring and damaging the glider. It is best to return to high tow to release. During a descent on tow there is less chance of this happening so a release from low tow may be possible if done with care.

- CALL checks must be completed before height loss exercises. Be aware you may lose more altitude than you anticipate in spin exercises and should plan your return to the field without being too far away. Spin recoveries should be completed by 2000' agl and exercises are usually started at about 3000' agl. The wearing of parachutes is recommended.

- The rudder should be against the mechanical stop, against (opposite) the rotation of spin. Many pilots underestimate the amount of force this may require. The pilot seating position should be set such that the knees are slightly bent so that the quadriceps muscle can be engaged during the rudder push and not using only the calf muscle. In a two-seat glider, another pilot's feet on the pedals may be enough interference to prevent full rudder.

- If rotation does not stop when you move the stick forward, you likely don't have full rudder or have brought the stick forward too soon and blanked the rudder, or didn't center the ailerons immediately, or the C of G may be too far aft. Repeat the recovery sequence with stick all the way back when you center the ailerons and use more rudder force (leaning forward if necessary).

- The stick movement forward should only be enough to stop the rotation. Should rotation stop at any time the aircraft will be un-stalled and the recovery from the dive should be immediate, moving the stick forward beyond this point will only steepen the dive angle and possibly invert the glider. However, the stick may also have to go all the way forward to stop the rotation depending on weight and balance and particular design of glider.

- The normal pull out of the dive is achieved by "**looking up"** at the horizon, with wings level to prevent non symmetric stress on the wings (ailerons not centered), and raising the nose **smoothly** - Not centering the rudder during the recovery from the dive can lead to a spin in the opposite direction.

- Soft seat back cushions have prevented full rudder from being applied as pilot compresses them. In addition, pilots have leaned back in steep nose down spins on soft cushions preventing stick forward despite arm fully extended. Spacer cushions must be made with hard materials such as denser upholstery foams or harder materials, not soft foam.

- Low altitude spins must be avoided by flying at the minimum approach speed below 500' agl. the formulas (1.3 Vs + Vw for basic two seat trainers and 1.5Vs +½Vw + Vgust for higher performance single seat gliders) only if the approach speeds are not specified in the POH.

- Expect low level wind shears that might stall a wing when surface winds exceed winds aloft or major changes in wind direction, terrain elevation changes are evident, tree lines or buildings are present that may disrupt the airflow. Upslope winds in mountains have had similar effect creating abrupt angle of attack changes to stall the wing.

Human Factors

- Anxiety over spins occurs sometimes. Practice will make the pilot less anxious and more comfortable with the recovery procedures. Key is to be smooth with the controls and resist jerking them which induces higher stress loads.

- We get accustomed to the performance capability of the glider and when something happens (high sink or spoilers locked open) we don't expect it is possible we may feel overwhelmed and stop reacting (stress reaction). Breathe deeply and try to relax. Fall back on predetermined courses of action (have a plan) and re-assess the situation, then take the appropriate actions and keep monitoring the situation and developing new courses of action as required.

Stage 16 – Further Spinning exercises; Changing Effect of the Rudder at the Stall; Spin Left off a Right Turn, etc

Review: Describe a full spin recovery and how it is different from spiral recovery.

Further spinning exercises (demo with model or simulator videos)

- There have been 15 spin scenarios identified that pilots should be familiar with to try to **avoid** entering stall/spin situation. From most common based on OSTIV TSP accident data.

1. **Final turn to land** - low height <300'agl, too slow and may be raising nose to stretch glide, not wanting to bank too much so using rudder to turn towards final (skidding). Possible wind gradient and/or not adding V_{wind} to $V_{approach}$.
2. **Pear turn to final** – on base leg the runway centerline is overshot, and pilot attempts a steep turn back to centerline. Attempt to tighten turn by pulling back on stick. $V_{approach}$ is now below 2g stall speed (48 kts?).
3. **Rope break on tow or winch cable break** – Slow response to lower nose and recover $V_{approach}$. Starts turn back to launch point before air speed has built up.
4. **Centering a thermal** – tightening turn too quickly while steeply banked using back pressure on stick.
5. **Thermalling (inside spin)** – Bank angle may be increasing, and pilot tries to lift down going wing with aileron increasing A of A. stalls inside wing.
6. **Thermalling (outside spin)** - slowing to reduce diameter of circle and decrease sink rate. Attempts to lift wing with aileron and further effects of rudder. Outside wing stalls.
7. **High speed entry to thermal** – rapid speed decrease with 2-4 g pull up and enter steep turn to try to center thermal core but glider below 2-4 g stall speed.
8. **Abrupt direction change in thermal** – attempt made to change circling direction in thermal or to center core in opposite side. Airspeed not increased from minimum sink or slow thermal speed and turn made aggressively or from too slow an airspeed.
9. **Abrupt direction change in circuit** – airspeed not increased from best L/D and below 2g stall speed and a tight well banked turn is made to reverse direction to change circuit direction.
10. **Spin from secondary stall** – During a stall recovery nose is raised to aggressively leading to high-speed stall/spin.
11. **Wing drop stall recovery** – nose is lowered to correct attitude during recovery, but rudder is overused to help level wings before air speed is allowed to increase.
12. **Contest finish** – glider enters a high-speed climb from low altitude at high g loading. At the top of the climb a steep 2 g turn to downwind is attempted at low airspeed.
13. **Opposite spin from a spin recovery** – After applying rudder against the rotation during the recovery the rudder is not centralized and the pull up is aggressive with a at high-speed stall or failure to move the stick forward after opposite rudder.
14. **Low altitude circling over a land mark** – circling over a land mark at or below 300' agl. Wing tip appears to move forward of the landmark instead of backward as it does at higher altitude. Pilot corrects with rudder to keep wing tip on reference point or by reducing speed.
15. **Low altitude illusions created by drift** – closer to ground when making turns in cross winds give allusion of skid or slip. Pilot attempts to correct with rudder and slow down because of tail wind component.

