Soaring Association of Canada

INSTRUCTOR HANDBOOK

2003 April

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Address

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SOARING ASSOCIATION OF CANADA

INSTRUCTOR HANDBOOK

(Used to be called Instructor's Air Notes)

INDEX

FLIGHT TRAINING & SAFETY COMMITTEE

First issued 2003 April

Reference Documents:

SOAR and Learn to Fly Gliders, the Soaring Association's student glider pilot manual, 2002 March.

Soaring Instruction Manual, the Soaring Association's instructor guide, 2003 March

INTRODUCTION

This Handbook has been derived from the original Instructor's Air Notes and it contains important changes and additions that were being introduced in late 2002 and early 2003. Instructors are encouraged to discuss this with their CFIs and other instructors who have received this material. A shortened version of this handbook is available, known as the Instructor Pocketbook. The Pocketbook should only be used in the air when the instructor is thoroughly familiar with the more detailed notes in this Handbook, and has been instructed in and has satisfactorily demonstrated competence at giving all the lessons and exercises.

The notes in this book start with typical words and phrases that instructors are encouraged to use when instructing in the air. Later exercises are described in sufficient detail to remind instructors of the demonstrations and exercises to be practised, but are not necessarily the words to be used in the air. This is increasingly left up to the instructor.

Changes in words and designations are designed to improve the teaching of the exercises and to facilitate better and safer piloting. In particular we introduce changes to the teaching of the circuit, the stall and spin, the latter two to emphasise avoidance of stalls and spins. The changes follow detailed discussions by the Flight Training and Safety Committee and the OSTIV Safety and Training Panel. Note that these changes will be in effect from the instructors' course run in late 2002 and will have been introduced to all CFIs at the start of the 2003 season.

The wording for the points in the circuit are now **High Key Area** compared to the initial point, or Goal # 1, used previously. The word Key is used to denote a critical *decision point*. The downwind leg starts after the high key area and ends at the **Low Key Point** (previously Goal # 2) at between 500 and 600 ft agl when opposite to, or abeam the **Reference Point – RP –** that was previously called the aiming point. This is still the point at which the glider would hit the ground if it were not rounded out. The change in name is to avoid the tendency of pilots to aim the glider by pointing at the ground using the elevator. They should instead correctly use the airbrakes to adjust the glide path at a constant approach speed.

The standard circuit pattern has been revised to include a **diagonal leg** that cuts off the corner between the downwind and base legs. It is considered a safer pattern for gliding operations in general when compared to the rectangular pattern. It is now being adopted in the Association's training manuals. (This circuit is becoming or is already the standard in several European countries).

The instructor will be transferring responsibility gradually to the student throughout his or her training. A suggested sequence or guide for each flight is given in the notes for the first several lessons. These guides specify who performs which function, e.g. instructor in control and gives demonstrations, student following through or not, followed by student given control to practice while

instructor prompts and monitors. During later flights we expect the student to be performing all functions, so we suggest no particular sequencing. Instructors must be aware of how the student has progressed, ensuring basic skills have been grasped before adding new skills in subsequent lessons.

A number of smaller exercises have been added to the curriculum. These will help students to advance quickly by being taught in a logical sequence. All recommended exercises are listed in the new **Pilot Training Record – Gliders (PTR)**. Notes are included in this and the instructor's manual for the instructor's guidance to judge when the student would be ready to proceed to the next exercise or lesson. This is important, for example, when first trying the aerotow or the approach and landing, when starting either Stage too early can unnecessarily stress the student.

Modern gliders will have their airspeed indicator marked with a bug at the minimum recommended approach speed. This should be followed and used for zero wind conditions, adding extra speed for light and stronger winds as appropriate, according to the formula:

Approach speed = 1.3 Vs + Vw
Where Vs is the stall speed, and
Vw is the max wind or gust speed.

As is now the practice, this approach speed to fly should be selected at the A – Airspeed item in the pre-landing **SWAFTS** checklist. The speed should be no less than 45 knots (50 mph) or less than the bug speed shown on the ASI. Pilots must be taught to adjust to local conditions such as at wave sites that require special caution. In all cases, whenever a pilot flies another glider for the first time he or she must also be taught to refer to the pilot operating handbook for that aircraft.

The recommended sequence for the flight training to first solo is shown next in a list of the lessons or exercises to be included at each stage and thus the progression from one stage to the next. The list is included in the student's PTR. Most importantly the list shows skill requirements or pre-requisites that should be reached before the next lesson or exercise is taught. For example, for sideslipping at Stage 13, more than one flight will be needed to achieve an acceptable skill level. All instructors should be familiar with and follow this sequence. We must realise that only an exceptional and persistent student may be able to complete the training satisfactorily in a minimum number of about 30 flights. Most student pilots would be expected to take more than this to solo, and this will depend of course on many factors such as the pilot's initiative, age, frequency of flying, and of course the consistency of instruction. It is more important to remember that it is the exercises that have to be completed and the relevant skills acquired before first solo, not a set minimum number of flights!

Comments are always of use and interest to the Flight Training and Safety Committee. If you have some, please contact any committee member.

RECOMMENDED SEQUENCE FOR TRAINING PROGRAM TO FIRST SOLO

Pre-requisites are shown in square brackets. The student pilot should achieve the skill levels shown in these brackets before the new skills are taught at that Stage. All students should practice each exercise or skill after it is first demonstrated. This must extend into several subsequent flights. For clarity this is not shown in the detailed listing below.

Skill levels:

1. Preparatory Ground Instruction and Demonstration; Instructor had to take control for Safety reasons;

2. Student able to perform manoeuvre with physical (& verbal) assistance;

3. Student able to perform manoeuvre with only verbal assistance and the manoeuvre contains non-critical errors;

4. Student able to perform manoeuvre with no verbal or physical assistance with only non-critical errors, i.e. only minor deviations from the standard;

5. Student Flying Standard – Satisfactory for Solo; manoeuvres flown with precision, no assistance, no errors, no judgement or decision-making errors.

Stage #	Lesson Skills and Exercises	Pre-Requisites
Famil.	Instructor introduces CISTRSCO and LOOKOUT.	
1	Demo Interior and Exterior Inspections; Demo CISTRSCO and LOOKOUT; Primary Effects of Controls - Elevator, then Ailerons (and Rudder) to perform Gentle Turns entry and exit; Control of Speed	
2	Aileron Drag; Continuous Turns; demo SOAR technique	
3	Stability; primary Effect of Rudder; The Trim; SOAR Continuous Turns; Demo SWAFTS (including radio call)	
4	Reduced-g; Slow Flying; 1g Stalls; Turning to a Heading; SOAR SWAFTS.	
5	Medium Turns Thermalling Technique and Protocols Straight Flight (towards a reference point on horizon)	[Effects of Controls & Turn Coordination – 3]
6	Demo Takeoff & Aerotow/Winch Launch Effects of Airbrakes at height Approach Control using Airbrakes & Overshooting and Undershooting Demo Landing	[Medium Turns – 3] [Speed Control – 4 & Straight Flight – 3] [Effects of Airbrakes – 3]
7	Practice Takeoff and Tow/Winch launch Turns; Lookout, Straight Flight; Stalls; etc. Approach and Landing (from high Final Turn) Thermalling*;	[Medium Turns – 4] [Medium Turns – 4; Effects of Airbrakes – 3] [Overshooting & Undershooting – 3]
8	Steep Turns & Advanced Thermalling* Demo Circuit Planning Practice Approach and Landing	 [Approach and Landing – 3] * for note see page 5
9	Steep Turns, Thermalling* Demo and Practice Collision Avoidance Flying the Circuit (normal Final Turn Height); Use of Radio	[Medium Turns – 4]
10	Spiral Dives and Benign Spiral* Zigzag in Downwind exercise	[Steep Turns – 3] [Circuit Planning – 3]
11	Boxing the Slipstream; Low Tow; High Tow Further Stalling exercises (Climbing, Descending, and in a Turn)	[Aerotow – 3] [1g stalls – 3]