Changing effect of rudder at the stall (demo with model)

- Misuse of rudder at the stall can lead to unintentional spins. At the normal gliding speeds, the rudder will tend to yaw the nose of the glider more than rolling. Closer to the stall the rudder will have more effect at rolling than yawing the glider, contributing to a wing drop at the stall and spin entry.

Safety

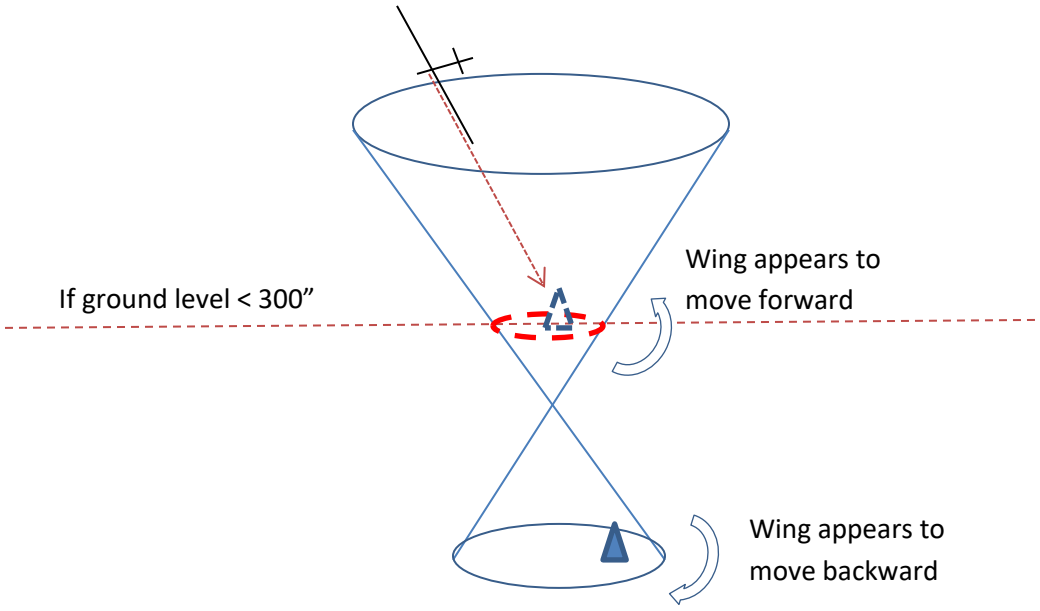
- In slow flight in gliders ailerons tend to remain effective while using rudder secondary effects can lead to spin entry if gliders is stalled. Note for power pilots have been trained to avoid aileron use in slow flight and use rudder to keep the wings level due to short coupling of controls and short wings on powered airplanes.

- Practicing spin entries for understanding the scenarios must be simulated at safe heights for recoveries (min 2000" agl) and returning to the field. For example, do not practice contest finish below 2500' agl.

Human Factors

- While under stress it can be difficult to realize how much control force is being applied. As stated earlier there is a tendency for the pilot to tense up muscles, push on both rudder pedals, or maintain a control input that is not desired. We also tend to hold our breaths when under stress. Or attention can become focused, and we lose situational awareness. Most spin scenarios were caused by loss of situational awareness. Also be cognizant that when trimmed for back control stick it is easy to pull additional g without realizing it. In turns this can help lead to a stall.

-Low level spin circling over landmark. Inside cone of normal turning wing will appear to move in opposite direction than when at higher altitude. Glider may be over higher ground or near landing field. Also risk thermalling low level!



Stage 17 - Spins Avoidance Practice (recover before spin develops), Instruments covered exercise; Right-hand Circuit exercise

Review: Describe 15 Spin scenarios.

Ref: SOAR Chap 4 pp 96 - 105

Spin avoidance practice

- A spin requires an aerodynamic stall and a yaw component (loss of lateral dampening). Being able to sense an approaching stall and lowering the nose will prevent the stall from occurring in most situations. If you do stall, recovering from the wing drop stall will prevent the spin. To recover from a wing drop stall immediately lower the nose to reduce the angle of attack, level the wings normally and recover from the dive.

- If your glider is not approved for intentional spins, you can get a Puchacz type spin checkout or other two seat glider with similar spin characteristics to most single seat gliders, as it will prepare you for inadvertent spins in single seat gliders. Incorporate adequate spin recovery training as part of you spring or annual checkouts.

- Practice the various scenarios at safe altitudes and recover at the wing drop to avoid the spin to build confidence in recognizing and avoiding spins.

Instruments covered exercise.

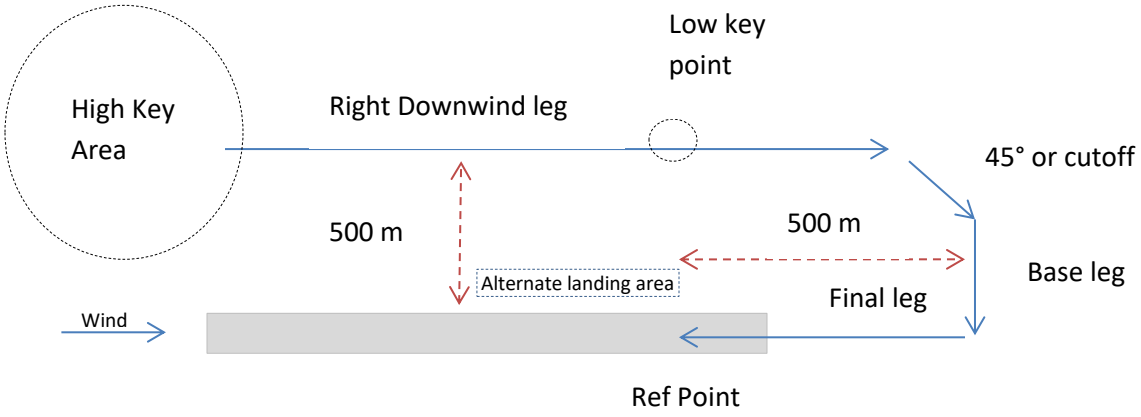
- Primary instruments of altimeter and airspeed indicator can be covered one at a time each flight to practice a circuit without a mechanical reference. You may be surprised airspeed can be managed by sound and feel of the controls, and visual reference only. Caution for illusions caused by wind drift. Practice at altitude with instructor as safety pilot and get used to what approach speed would sound like at safe altitude first before landing attempt. Hint: leave wind vents open.

- Altimeter can be covered and key heights from 2000', 1500', 1000', and circuit heights 800', 500' and 300' should be practiced with instructor as safety pilot. Student attempts altitudes with instructor verifying if correct.

- The aim of exercises is to develop confidence to handle minor emergencies of malfunctioning instruments.

Right hand circuits

- Potentially these have not been practiced before this point and students must be comfortable executing them. Make sure radio calls are made for simulating other than standard circuits to other pilots and ground flight line crews.



SAFETY

- Whenever conducting non-standard exercises always make radio advisory to traffic. Do not assume everyone will get the message or even be on the right frequency. Keep a good look out and be prepared to yield to traffic. If a conflict occurs, make a standard circuit. However, PIC is responsible to ensure the safety of their (own) aircraft also. You may have to land in your alternate landing area or long on the intended runway.

- Some airfields have right hand circuits as standard for operational or safety reasons. This information may be in the VFR chart supplement.

Human Factors

- There is a strong tendency to want to return to the launch point when doing non-standard circuits or modified circuits. Use whatever part of the landing field that will make a safe landing area. On very wide fields consider landing diagonally, perpendicular, or on reciprocal or alternate runways.

Stage 18 - Rope Break demo at 500+ feet agl Abbreviated Circuit

Review: Describe initial actions taken on a rope or cable break?

Ref: SOAR Chap 3 pp 75

Aerotow

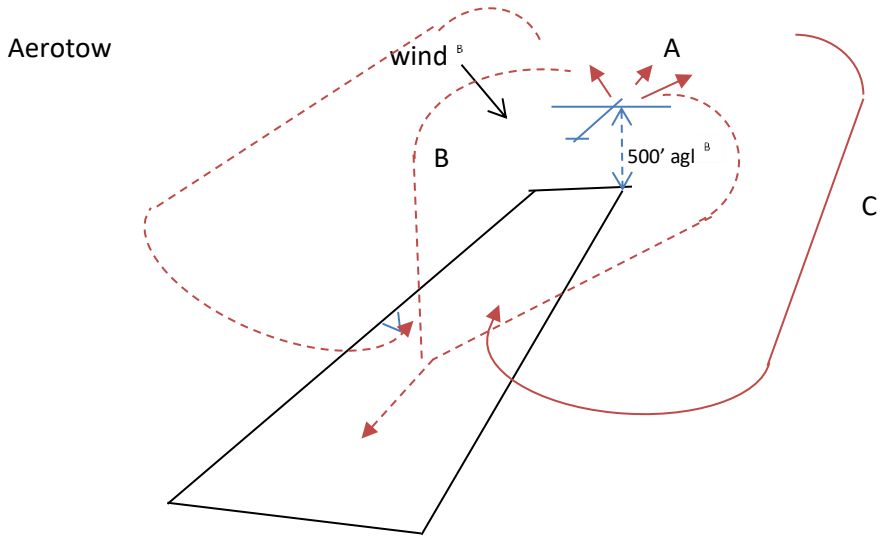
- First in our rope break training we learned what initial actions should be taken to recover and how long it took and what height was loss to perform a recovery. The second stage in the rope beak series of training is how to deal with breaks at circuit height (perform a normal circuit) and breaks 500' agl up to circuit height.

- In no wind conditions after lowering the nose and accelerating to $V_{approach}$, the pilot determines options that are open. Ideally, we would land straight ahead if that option is available (option A). If no suitable landing area ahead and we have enough height to consider a 180° to land on the reciprocal heading (option B). There is no requirement to attempt "S" turns to try to land short on the button (nearest end) of the runway. Use runway available to make a normal approach to land if possible.