12 Rope/Cable Break Recovery Technique at altitude
Effect of Angle of Bank on Stall Speed [Further Stalling – 3]

13 Slack Rope on Aerotow & Rope/Cable Break Recoveries at altitude
Sideslipping at altitude exercises
Abbreviated Circuit [Circuit Planning – 4]

14 Tug Upsets & Emergency Aerotow Procedures
X-Wind Takeoff; Laying Off for Drift on Winch
Sideslipping & Sideslip on Approach [Sideslipping – 3]
Illusions created by Drift; X-Wind Landing

15 Descending on Tow* [Aerotow – 4]
Spins – Comparison to Spiral Dive [Spiral Dives – 3]
Airbrakes fully open before Circuit ex. [Circuit Planning – 4]

16 Further Spinning exercises*; Changing Effect of the Rudder
at the Stall; Spin Left off a Right Turn, etc. [Spins – 3]

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

18 Rope Break demo at 500 ft + agl [Rope/Cable Break Recoveries – 4]
Abbreviated Circuit [Abbreviated Circuits – 3]

19 Off-field Field Selection and Circuit Planning

20 Rope/Cable Breaks flights (demo first at lift-off, at low height,
at medium height (300 ft agl), then student practice with full briefing
before each flight) [Rope Break demo at 500 ft – 1]

21 Review and Practice all manoeuvres and skills

22 First Solo flight [All identified exercises and skills – 5]

23 Post-Solo: [dual flight after every 4 flights max.] Review basic
manoeuvres, upper air work, incl. descending on tow, Slipping Turn
onto Final, etc.

24 Upper air: Post-basic training exercises, Review of flight test elements

25 Upper air work: Review spins and spin avoidance, slips, etc.,
advanced thermalling, etc., off-field field and circuit selection

26 Flight test review and recommendation [All exercises and skills – 5]

FAMILIARIZATION FLIGHT

1) INSTRUCTOR demonstrate **CISTRSCO*** (*see note on next page) pre-take-off checklist, performs the TAKE OFF and TOW.

2) **WITH AB-INITIO STUDENT**:

a) Point out landmarks, airfield, and other points of interest outside cockpit as flight progresses;

b) Student to look at the rope, and then pull release (only allow student to pull release after careful explanation and cautions before takeoff);

d) Introduce importance of LOOKOUT before all turns and throughout the flight, and identify aircraft as you see them during the flight;

e) Let student try controls briefly after briefing; (include protocol for "I have control" and "you have control");

f) Describe operation of air brakes, and explain landing.

3) **WITH POWER PILOT**:

a) Explain difference in controls and instruments, including requirement for more positive use of rudder for turn coordination;

b) Point out lack of noise and vibration;

c) Let him or her handle controls in free flight; linked turns are a good coordination exercise;

d) Emphasize importance of LOOKOUT because of frequent close proximity to other gliders, especially in thermals;

e) Discuss lack of need to concentrate on instruments by emphasising use of horizon;

f) Describe operation /use of air brakes and need to change attitude, and practice using now at altitude (above circuit height);

g) Describe landing procedure and warn that the flare is much closer to the ground and that following rotation, the nose is held at a more level position compared to power aircraft.

4) **INSTRUCTOR APPROACH, LAND** and **ROLL OUT.**

5) **REVIEW OF THE FLIGHT**

Ask how your passenger enjoyed the flight, and provide a positive review of the flight and make him or her want to come back for more flying!

COCKPIT CHECKS

On ALL flights instruct all students to perform:

1) **Exterior** inspection or pre-takeoff **Walk-Around** check to include inspection for damage, & removal of tail dolly and control locks;
2) **Interior** inspection for seat adjustment and removal or addition of ballast as required, loose objects;
3) After getting in and only after attaching and tightening the lap belt and shoulder straps, perform **CISTRSCO*** check;
4) Part of the pre-takeoff checks is the hook up of the winch cable or aerotow rope. Make sure you thoroughly brief the student on the full procedure for the first few flights, then ensure they go through the procedure themselves on all subsequent flights;
5) Student to ask wing runner "all clear above and behind?" When a positive answer is received and the student is sure the runway is clear he is to initiate the takeoff; instructor monitors all above;
6) After release from the tow or winch, perform **Post Release Check**: "rope/cable gone", turn right, adjust speed, raise wheel, re-trim and confirm airfield location.
7) Prior to stalls, spins, etc., **CALL** check,
8) Pre-landing **SWAFTS** check; also
9) Emphasize LOOKOUT technique throughout all flights; emphasize need to avoid distractions, e.g. setting GPSs;
10) Check that student is looking out adequately, point out other aircraft as they are seen, and use sightings to discuss collision avoidance.
11) Emphasize **LOOKOUT** and **SOAR** techniques throughout all flights; emphasize need to avoid distractions, e.g. setting GPSs;
12) Use sightings of aircraft close by to discuss **collision avoidance**.

* **O**ptions item in the CISTRSCO checklist: Before the first flying lesson, discuss some of the factors that dictate decision-making that will be needed immediately following a premature launch interruption. These may include wind direction and strength, landing areas available immediately on/off the airfield, obstacles, alternative options and actions, and so on. Emphasize that the options and needed actions will be taught as part of later lessons throughout the student's training.

CONTROL EFFECTS - 1
& COORDINATED GENTLE TURNS

1) Instructor go through all ground signals for launching, including **STOP** signals, then demonstrate **Exterior or Walkaround** and **Interior** inspections, then enter the cockpit and prepare for takeoff.

2) Instructor perform **CISTRSCO** checks, ensure runway is clear of hazards, then take off and tow. Student does NOT follow through.

3) **LOOKOUT**. Teach how to scan NOW during the first tow or immediately after release from winch launch; start the scan by focussing on the wing tip opposite to the intended direction of turn, to wing tip in direction of the turn, then **above** and back down to the horizon directly ahead.

4) Instruct student to look at rope, pull release, visually **ensure** the rope has gone, call "rope gone", turn right as speed is adjusted (do NOT teach climbing turns), level the wings, raise the wheel as appropriate, re-trim, and confirm location of the airfield.

5) **ELEVATOR controls PITCHING**. Look ahead to notice relationship of horizon and nose, the amount of ground visible over the nose in the *normal gliding attitude* – ask student to read ASI. Then ask student to follow-through;

a) Move stick forward, nose goes down, more ground ahead is visible, and the glider speeds up, also note slow response (slow acceleration) of the glider;

b) Move stick back, nose rises, less ground is visible ahead, glider settles into a new attitude, and slows down;

c) **Lower** the nose to the normal attitude;

d) Direct the student trying this **effect of the elevator**.

6) **COORDINATED GENTLE TURNS**. Start by flying with wings level. LOOK OUT first, then

a) Look ahead over the nose to the horizon; to **roll** into a left turn:

b) Use **ailerons** to the left to bank the glider, and simultaneously press left **rudder** pedal;

c) When desired angle of bank is reached, stop the rolling by centralizing the stick and rudder together;

d) Maintain or control the angle of bank in the turn by using stick and rudder together, and

e) Maintain or control the pitch attitude as before, by raising or lowering the nose with the elevator;
f) To roll out of the turn, look **under the high wing** then **ahead**, and if all clear, level the wings using stick and rudder together, and centralize both when wings are level – direct the student's practice.

7) **CONTROL OF SPEED** - Fly in the normal gliding attitude, student flying - Ask student to read ASI.
a) Lower nose and hold new attitude, note ASI, also note the glider takes some time to increase its speed [slow response because of glider's inertia].
b) Raise nose and again hold new attitude; note ASI.
c) Demonstrate attempts to control speed by watching ASI only; use this demonstration to emphasize that best method to control speed is to control the pitch attitude.