- If the headwind is fairly strong and there is increased risk of ground loop, the option to do an abbreviated circuit can be selected (option C). The downwind will be short and little height will be lost compared to the ground covered. Only fly down wind enough to make a safe base leg and final to the upwind end of the runway. Do not attempt to land at the take off point. The base leg and final leg will be closer and shorter respectively due to headwind.

- In the case of an abbreviated circuit for headwinds it is better to turn away from the wind so the base leg will have a head wind component.

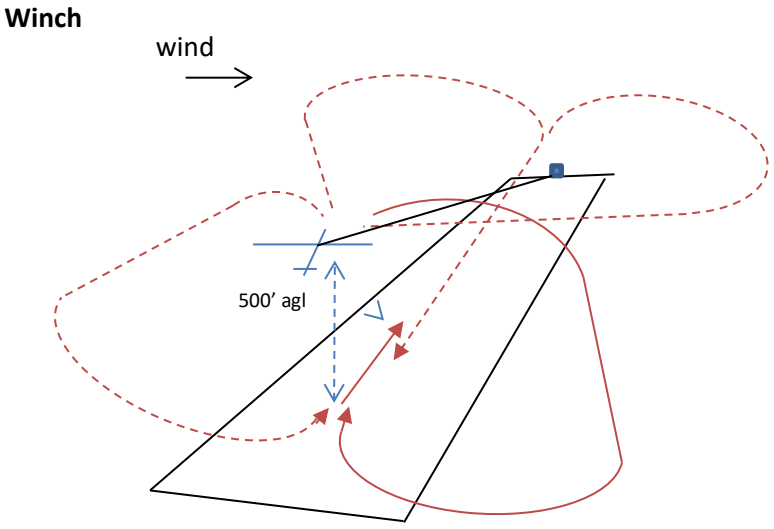
- If the towplane and glider have already started a low turn, continue that turn and land as appropriate.



Winch

- On winch launch up to 500' there is plenty of runway to land straight ahead as you will have travelled less than 1000' down the runway. Consider a modified circuit if there are obstacles on the runway (E.G. landed glider).

- A teardrop turn by flying further upwind can be made if wind is not a factor.



Safety

- Tow pilot must be briefed before exercise practiced. If traffic or conditions change exercise can be aborted for safety. Discuss with flight instructor.

- There should be no surprises during initial training and all emergencies should be briefed. Once student has demonstrated proficiency in these series of rope brake exercises the instructor(s) may create an un-announced exercise.

- Action on rope break is lower nose to recovery attitude and accelerate to $V_{approach}$; pull the release to let go of any remaining rope; assess the height remaining and make decision on action.

- Winch specific safety recap:

- If you cannot keep the wings level on the ground run – **Release.** By the time the wing has touched the ground, it may be too late to prevent a ground loop and fatal accident.
- If the launch fails, especially close to the ground, pilot reaction time is critical – less than 1.5 seconds reaction time preferred.
- Once the glider has left the ground in a level attitude, take around 5-6 seconds to allow the glider to rotate into the correct full climb attitude. This is to avoid an accelerated stall and flick roll, almost always fatal, through too fast a rate of rotation.
- Once the glider has left the ground in a level attitude, do not allow the nose to rise much until airspeed has been confirmed. This means around 1.5 x stall speed and CONTINUING to accelerate.
- If the launch fails in mid-launch, achieve a sensible recovery attitude, 25 to 30 degrees nose down, release and WAIT for a safe airspeed, (approach speed), BEFORE manoeuvring or using the airbrakes.

- If glider cannot release and winch cable is still attached circle over winch until final. Do not drag line to make a circuit.

Human Factors

- Maintain situational awareness. Do not panic and fly the airplane. There is time to assess conditions and select an option. It is best to have run through options before taking off. Be familiar with obstacles and landable areas around field and have a plan before takeoff. Always be flexible to modify the plan as needed to meet the situation. No plan before takeoff is not good airmanship.

Stage – 19 Off-field Field Selection and Circuit Planning

Ref: SOAR Appendix B

Field selection

- A method of analyzing a potential field is the acronym SSSLOW. You will have more training in this for Bronze Badge cross country flying but if you do not have sufficient height to return to the airstrip the pilot should have some basic skills.

S – Slope: notice any at 2000' agl too steep/land uphill if no choices

S – Shading: dark green crops not good, dull yellow/brown cut hay best, light brown or ploughed fields. Patchy green could be dangerous for rocks, ditches, fences.

S – Stock: animals indicate poor ground for crops. Farmer will not risk his plough in field. Lone cow danger!!!

L – length: plan on 300m – 500 m (football field 100m) if necessary, land on diagonal!

O – Obstacles: buildings, trees, wires, ditch, fence, rocks (sucker holes between trees/buildings) fly over poles not between them, especially high-tension towers.

W – Wind: smoke, flags, waves, crops, cloud shadows, drift of glider.

Decision heights (agl) for planning a field landing:

2000' – fly towards landable areas (@ 28:1 L/D will glide 7 km in 1000' altitude loss, more downwind)

1500' – Select 2-3 potential fields

1200' – select a main and alternate (alternate should be close enough to reach from final turn)

1000' Select reference point and upwind entry (high key) and head for circuit. No more thermalling.

800' establish downwind (use angle method to fly circuit)

Safety

- The biggest mistakes pilots make in off field landings is making decisions (field selection) too late. The second mistake is not committing to land below 1000' agl. The likelihood of safely getting away is not worth the risk of low thermalling (stall/spin). If you find a thermal above 1000' circle away but be careful of drifting away from a selected field by wind!

- Losing sight of the reference point before base turn has occurred too often. This has led to undershooting your intended field or landing in a field not selected. Offset your base leg so you are not flying away out of sight of your reference point.

- Remember you cannot see wires only the poles or towers. Often out buildings have wires running to them. Wire fences or electric cow wires are not likely visible, but the darker grass line may be visible.

Human Factors

- There is a tendency for pilots to want to land parallel to field lines, but it is better to land straight into wind even if it means a diagonal landing into a field. However, if the field is furrowed, land with the furrows.

- Never promise anyone you will not land out. Pilots will make poor decisions if they place this pressure on themselves. Always be prepared to land out and fly accordingly (airmanship).

- Factor that may affect decision making and cognitive abilities, also cumulative effects must be considered. Fatalities have occurred when not heeded:

- **Fatigue**. Long flights can cause degradation in cognitive processing 5-10%. Low blood sugar can double effect of fatigue. Importance of having low sugar snacks with protein. See risk management assessment matrix on next page and give as handout. Also discuss IAMSAFE checklist again.
- **Hydration**. Dehydration reduces cognitive capability 5-10 %. Severe dehydration occurs at 3% water loss. You feel thirsty at 2% water loss. Oxygen and or high altitude contribute to dehydration.
- **Hypoxia**. Can occur as low as 7,000' depending on person. Smoking lowers limits. Flights near 10,000' should be on supplemental oxygen. Slightly hypoxic can cause 5-10% mental degradation.
- **Temperatures**. Hot days can add to fatigue and dehydration and can be very dangerous. Cooler temperatures at altitude cause body to shed blood volume (passing water) as arteries constrict. Descend into lower warmer air then causes dehydration as arteries expand in warmth and liquid volume has to increase taking water from body tissues.
- **Barosinusitis**. Painful sinus effect of changing altitude and exposure to different ambient pressures. Can cause lack of concentration.
- **Bends**. Decompression sickness where exposure to low pressure at high altitudes over long flights can cause nitrogen in blood to form bubbles (due to Boyles law and partial pressures of gasses). Bubbles can form in joints and cause pain (distraction). Other effects are more likely at high altitudes in wave flying.

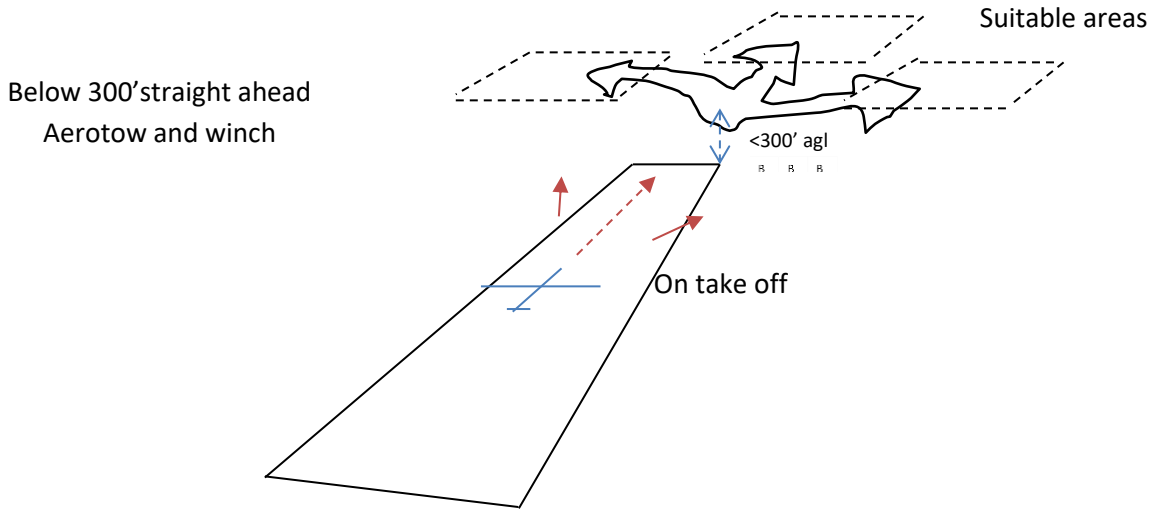
Example Risk Management Assessment Matrix

	Category of Risk	Risk			Score
		Low	Higher (+1 point)	Highest (+2 points)	
Pilot Factors	Sleep	8 hours	6 hours	4 hours or less *	
	Experience	Multiyear recent	Multiyear gapped	First year	
	Site familiarity	Many flights	Some flights	First time on location	
	Family/Personal	All is well	Some problems	Many problems *	
	Work	Some	Moderate	Swamped	
Type of Flight	Instructional ab-initio	Pre-solo	Post solo	Advanced (Spins etc)	
	Licenced pilot solo	Experienced in type	Under 10 flights/type	First flight in type *	
	Licenced pilot passenger	Experienced	First one this year	First 5 passenger rides	
	Aerobatics	Under instruction	First 5 solo aerobatics	Inexperienced	
	Cross-country	Diamond dist/goal	Gold/Silver equiv,OLC	Bronze not current	
Flight Factors	Duty day	Under 6 hours	6-10 hours	10 hours or more *	
	Currency	0-14 days	15-30 days	30+ days *	
	Planned flight time	Under 1 hour	1-2.5 hours	2.5 hours or greater	
	Number of flights today	1-4	5-7	More than 7	
Weather	Winds	0-10 kts	11-20 kts	Over 20+ kts *	
	Crosswinds	0-7 kts	8-12 kts	Over 12+ kts	
	Turbulence	Light	Moderate	Forecast severe *	
	Temperature	-10 – 20 C	21 – 30 C	30 + C	
Traffic	Traffic mix	Glider/tow planes	Mix winch/aero-tow	Add in GA/commercial	
	Traffic density	Few (1-4)	5-10	Very busy (10+)	
	Traffic type	Club ops	Contest	Contest/club ops/GA	
Contest Air Meet	Size	Under 10	11-20	20 +	
	Experience	Multi-contest	Completed 1-2	New to contests	
	Pressures to fly	Contest in or likely	Some doubts	One more day needed	
	Power FLARM used	All gliders	75% or more	Under 75%	
	* if these factors are grouped two or more use caution or consider dual			**Total**	
0-14 points – OK to fly	**15-20 points** Use caution or consider dual		**21 + points** Fly with instructor or cancel		