8) **PRIMARY EFFECT OF RUDDER - RUDDER controls YAWING** Student follows through on rudder pedals only; look ahead to a reference point on horizon (e.g. water tank);
a) Apply rudder one way and hold for a few seconds only and maintain wings level;
b) Ask student to notice the yaw relative to the water tank, but emphasize that **the glider does not turn**. Notice yaw string shows glider is slipping; then centralise the rudder.

13) Allow student as much time on the controls as possible, including some of the circuit, directing him/her to perform frequent good LOOKOUTS, to turn and to change speed as required. [Do NOT discuss circuit planning when he is flying in the circuit at this early stage!]

14) Introduce **SOAR** technique at this time; i.e. discuss the decreasing height, the location of the glider, and the need to decide when to return towards the airfield.

15) Instructor perform **SWAFTS** check verbally – not a demonstration until the next flight – then take over control before *low key point* for balance of flight; after landing and roll out.

16) **REVIEW** flight.

CONTROL EFFECTS - 2
AILERON DRAG & MORE TURNS

1) Student to do CISTRSCO checks, instructor supervises; instructor does takeoff and tow. On tow develop student's height judgement and lookout technique; review topographical features near club. Teach the **rules of the air** and methods to avoid other aircraft.

2) Student performs LOOKOUT, looks at rope, releases, calls "rope gone", then instructor turns right, adjusts speed, raises the wheel, then re-trims (see page 12); student confirms location of field.

3) **LOOKOUT**. Before every turn, remind student to perform LOOKOUT; Take control if he forgets and re-start the exercise.

4) **AILERONS control ROLLING**. Review this primary *effect of controls* now, student **follows through**;

a) Note glider is flying with wings level (refer to sides of cockpit or instrument panel relative to horizon). Move stick and rudder to left – glider rolls to the left, stops when controls are centralized.

b) To roll the wings level again, move controls to opposite side; centralize the controls when the wings are level.

c) Point out primary effect of ailerons is to roll the glider.

5) **AILERON DRAG**; Choose a horizon reference point ahead, student continues to **follow through**;

a) Move **stick only** to left, glider's nose (initially) yaws to right; this is ADVERSE YAW caused by aileron drag; **

** Demo only; student should NOT practice this, see page 13, note 2.

b) Use both controls to correctly roll to left, nose also swings simultaneously to the left;

c) Level the wings using stick and rudder together; and centralize the controls as the wings come level.

6) **MORE ON TURNS**

a) There are three stages to any turn: rolling in, staying in and rolling out. With the student **following through**;

b) To enter a turn to the right .... first perform good **lookout** as before;

c) Then, looking straight ahead to the horizon, roll into the turn using ailerons and rudder together;

d) Stop the bank increasing with ailerons and rudder together at the desired angle of bank;
e) To stay in the turn, keep the attitude constant with the elevator and notice how the nose moves steadily around the horizon;
f) Continue to keep a good lookout particularly in the direction of the turn and along the horizon;
g) To roll out of the turn, make sure the areas **ahead** and **above** , to **both sides** and **under the high wing** are clear of other aircraft; look ahead to the horizon, and;
h) Level the wings using ailerons and rudder together; relax the backpressure on the stick, and centralize the controls as the wings come level.
i) Direct the **student to practice** a series of turns as in 7 a) below.

7) **STRAIGHT FLIGHT**. Select and fly towards a reference point on the horizon.
a) Use a series of shallow coordinated turns to fly towards reference point, using ailerons and rudder together; limit change of direction to about 30^{o} either side.

8) **PRE-LANDING CHECK**. As you allow student as much time on controls as possible, introduce student to the pre-landing checklist before arriving at the high key area, see below; allow student to continue flying as appropriate, but watch that he does not become distracted from flying.

a) Demonstrate a quick and efficient **SWAFTS** checklist and don't forget to lower the **w**heel (or gear). On the next flight you will need to start the student 's first attempt at going through this checklist much earlier than when flying directly to the **High Key Area.**

9) Allow student to fly as much as possible, talking him or her around the circuit but DO NOT discuss circuit planning at this stage. Instructor take over control at **Low Key Point**, approach and land;

10) **POST-FLIGHT REVIEW**.
Review important points first; lookouts and the main points of the lesson. Review rules of the air and collision avoidance. Also discuss functioning and errors of the ASI and pitot/static port system. Ask for feedback and leave student in a positive frame of mind.

STABILITY, The TRIM
& FURTHER EFFECTS of CONTROLS

1) Student to do **CISTRSCO**; Instructor take off and tow. Develop student's lookout technique; indicate other aircraft. Before release direct student to perform lookout, look at rope, then release, call "rope gone", turn right, adjust speed, level the wings, raise wheel as appropriate, then re-trim; student confirms location of airfield.

2) **STABILITY**. **Directional stability** - Instructor **demonstration only**. Pick horizon reference point; Student does **NOT** practice; see p. 13.
a) Press right rudder pedal slightly - nose yaws to right;
b) Centralize rudder - nose swings back – caused by directional stability or *weathercock* stability of the glider.
c) **Pitch Stability –** Instructor fly in normal gliding attitude with glider trimmed; student **follows through**.
d) Let go of stick - glider continues to fly by itself - it is stable;
e) Move stick forward a small amount and let go - it returns to its original attitude because it is stable; then **student to practice** this.

3) **THE TRIM**. To teach student correct use of trim, direct the **student to fly** in normal gliding attitude;
a) To increase speed, lower the nose and hold the new attitude;
b) Notice a force has to be applied to stick, read the ASI;
c) Adjust the trim to reduce the stick force to zero, check ASI and ask student to read the speed;
d) Direct student to adjust to new speed, and re-trim; Point out that for each attitude there is a corresponding speed, and for each change of attitude/speed, the glider should be re-trimmed.

4) **FURTHER EFFECTS OF RUDDER**. Instructor **demonstration** only: Student does **not** follow through; see notes on next page.
a) Keeping ailerons centralised, apply right rudder, glider initially yaws to right, left wing speeds up and generates more lift, glider rolls to the right;
b) Continue to apply rudder, glider skids, note yaw string, left wing generates more lift because of the glider's lateral stability or *dihedral*, glider continues to roll;
c) Return to level flight by using the controls normally, stick and rudder together.

5) **FURTHER EFFECTS OF AILERONS.** Instructor **demonstration** only: Student does **not** follow through. This demonstration must be performed in very still air to be effective.

a) Roll to a banked attitude as if entering a medium turn, re-trim, then centralise the controls and allow the glider to fly hands off. Ask the student what happens next.

b) The extra drag of the faster-moving upper wing will initially yaw the glider away from the turn; it is this yaw that is called the further effect of ailerons – note the effect can be very subtle! It should not be confused with aileron drag (the ailerons are in fact centralised so they cannot produce unbalanced drag).

c) The nose will next yaw down towards the lower wing and the airspeed will increase unless the pilot takes over control. Return to wings level flight with normal use of the controls, then re-trim.

6) Student to **take over control** to practice turns, and use of **SOAR** under guidance of instructor to decide when to return towards airfield, and to do pre-landing **SWAFTS** checks. Start well before the **High Key Area** on these first attempts – aim eventually to go through this checklist efficiently and quickly.

7) **PRE-LANDING**. Student may fly in the circuit, but as prompted, instructor approach and land. Instructor **demonstrates radio call** at **T**raffic item in checklist above. Student to practice on the ground after the post-flight review.

8) **POST-FLIGHT REVIEW.** Briefly review the *stabilities* and *collision avoidance*, and discuss the student's flying practice.

NOTES to Instructors

1. Note that only directional (or yaw) and pitch stability are covered in the previous lessons. Lateral stability is difficult to demonstrate in a simple rolling motion, so discuss this effect on the ground!

2. The student should not be asked to use a single control by itself any longer than needed to feel its effect, e.g. to repeat the aileron drag demonstration. This avoids developing the bad habit of NOT coordinating all three controls together (note – law of primacy).

UN-ACCELERATED STALLS & RECOVERY, SLOW FLYING

The stalls are to be un-accelerated or 1*g* stalls; demonstrate these stalls to show the symptoms first, then the stall and the recovery. Emphasize to the student that the primary objective of the stalling exercises is to learn how to recognise the symptoms, and then to avoid stalling.

It may be inadvisable on the first stalling lesson to cover all exercises listed here. These flights may be from higher than normal tow heights.

Height must be above specified minima after recoveries. Centre of gravity of glider must be within limits. Lightweight pilots are to add ballast that must be adequately secured against coming loose under **all** conditions, including **negative-*g*** loads.

1) Student does **CISTRSCO**, instructor supervises; discuss **O**ptions and look for hazards on runway; instructor performs takeoff and tow/launch; if reduced-*g* exercise has not been done, include it on this flight.

2) During tow keep looking around; student to perform LOOKOUT, release, turn right, adjust speed, level wings, then raise wheel and re-trim, student confirms location of airfield.

3) **REDUCED-*G* SENSITIVITY.** Instructor demonstrate **CALL** check. Check the susceptibility of the student to reduced-*g* sensations before the stall exercise is started.

a) Describe this exercise as you do it, but Do **NOT** allow student to follow through;
b) From the normal gliding attitude, increase speed by lowering the nose to about 15^{o} nose down (if student reacts very adversely to this, stop the exercise);
c) Continue the *pushover* to about 30^{o} nose down and carefully watch student's reactions;
d) Pull up into a climb; then pitch the glider down to the normal gliding attitude as the speed drops. This should allow you to assess adequately the sensitivity of your student. If student is in any way sensitive to reduced-*g* make a notation in the Pilot Training Record, PTR, for other instructors to see;

e) Explain that, even under reduced-*g*, the glider is flying; it is not stalled, and the first pushover **can be stopped at any time**; relate the feeling to that of the *falling* feeling at the stall, which cannot be stopped until the glider had regained speed.

Use similar manoeuvres to de-sensitize the student on subsequent flights, eventually getting students to do the manoeuvres themselves.

4) **SLOW FLYING**

a) Student to follow through during initial demonstration. Instructor raise the nose a little above normal to demonstrate the **symptoms** of the approaching stall;

b) The airspeed begins to reduce, noise changes, note changing response of the glider to the controls, and extra back-pressure needed on stick to hold nose up (ask student to feel this force by handing over control briefly);

c) Continue to fly slowly **using all controls normally**; note the nose-high attitude and the speed at which buffeting is felt;

d) To recover to normal flight, lower the nose, check the ASI reading (is it increasing?), look ahead to the horizon and return to the normal gliding attitude.

e) Student repeats separately for a couple of symptoms, identifying the symptom, then recovers to normal gliding attitude in each case.

5) **UNACCELERATED OR 1G STALL**. Student does not follow through on initial demonstration – perform CALL check;

a) Raise the nose slightly above normal (make sure it does drop);

b) In spite of attempts to hold nose up (hold elevator against the stop and mention this), it drops; note the ASI reading at the stall;

c) To recover, *lower the nose*, check the ASI reading, look ahead (**up**) to the horizon and return to the normal gliding attitude; Note the height that has been lost.

d) Repeat and allow/make one wing stall first - comment on it - to recover, *lower the nose*, check ASI, look ahead and level the wings with ailerons and rudder together **but only after** speed increases above the 1*g* stall speed, then return to normal gliding attitude;

e) Student repeats above stalls without and with a wing drop.

NOTE: **Power pilots** need to be watched; they are likely to push the stick fully forward when initiating a stall recovery unless carefully briefed!

6) **STALLS in a TURN**. Perform CALL check.
a) Repeat 5) above but with the glider in a typical gentle turn, again without and with a wing drop.

7) **MUSHING STALL**. Student may be talked through this exercise.
a) Raise the nose slightly above normal so that speed reduces but the nose does not drop;
b) Ask student to identify when each symptom is felt or noticed;
c) Emphasize that this is a stall, in this case a *mushing* stall when the nose does not pitch down; point out the high sink rate;
d) Recover to the normal gliding attitude by lowering the nose, etc.

8) **STALL** with **AIRBRAKES or SPOILERS OPEN**, as for 5) above;
a) Note symptoms of the stall and note higher stall speed;
b) Recovery to include closing brakes/spoilers.

9) **BALANCE of FLIGHT**
a) After the stall exercises, return to practising rolling into and out of turns with *stick and rudder together*; more continuous turns will be used by the student to fly towards the high key area, re-trimming in each case to maintain steady speed in the turns. Gradually make the student fly at increased angles of bank up to 30°.
b) Keep student looking out, during and prior to all turns.

10) **SUBSEQUENT FLIGHTS**
Take every opportunity to review and perform stall recoveries from different situations as above, emphasising stall avoidance when the first pre-stall symptom is recognised. A useful exercise is to practice slow flying and gentle turns, noticing some of the pre-stall symptoms but avoiding a full stall.

11) Instructor plan circuit, student fly in the circuit to *low key* point, instructor then take over control for balance of circuit and landing.

12) **POST-FLIGHT REVIEW**. Go over the stall recovery sequence and the importance of unstalling the wings as the first essential action. Include a review of the **compass**, how to swing and use it, and its errors.

NOTE to Instructors: Refer also to **Further Stalling Exercises**, in which accelerated stalls and recoveries will be covered – see page 50.

This page for Notes

MEDIUM TURNS & THERMALLING

1) Student performs **CISTRSCO**; Instructor performs take off and tow. Student performs lookout and release, then takes over control, and does checks.
2) A **major objective** in this exercise is to produce pilots who are firm in their use of the controls, to roll briskly into and out of medium turns (30 to 45 ^{o} angle of bank) with conviction and confidence.
3) Before turns exercise, perform **lookout –** scan on *both* sides, then *above* and to the front. Faults in turns often start from inaccurate flying before entry; start from a well-balanced straight and level attitude and looking straight ahead.

4) **ROLLING INTO TURN**:
a) Look ahead to point on horizon – see note below – increase speed slightly (from now on always teach the student to lower the nose slightly – it should be a deliberate action – as they start any medium turn). Then roll into the turn to about 30 degrees angle of bank, using firm control inputs.

5) **STAYING IN**:
a) Look well ahead to horizon to judge angle of bank; control bank angle using stick and rudder together;
b) Maintain a good **lookout** around the horizon; avoid looking down during the turn;
c) Keep speed constant by maintaining constant pitch attitude, with nose of aircraft in a level sweep around the horizon; the yaw string should be straight; re-trim to remove backward stick force.

6) **ROLLING OUT**:
a) Look around for other aircraft, including **under** the high wing, look ahead then roll out of the turn; and
b) When flying straight and level, ease off backpressure on the stick, and re-trim.

NOTE to Instructors
Judge how much rudder input to use when rolling into a turn by watching for *adverse yaw*. Not enough rudder input, nose yaws away from intended turn; too much rudder and yaw starts before the glider begins to roll.

7) **FAULTS IN MEDIUM TURNS**

a) Failure to perform adequate **lookout**; immediately take over control to prevent the turn, and to emphasize the need to perform a lookout before turning. Complete the lookout, then start the turn.
b) Slow rate of roll; can lead to poorly coordinated turns that are potentially dangerous.
c) Angle of bank varies; judge by reference to angle between the horizon and the top of the instrument panel or cockpit sides;
d) Angle of bank increasing or decreasing in turn; need to recognise these, and to avoid **ruddering** the glider round the turn when bank tends to decrease.
e) Speed increases (nose drops) because of insufficient stick backpressure or nose-up trim. Refer to pitch attitude relative to horizon, and when correct, re-trim; listen to the sound.
f) Over or under-ruddered turn entry; See above note to instructor to correct this fault. Slip or skid in a steady turn (incorrect rudder) is indicated by yaw string.
g) Check slip or skid by reference to yaw string or ball; if the string attachment location on the canopy makes it seem overactive try moving it! It is negative learning to learn to ignore the yaw string.