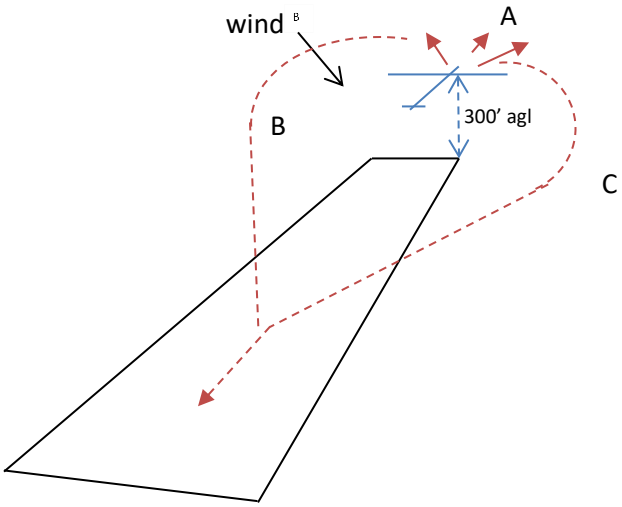
Stage – 20 Rope/Cable Breaks flights (demo first at lift-off, then at low height, and at medium height (300 feet agl), then student practice from only medium and higher heights with full briefing before each flight)

Ref: SOAR Chap 3 pp 75

- For cable breaks on takeoff below 300’ agl always plan to land straight ahead.



- For aerotow cable breaks between 300’ and 500’ first option is landable areas ahead or a turn back the runway. Turn into wind. On a winch launch land straight ahead as most of the runway will be available.



Safety

- Many accidents from gliders attempting to turn too low after rope or cable breaks. Not lowering nose and banking before air speed has built up, striking wing on ground in the turn, striking obstacles in the turn. You must know your take off area and landable fields beyond the runway and what hazards exists. Walk to far end of runways and visit fields beyond runway within gliding distance of rope break and check for hazards.

- Always get a local checkout at new aerodromes and visit the areas before flying.

- Caution for tailwinds for slowing too much or for a ground loop when landing.

- Turning into x-wind is better for low level breaks around 300' as the wind will drift you back over the runway. Turning with wind could put you too far to reach runway. If tow pilot flies an offset to correct for this (up wind) it may be better to turn down wind.

- Partial or full Power loss on tow plane can catch you unprepared. If tow plane acceleration feels weak and you are not airborne by mid field or your calculated lift of point, pull the release and land straight ahead or slightly right to avoid the tow plane who should be going to the left. Stop short as safely possible as it has happened that once the emergency seems over the tow plane taxied across the runway in front of the glider causing a collision.

- On winch loss of power has also led the pilot too stay on winch and slow down into a mushing stall. Lower nose immediately to maintain approach speed and plan to land. If well above the winch cable release is possible but in the early launch (phase 1) before the climb and there is still some power on the winch, releasing low will cause the parachute to open in front of you with potential of glider flying into the open parachute.

Human Factors

- Looking in cockpit on takeoff or distracted by window vent adjustment, reaching for ancillary control, or loose canopy has led to emergency condition created by pilot.

- Not having a plan once, the pilot has voluntarily pulled the release for an emergency. Make yourself familiar with the location of the release before each flight and review the top ten reasons you might release in your head.

- Illusions created by drift (Skid). Yaw string straight or slightly slipping turn safest.

- Tendency in turns back to the field to go for button to land short. This is not necessary and creates a hazard with "S" turns at low altitude.

STAGE 21 – Practice Lessons

Pay special attention to:

- Lookout & Collision avoidance
- Maintaining approach speeds and coordination of low altitude turns
- Recognizing when flying too slow and early recovery
- Stall, wing drop stall, spin, and spiral recoveries.
- Landing skills and dealing with bounced landing, PIO, too high a descent rate before round out.

Safety

Review with student their answers to following questions:

- How would you deal with control failures? Ailerons, elevator, or rudder? Air brakes?
- Explain how you crab a glider?
- What is the risk of using only rudder to point the nose?
- Explain the causes/scenarios for ground loops?
- You land long and are going to run into a fence what do you do?
- Explain tow plane upset. How can you prevent it?
- What do you do if the canopy opens after lift off?

Human Factors

- Do you recognize your own limitations?
- When something does not go right, do you make excuses?
- When you do something, and you do not get the response you expect do you freeze up or work through it? If you do A and B results, do you see it will lead to C?
- Can you describe what internal pressures are and external pressures are?