8) **THERMAL ENTERING** exercise (joining other gliders)

a) Approach thermal from the side on a tangent to the circle in same direction of turn as other thermalling gliders; if at approximately the same height, position the entry so as to be opposite the other glider; if more than one glider is in the thermal, position to maintain visual contact of all others; it is safest to approach and enter an occupied thermal either from below or above;
b) Emphasize LOOKOUT needed for **collision avoidance**; see also **Notes** about collision avoidance on p. 49.

9) **THERMAL CENTERING** exercise

a) Look around both sides and above for other aircraft;
b) If entering an unmarked thermal, as rising air is entered, judge which wing rises first;
c) As strongest lift is encountered, start turn toward centre of thermal. Allow for *lag* of variometer;

d) To centre thermal; when variometer reading increases as glider flies into strongest lift, level the wings;
e) After 2 - 3 seconds resume previous angle of bank;
f) This moves the centre of the turn towards the centre of the thermals; repeat d) and e) as necessary during the climb to stay in the centre of the thermal.

10) **MAINTAINING SEPARATION** in thermals exercise

a) Adjust thermal turns so as to maintain visual contact with other thermalling gliders and avoid turning abruptly inside another glider when pilot might lose sight of the other glider;
b) Maintain a continuous lookout above, below and as far as possible around to both sides of the glider;
c) Use radio to contact others if unsure they have seen you, or to determine their intentions;
d) If sight is lost of another glider, leave the thermal briefly, and then re-enter when visual contact is regained.

11) **FLYING STRAIGHT** coordination exercise
Use a series of turns as a coordination exercise to fly (straight) towards a point ahead on horizon. If the student has problems, it is usually because the rudder is not in sync with the ailerons. Limit angle of bank to about 30^{o}.

12) **BALANCE OF FLIGHT**. The student should perform the SWAFTS checklist well before entering the **High Key Area** and should then fly in the circuit. Instructor to take over control at the **Low Key Point**, student observing for balance of flight and performing all lookouts required in the circuit.

13) **POST LANDING**

a) Review all items of the flight;
b) Pilot responsibility for glider remains until next pilot takes over. Stress importance of ground handling in winds; airbrakes open, canopy closed, and locked; if necessary tie down the glider properly.

This page for Notes

EFFECTS OF AIRBRAKES, FLYING THE FINAL APPROACH

1) Student performs **CISTRSCO** checks as usual, search area **ahead and above** for hazards and other traffic. Instructor **demonstrates takeoff and aerotow** to release height, see page 38.
Student to follow through.

2) **EFFECTS OF AIRBRAKES** exercise at altitude (above circuit height).

Before this exercise is taught, the student must have good elevator, aileron and rudder coordination plus good speed control – see also the recommended flight sequence and pre-requisites on pages 4 - 5.

a) Student to perform CALL check then fly wings level towards a horizon reference point at typical approach speed; **Instructor takes over control**;
b) Student unlocks then opens and looks at the airbrakes; note tendency to suck out, the change in pitch needed to maintain speed, increased rate of descent, force needed to close the brakes, and the need to raise the nose to maintain the same airspeed as brakes are closed;
c) **Student takes over control** and repeats b) smoothly from brakes closed to half open, checks visually against position of lever (that may not be at the half position); then opens brakes fully, maintaining approach speed; close and lock brakes.
d) Student to repeat c) at higher speed if forces vary significantly over the normal range of approach speeds;
e) Student to dive glider to close to manoeuvring speed; repeat c). Note forces needed to operate and close the brakes when they are being used as in this case, for speed limiting – see also item h);
f) After this exercise, student to practice use of airbrakes on the approach, instructor prompting their use. Do not discuss circuit planning at this stage, but see later on page 30;
g) Instructor take over control to demonstrate landing - page 26 - student following through.
h) **Spoilers**. Larger trim changes may occur compared to **airbrakes**; the speed limiting dive, e) is therefore inappropriate.

3) **APPROACH CONTROL & UNDERSHOOTING and OVERSHOOTING** exercise.

Before this exercise is performed, the student should have good directional control, flown the approach to a landing to a good standard while the instructor prompts use of airbrakes, and have completed the above **Effects of Airbrakes** exercise satisfactorily.

a) **Instructor fly** the glider, student following through;
b) Agree on a **Reference Point** as you pass abeam the landing area – e.g. the landing "T" or a mark on the runway; see also h);
c) Fly the final turn **higher than normal** to give time for the demo;
d) Demonstrate an **Undershoot** – ask student to note which way reference point is moving on the canopy;
e) Emphasize steady speed and attitude;
f) Demonstrate an **Overshoot** and ask student to note how the reference point is moving in relation to a point on the canopy.
g) On next flight or two, student to fly long approach to gain understanding of principals of undershooting and overshooting – subsequent flights to be from usual final turn position.
h) To save airtime, you may agree on a Reference Point before takeoff – and confirm it in flight before the approach and landing.

4) **FLYING THE FINAL APPROACH** exercise

This exercise should be demonstrated and then practised by the student after he or she has completed the above **overshooting and undershooting** exercise satisfactorily.

a) From a high final turn, instructor demonstrate approach at ½ - ⅔ airbrake setting (approximately half effectiveness); student to follow through on controls including airbrakes. Note no apparent movement of *reference point* on canopy; emphasize steady speed and attitude;
b) Using a longer than normal approach allow student to practice flying the approach using airbrakes to control descent rate or glide angle, and elevator to control speed;
c) If final turn is made to one side of runway centre-line or chosen landing line, correct this early on the approach;
d) On later flights student to make final turn at correct position;
e) From a low final turn but at usual position, ensure student does not use airbrakes early, i.e. before establishing an overshoot or before intercepting the usual ½ - ⅔ airbrake approach glide path.

5) **POST FLIGHT REVIEW**

Remind the student of the need to keep the hand on the airbrake lever, when opened, to avoid them being sucked open further; the need to coordinate with the elevator and to monitor the speed more frequently, and the need to use the brakes if at any time the speed is accelerating through Va, the maximum manoeuvring speed.

PROBLEMS IN APPROACH CONTROL

1. Too frequent adjustments of the airbrakes. This does not allow time to observe the effects on sink rate while speed is controlled; small adjustments could lead to PIOs.

2. Gradual closing of the brakes just before flaring; power pilots converting to gliders may do this; try to discourage this, except when speed is decaying too rapidly at the flare and a hard landing is to be avoided. Landings are easier at the ½ - ⅔ airbrake setting – during the roundout and float the rate of decay of speed is comparable with a comfortable rate of elevator movement.

3. Need to close the brakes close to the ground indicates poor coordination between elevator and airbrakes or inadequate allowance for the wind gradient. Poor judgement of height close to the ground may also be the problem – look ahead and to the sides (use peripheral vision) as the flare is started, to try and better judge the height.

4. Opening the airbrakes when not needed; i.e. the automatic landing syndrome; get student to recognise an undershoot condition; an overshoot situation **must** be established before opening the brakes on final approach.

5. **It is not safe to send a student solo** if he or she has not been shown an undershoot or cannot recognise when an undershoot is about to occur.

This page for Notes

THE CIRCUIT
Part I LANDING

Only permit a student to attempt a landing when he has reasonable handling abilities and control of the glider. Difficulties may occur because of trying this exercise too early, and the student becoming up tight about it. What we are attempting is to improve and build on the student's skills efficiently, which will occur if the student is introduced to new work in a disciplined manner, in incremental and controlled amounts one at a time.

1) Student performs **CISTRSCO** checks, search ahead and above for hazards and other traffic.

2) When student has adequate handling abilities allow him/her to do **takeoff**; instructor to take over at low height to debrief, then hand over control to the student for balance of tow; instructor follow through.

3) **LANDING** demonstration. First demonstrate a flare, hold-off and landing from a good steady approach, allowing the student to follow through. Emphasize that the landing is complete only when the glider comes to rest. On subsequent flights, monitor and prompt as needed with student flying. See also # 6 in Notes to Instructors on the page 28.

4) **THE LANDING** - three phases - flare, hold-off, and the touchdown and rollout.

- The **FLARE**, or ROUND OUT.

a) Look well ahead (suggest distance equivalent to when driving a car, e.g. 30 to 40m or more, to the far end of the runway) when nearly ready to land (approximately 3 to 4m height);
b) Begin to *flare* by adjusting *attitude* of glider, ready for the hold-off or float;
c) Keep airbrakes fixed (**ideally at** $^1/_2$ **-** $^2/_3$ **airbrake setting**), check wheel brake not on (airbrake/spoiler handle on some gliders also operates the wheel brake).

e) Explain that if speed is allowed to get too slow before the flare (below 50 knots) with too much airbrake open, a hard landing will result in most modern sailplanes.

- **HOLD-OFF** and **FLOAT** (demonstrate correct *attitude* prior to takeoff).

a) With attitude being held correctly for landing, hold glider at ½ metre or less height. Continue to hold-off as airspeed drops, to allow glider to float. This is a fully held-off landing (or low-energy landing) in which the main wheel touches the ground just before the tail wheel or tailskid. If the tail touches first that too is OK (though not preferred), the energy is lower and the glider will not bounce into the air after touching down.

- **TOUCHDOWN and ROLLOUT**

a) After touchdown, keep attitude constant, wings level;
b) Open airbrakes fully and use wheel brake if desired;
c) Keep straight with rudder, and keep nose wheel or skid off ground as long as possible or until glider stops;
d) Use wheel brake and skid as necessary to avoid hazards on ground;
e) Keep into-wind wing low; as wing drops to the ground, centre the stick to avoid aileron damage.

5) **DOWNWIND LANDINGS** (This exercise to be done later in training). A downwind landing may be required, for example following an interrupted launch or when being caught low with insufficient height to do a normal circuit. Rapid decision-making is needed, as below:

a) Choose reference point on runway for a comfortable approach path, leaving adequate runway length beyond the reference point;
b) Control speed on approach; it tends to increase in wind gradient;
c) Establish overshoot, then use airbrakes to descend to reference point, and leave as much room as possible on either side of glider;
d) Hold off well, and maintain wings level as long as possible;
e) Keep straight to avoid ground-looping tendency, particularly with gliders with the cg behind the wheel (no nose-wheel steering).

NOTES to Instructors

1. **Judgement** of the roundout point depends on the steepness of the approach, the perspective of the landing area, e.g. large grass area versus marked runway, slope or unevenness of the landing area, rate of sink, and control movements required to flare, etc. Height judgement low to the ground is aided by peripheral vision, and looking to the sides provides more detailed height information.

2. After a demonstration landing, **prompt the student's first landings**, as their workload is higher than normal.

3. Encourage the student to **fix the airbrakes** for the last part of the descent, ideally at the ½ - ⅔ airbrake approach setting.

4. Students may concentrate on an **obstruction** and will then tend to swing towards it instead of looking along the runway to the intended landing spot or *reference point*.

5. In **strong winds** the approach speed will be higher, therefore the float will be longer following the flare, however the glider may be touched down earlier and at a higher airspeed than in lighter winds. This higher airspeed at touchdown gives better control in gusts or turbulence. Open the airbrakes fully immediately at touchdown to prevent the glider taking off again in a gust.

6. Watch for **rounding out too high**: take over control only if necessary, e.g. to complete the landing; but **do not delay taking over control until it is too late**. It is better to take over too early than too late. Maintain control to the landing – students often relax and will not be prepared to assume control again under these high-workload conditions.

This page for Notes

THE CIRCUIT,
Part II PLANNING

The standard circuit pattern should be demonstrated first with the student NOT following through; he should be fully concentrating on the demonstration. This should be of the circuit that the instructor would wish the student to fly if solo. The **objective** is to arrive at a safe speed and at the right height and position for the **FINAL** turn onto the approach. For reference, a minimum height of 300 feet above ground should be chosen, and this should be judged by comparison to the heights of ground features such as trees or buildings, and their appearance, not by reference to the altimeter!
Note that a safe **alternative** approach path and landing area should always be chosen. The selection of the **Reference Point** for landing should allow for an adequate undershoot area. Always admit if your demo is not as good as you wished, e.g. height not right.

1) **THE HIGH KEY AREA**

a) Plan to fly towards ***HIGH KEY area*** when glider descends towards 1000' agl; this area is upwind of the runway and is positioned to permit easy entry to the downwind leg when judged appropriate.

b) Before starting the downwind leg, begin **SWAFTS** checklist. Aim to complete this quickly and efficiently;

c) Crosswind leg, if applicable, is flown towards downwind side of circuit.

2) **DOWNWIND LEG**

a) Start downwind leg with sufficient height, usually 700 – 800 ft. agl or higher if the circuit is busy. This leg begins in the high key area and ends when opposite or abeam the ***REFERENCE point***, i.e. at the ***LOW KEY point.*** The height at this point should be 500 ft agl minimum;

b) The downwind leg is flown parallel to the runway at best L/D speed, making drift allowances for any crosswind, and flying closer to or further away from away if noticeably high/low; always have an alternative approach and landing area in mind.

c) FINAL approach speed will be a MINIMUM of 1.3 Vs + Vwind; see also notes on page 2. On downwind, select the ***reference point*** and judge remainder of circuit with respect to this point. This point could be agreed before takeoff – use a ground feature or runway markers, for example, as a useful guide.

d) Raise speed to the value chosen in c) above as the ***low key point*** is reached, and re-trim.

3) **DIAGONAL LEG**

a) As low key point is passed, turn 45° to fly a diagonal leg towards the base leg;

b) Monitor position and angle to the reference point, and adjust by extending or shortening the diagonal leg or by using airbrakes (spoilers) if necessary to lose any excess height. Note drift in winds and again adjust diagonal leg as needed;

c) If low or in very strong winds, turn early onto base leg or angle in towards runway;

d) Search for aircraft on opposite side of runway and/or on a long final approach.

4) **FINAL TURN**

a) Demonstrate a well-coordinated and well-banked turn to FINAL, especially in strong winds; emphasize need to maintain correct approach speed. Minimum desired height should be chosen with reference to ground features, not the altimeter. For example, the recommended minimum may be set at three or four times the height of large trees or the hangar roof.

5) **FINAL APPROACH**

a) On FINAL approach note glide path with respect to reference point, and establish **overshoot** condition first, then open airbrakes as needed, and recheck glide path; Use ASI more often than in normal flight, to confirm airspeed.

b) As WIND GRADIENT is traversed anticipate drop in the airspeed and increase in sink rate. Correct promptly with nose down (airspeed), and close airbrakes (to reduce sink rate).

6) **POST-FLIGHT REVIEW**

First review the circuit demonstration and any aspects of the demonstration that were not as good as desired, and ask for the student's evaluation of the circuit and the decisions, etc. Then review the other exercises practised on this flight.

THE CIRCUIT
PART III FLYING THE CIRCUIT - 1

For the student's first attempts to plan and fly the circuit discuss with the student and assist him or her to arrive at the High Key area, at the Low Key point and the Final Turn at the demonstrated heights and positions.

1) **BEFORE STARTING THE CIRCUIT**

a) Throughout the flight, monitor glider's position and height relative to the airfield using **SOAR** technique;
b) Assess wind and decide on the best position for the high key area, adjusting this for wind direction and length of runway; strong winds might require high key area to be more upwind; in crosswinds move closer to or further from the side of the runway;
c) Make definite decision to join circuit and plan to arrive in high key area at 1000 to 1200 ft agl;
d) Start **SWAFTS** check before entering high key area.