STAGE 22 – First solo

Review: all emergency signals and emergency procedures

- Make sure your paperwork is up to date student pilot permit and medical validation and your pre solo exam is completed and corrected to 100% and your PTR has been signed it has been completed.

- Review your PTR to see you have completed all the necessary training.

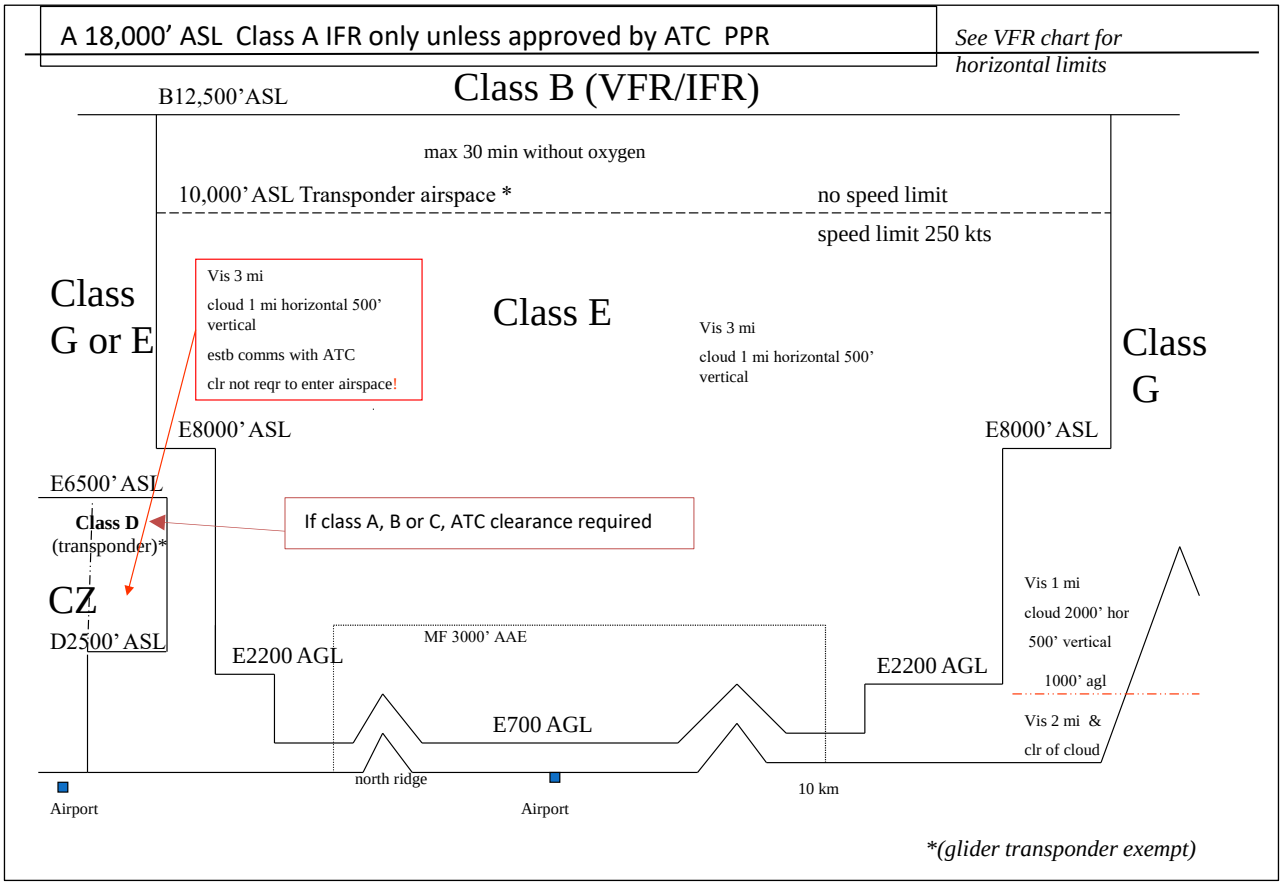
Safety

- Weight and balance when solo without the instructor will make the glider more pitch sensitive. Consider adding nose ballast or seat ballast to reduce this effect and be prepared for it. Anchor arm on lap and use wrist action to control stick to avoid PIO.

- On your first solo follow your instructor's instructions. They will likely be along the lines of taking a normal tow and making a few turns and staying near the airfield **upwind** but focusing on making a good proper circuit and landing.

- Your instructor will monitor your solo flight by radio so if you have any difficulties call down for assistance.

Airspace Review



Human Factors

- The first solo will likely come when your instructors have determined that you have the knowledge and skill to fly safely and have the judgement and self -discipline to make the safe decisions in flight.

- They will be looking to see if you anticipate potential problems and that you can see the consequences of your actions or inactions. Are you still nervous about flying, can you cope with unanticipated events (stress reaction)? What is your attitude towards safety and responsibility with the aircraft? Review the SAC *Recommended Standard for Glider Pilots* on the SAC website.

- Other factor affecting decision to solo include pilot's attention to detail, responsibility, and self-evaluation.