2) **HIGH KEY AREA**

a) Re-assess height, distance and angle to the landing area; look for obstructions on the ground;
b) Maintain a good lookout for traffic in the circuit and approaching the high key area with you;
c) If much too high, continue to practice, e.g. turns, or leave area and plan to return at the desired height;
d) When in the high key area make turns only **in the same direction** as the circuit that is to follow; however, to be safe an immediate turn to downwind in the opposite direction is acceptable if low;
e) Look for any following gliders before entering the circuit, and when turning in the circuit look for other aircraft **above, below, inside and outside your turns by searching also under the high wing** and **above the low wing**;
f) Start the downwind leg at 700 – 800 ft agl and choose the *reference point* & *alternate landing area* now.

The alternative landing area may be further upwind on the runway, or on an alternate runway if available. This is to allow for obstructions on

the airfield or to allow for extreme sink that can place the chosen landing area out of reach.

3) **DOWNWIND LEG**

a) Fly at best L/D speed but increase speed in sink; keep monitoring the variometer for lift or sink;
b) In a crosswind adjust heading to compensate for drift by crabbing towards the wind;
c) Continually assess height, angle and distance to the landing area and adjust downwind leg as appropriate;
d) Maintain lookout and keep aware of other gliders in the circuit; adjust so as to maintain separation;
e) Keep the alternative landing area in mind;
f) Adjust speed to that for the approach as the low key point is reached – use a value of 1.3 Vs + Vw minimum, then adjust the trim.

4) **LOW KEY POINT**

a) Check height and position relative to landing area and decide to make any needed adjustments; stop using altimeter;
b) If too high adjust height by reducing the angle of the diagonal leg or by using airbrakes with care:
c) Look again for any following gliders by looking above, below and under the high wing and above the low wing; also search for aircraft making an opposite-sided circuit;
d) If very high, never use *full* airbrakes to let down in a *straight line* – you may descend onto a glider below whose pilot may not see you;
e) Choose reference point if not already chosen.

/See next page for Diagonal leg

5) **DIAGONAL LEG**

a) Before losing sight of landing area, turn onto the diagonal leg; this may normally be made soon after passing the low key point;
b) Identify and take hold of airbrake lever if not already done;
c) Continually monitor airspeed – every 2 to 3 seconds;
d) Make any adjustments to diagonal leg to compensate:
   - If low or drifting because of wind, turn onto base leg sooner;
   - If too low, turn onto **final** early;
   - If too low to reach the planned reference point, land on the undershoot area or on the previously chosen alternate landing area;
   - If close in but at good height, angle away from the chosen landing area, or move reference point into wind and land further up the field or runway;
   - If high, use airbrakes;
e) Maintain a good lookout, including searching for aircraft in an opposite circuit and on a long final approach.

6) **BASE LEG**

a) Check airspeed regularly as before;
b) Check landing area is free of obstructions;
c) Assess distance and angle to reference point; also assess height from perspective of trees, buildings, etc., not the altimeter;
d) Adjust base leg to compensate for wind drift and position; lose excess height with careful use of airbrakes;
e) Make final good **lookout** to both sides, also **above** and **below**, to check for aircraft on long final and on opposite circuit direction, as final turn is started.

7) **FINAL TURN and APPROACH**

a) Close airbrakes before final turn in early flights; teach final turns later with airbrakes open;
b) Deliberately lower the nose slightly as the final turn is started even if the speed is considered adequate and is at the pre-selected approach speed;
c) If glider is very high, brakes may be open throughout the turn, but do NOT teach or allow student to adjust or open the airbrakes part way through the final turn;

d) Final turn is to be at good angle of bank, normally at about 30°, therefore do not start turn early – leads to shallow angle and more time taken to complete the turn;
e) Maintain lookout to the circuit side to search for gliders behind in their downwind leg;
f) Select a **landing line** on the centre-line of the landing area, well clear of side obstructions such as markers along edge of runway and/or other gliders;
g) If turn is not onto landing area centreline, adjust this as soon as possible, and maintain adequate speed if angle of bank is increased e.g. in a ***Pear Turn*** manoeuvre;
h) Monitor speed as before, every 2 – 3 seconds; listen to the speed;
i) Use airbrakes to control descent rate at constant speed; aim for approach glide path or angle at ½ - ⅔ airbrake setting;
j) Be prepared to close the brakes and land long to clear other gliders or vehicles on the runway.

8) **RIGHT HAND CIRCUIT and COVERED INSTRUMENTS exercises**

At about this stage in training a right hand circuit should be flown if the club normally flies only left-hand circuits. At a similar point in training the student's instruments are to be covered for part of a flight. This should be limited to upper air work and is most beneficial if the pilot is not looking out adequately and/or his control of attitude and therefore his speed control is poor.

9) **THE FLIGHT**

Instructor monitors student's planning and flying of circuit, and how good was the lookout? Follow through closely on the approach and use of airbrakes; finally monitor closely the flare and landing.

10) **POST-FLIGHT** Review the flight; circuit planning – student's decisions – ask the student what might be modified next time – were the lookouts adequate and did they differ as needed for each part of the circuit?

Review also the hold-off and landing, and the other exercises that were practised during this flight.

THE CIRCUIT,
PART IV FLYING THE CIRCUIT - 2

1) **ZIG ZAG on DOWNWIND DEMONSTRATION** exercise

a) Instructor to take over control and fly the glider towards the high key area, at an angle of about 45^{o} to the downwind leg, but at a position that is higher and too far to the side for a normal entry;

b) Continue on this angle toward the airfield, and ask the student to advise you when he thinks you are at the correct distance from the airfield and angle (to the runway) to start a normal downwind. If he initially identifies a point too far away advise the student that it is too far (give reasons, e.g. crosswind effect) and continue towards the field. If he or she identifies a correct position, confirm the decision, but advise the student you will deliberately continue towards the airfield to allow angling away from the runway see d);

c) If the student allows you to fly the glider **too close** towards the runway, turn away from the field and explain the situation – too large an angle down to the runway and too close; even though the height may be correct for that position on the downwind leg, the circuit is now too cramped;

d) Angle away from the airfield before the low key point, and again ask the student to advise you when the position and angle to the runway will be correct for the lower height in the downwind leg;

e) Use this exercise to make the student more aware of the **angle** down to the runway, the **distance** to the landing area and the **height** having to be continuously monitored to ensure a good circuit prior to the final turn.

NOTES to instructor. Know your own limits with respect to flying away from the runway before turning back, as in d) above.
Do NOT indicate the correct distance from the airfield. Only show the student that a selected position is too close or too far away, then continue the exercise by turning back into the zigzag pattern. The student should make the decisions for normal circuit positions on subsequent flights. **Use good judgement: only perform when safe and when other traffic permits.**

2) **RUNNING OUT OF HEIGHT** and **ABBREVIATED CIRCUIT**

This exercise may be performed at any time after the student has started planning and flying the circuit.

a) Take the opportunity to demonstrate an abbreviated circuit if the student begins to run out of height before or in the circuit and arrives at a height of 500 ft. minimum before reaching the normal **low key point**. Or before returning to the **high key area**, deliberately try to have the student practice extra turning for example, to reduce the height to below the normal so that an abbreviated circuit situation has to be recognised and flown. Alternatively the instructor is to deliberately take control in the downwind, reduce height to below normal, then hand over control.

b) At the minimum of 500 ft. agl, a new low key point is now defined and therefore the **reference point** is on the runway opposite to or abeam the glider. The balance of the circuit is to be flown with respect to this new reference point (it will be further up the runway than normal). Emphasize it is better to fly the balance of the circuit and the final turn at the normal safe heights than to be picking up the debris at the start of the runway!

c) Make the point that at all times it would be very hazardous to try and fly a very low circuit. Always teach the student to have an alternative landing area on the runway. In cases of great loss of height the student is **free to land in any direction** and anywhere on the airfield, to make an opposite-sided circuit, or to land on an adjacent field if so low that the club's runway is out of range.