STAGES 23-25 Post Solo Exercises

Review: Any exercises to be flown should be reviewed

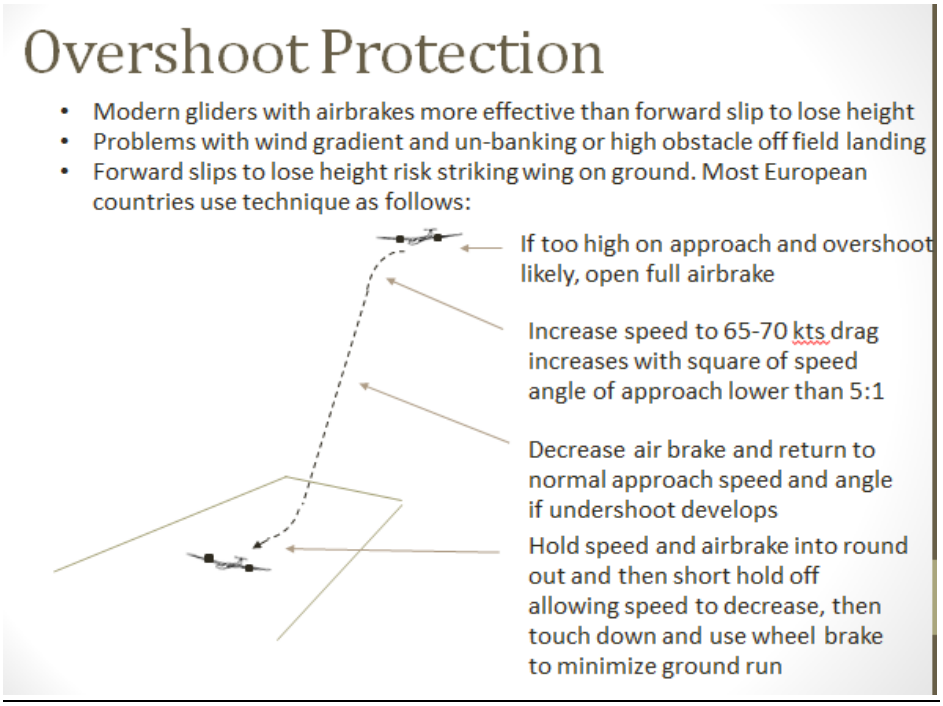
- Post solo phase is the consolidation phase. Any advanced exercises not done before solo should be completed. Any upper air work and all emergency procedures should be practiced with student.

- Ratio of one dual to every four solos should be anticipated. The advantage here should be that whenever conditions are challenging the student should take a dual flight to consolidate skills necessary and not attempt to fly only on benign days. The flight test may be conducted under challenging conditions and some students have found themselves ill prepared for these conditions.

- This is the time to review the SAC Standards for Glider Pilot Licence on the SAC web site. Prepare for the test by asking other instructors to review the exam contests and requirements with you in flight.

- The post solo is also a good time to practice scenarios that one might find themselves in and discuss how a pilot might deal with them (PDM) such as getting lost, x-winds exceeding aircraft limits, disconnected or otherwise inoperative controls, C of G problems, instrumentation malfunctions, canopy opening in flight, malfunctioning release, insect/pest in cockpit, forgotten procedures, loose object in cockpit, loss of VFR contact with ground, air sickness, vertigo, too low to reach intended landing point, overshooting intended landing point, panicked passenger, mid-air collision avoidance, and out-landing survival.

- Look at Dealing with emergencies presentation on SAC web site. See suggested flight exercises.



This exercise is primarily for off field landings when trying to land in a short field that you are going to overshoot.

Any time during the descent the glider reaches the normal approach angle, a normal approach should be resumed by raising the nose to the normal approach speed & reducing the airbrakes to roughly ½ (for normal 300-500 fpm descent rate)

Safety

- If not done so already you should take the time to review SAC annual and club safety reports. These will give you an idea of mistakes and problem areas for pilots. It is better to learn from the mistakes of others than make them all yourself. You should also be looking at the SAC checklist for Safety Training and attempt to complete the checklist before licence test flight.

Human Factors

- Heuristic traps – heuristics are rules of thumb we use to accomplish complex tasks. In our minds we develop a slice of metrics we use to make analysis of issues to come to quick decision. E.G., a rule of thumb is that if glider is not airborne by mid field abort the take off. Normally these decisions serve us well and you have likely been developing these rules as you learn to fly. However, there are some traps in doing this that we should be aware of as they have played a role in pilot decision making (airmanship) and aviation accidents. Before licencing you will be evaluated for vulnerability to heuristics traps:

- **Familiarity** – The more often we do something the more it becomes a comfortable action despite there being new information on a hazard or risk. E.G. if training for rope break at 300' you always make a 180 you will likely do so despite head wind and 5000' runway remaining.
- **Consistency** – once a decision is made it is easier to stay with that decision despite new information, EG pushing a final glide, or weather.
- **Acceptance** – doing something to get accepted by others (particularly younger men with women) despite the hazard/risk. E.G. competitive, aggressive or risk taking, such as aerobatics or low flying with passenger.
- **Expert halo** – following a leader of a group decisions because of their assertiveness or perceived expertise. It may not be a good decision. E.G. Experienced glider pilot leaves a thermal too low, but the others follow because he must know something they don't.
- **Social facilitation** – group decisions are enhanced risk with more skills of the group despite factors to the contrary. E. G. a group of contest pilots may decide to push weather when individually they might not make that choice.
- **Scarcity** – tendency to value opportunities in proportion to the chance that they may be lost. E.G. Pilot flying a MG may be more willing to take risks over hazardous terrain rather than lose the value of having spent so much money for the capability of a motorized glider.