11) **AIRBRAKES OPEN BEFORE THE CIRCUIT** exercise
This exercise is to be given at any time after the student's circuit judgement is becoming very secure and consistent. The element of surprise and increase in the workload can be stressful to the student. However this exercise is a useful one to improve the student's confidence. The circuit will very likely be an abbreviated one; the student could land on another runway or downwind. Emphasise to the student that such an unusual circuit is perfectly acceptable. The instructor is to monitor closely, and if necessary close the airbrakes.

12) **POST-FLIGHT REVIEW**
Discuss SOAR options after flight such as if selected runway would have been blocked, sudden sink or tailwind gust (down burst), or traffic conflict on final. Note wind direction/speed changes since take off, and discuss effects of crosswinds on circuit planning.

TAKEOFF, AEROTOWING & EMERGENCY PROCEDURES

Student take off and tow if this has been previously demonstrated – see note 1) at top of page 22.

1) **DEMONSTRATION**

Instructor to demonstrate tow from the start of ground run and up to release height, student to follow through.

a) Pre-brief, demo ground run and initial large control movements; takeoff, position of tug in canopy, normal tow; demo method for maintaining height position by keeping tug in an imaginary *sight* on canopy; move to *low tow* through slipstream and back. Maintain lateral position by coordinated use of stick and rudder (NOT rudder alone); demo position of glider during all turns.

b) Review after this demo flight and before student's first full tow. See detailed notes below.

2) **TAKEOFF** and **AEROTOW** exercise

Student to fly, instructor follow through as needed.

a) Adjust attitude of glider to run on wheel, note initial coarse control movements. Keep wings level and keep straight with rudder; if one wing drops to hit ground, or directional control is lost (more than about 30 degrees off the runway heading), **release immediately**;

b) At takeoff speed glider will lift off - don't deliberately lift it off at slow airspeed;

c) Hold just above ground until towplane begins to climb, make note now of position of towplane on canopy, and maintain towplane in this imaginary sight or *picture*; this is the **normal (vertical) position** of towplane that is to be maintained during the tow;

d) If glider gets low relative to the tug, a rapid climb into position can lead to a slingshot effect that causes **the tug to be upset**; this can be accentuated in a strong wind gradient. See also notes on Page 43.

** If at any time the glider should begin to climb rapidly or uncontrollably above the towplane, **release immediately**.

Also if glider pilot loses sight of towplane below nose of glider, **release immediately. Both actions are to prevent a ***towplane upset.***

e) Instructor take over control after initial climb out, debrief the student's takeoff, then hand over control for balance of tow.

3) **AEROTOWING – High tow** is used for launching, **low tow** for cross-country towing.

a) When flying straight and in correct vertical position, maintain position by keeping tug in the *sight* on the canopy – see 2 c) above [desired position of tug is with its wheels approximately 2m above horizon – for powerful towplanes this could be greater];

b) To maintain lateral position behind the tug, fly with the glider's wings parallel to the tug's wings, incl. in turns. Demonstrate what happens if one wing goes down slightly. Make correction using coordinated controls to turn glider back into position, and level the wings before reaching the correct position again, i.e. anticipate to avoid going too far. For small deviations the pilot need not turn briskly because the pull of the towrope will tend to move glider into line. If deviations are larger or if weaving side-to-side, first adjust glider wings to be parallel to towplane, then use firm medium coordinated turns to return into position directly behind the tug using a reversing turn if needed.

c) In turns, bank glider identically to towplane; aim at, or outside the outer (high) wingtip of towplane. Keep glider in same path as towplane – not inside; and keep the yaw string (or ball) centred.

d) **LOW-TOW** demonstration
At about 1000 ft agl, move down slowly through the slipstream, and notice vibration caused by turbulence in the slipstream. Note position of towplane in canopy; return to high tow.

4) **RELEASING FROM TOW**

a) Look above and to both sides, particularly to right, then release, visually **ensure** rope has gone, call out "rope gone", then turn to right, adjust flying speed, raise wheel and visually check the placards or signs that it is up and locked, then re-trim;

b) Confirm location of the airfield.

5) **BOXING THE SLIPSTREAM** exercise. Move to side, go down to low tow beside slipstream, cross under slipstream to other side, return up the side and manoeuvre to behind towplane again - all using coordinated manoeuvres, yaw string (and ball) straight. If not far out enough, note effect of downwash of slipstream tending to roll the glider. Alternatively first move down through the slipstream, then move to side, etc.

6) **SLACK ROPE** exercise. During a turn instructor to fly and allow the glider to move outside and slightly above the tug's circle. Then develop slack in the rope by turning sharply towards the tug and descending. To remove the slack, avoid a snatch on the tug and glider by yawing away from the rope, until it becomes tight. If the glider has descended well below the tug before the rope tightens, the rope may break when it is snapped tight. If the slack is excessive, use the airbrakes carefully, and again yaw the glider and close the airbrakes as the slack is removed. Student to practice removing slack that is produced by instructor.

7) **EMERGENCY PROCEDURES ON AEROTOW**
with **DESCENDING ON TOW** exercise

- If towplane waggles **rudder**, check **airbrakes** closed and locked;
- If towplane waggles **wings**, immediately **release**;
- If glider cannot release, move to **left** and waggle wings. Towplane will return to airfield and release;
- If you enter cloud, release immediately and turn around to exit as quickly as possible;
- If both glider and towplane cannot release, do a formation landing.

Before doing this exercise, carefully **pre-brief the tug pilot** that you wish to demonstrate the first two emergency signals from the towplane, as above, plus a demo of descending on tow.

a) At approx. normal release height gradually open the airbrakes; Note sound, and effect of airbrakes on climb rate. [Note: With the student and tug pilot, clearly define the heights as agl].

b) After approx. 10 seconds the tug pilot will give the **check airbrakes are closed and locked** signal by waggling the rudder; close and lock the airbrakes immediately;
c) The tug pilot will then gradually reduce power to fly straight and level;
d) Move the glider into the **low-tow** position; in this case the tug will appear on or slightly above the horizon;
e) When this is accomplished, the tug pilot will set up a descent rate at approx. 3 – 4 knots (300 – 400 ft/min); (this exercise may be modified to allow for tug cooling procedures taking priority);
f) Maintain the glider below or just in the lower part of the slipstream which effectively provides the extra drag. If needed, use airbrakes and/or yaw the glider slightly to keep the rope tight; take care not to exceed the max. aerotow speed;
g) After a stable descent has been flown for a few seconds the tug pilot will return to straight and level flight; close and lock airbrakes if open, and return the glider to the **high tow** position;
h) The tug pilot will then give the **release immediately signal** by rocking the wings. The student should release with no delay, then follow the normal post-release checks; see also 4) a) and b) above.

See next page for Rope Break Procedures at Altitude exercise/

8) **ROPE BREAK PROCEDURES** exercise at ALTITUDE

This exercise should be performed at **altitude** several times. The objective is to get the recovery procedure ingrained in the student's memory before a simulated rope break is given during a tow. **Note**: a rope break is synonymous with a **premature release** by the tow pilot. Student to fly; instructor prompting. **Motto: plan ahead.**

a) From best L/D speed at height, raise nose to normal tow attitude;
b) As speed drops towards the 1*g* stall speed, call "break"; this is to simulate a rope break or a premature release;
c) Immediately lower the nose to **below** the approach attitude and **wait**; start counting the time taken to reach a normal approach speed of 1.3 Vs + Vw minimum: Remember airspeed may be close to stall speed if towplane waves off the glider when low – it is vital to get the nose down after a break, to regain airspeed;
d) A turn may be started only when airspeed is adequate. Release aerotow rope and winch cable when able to do so;
e) Repeat exercise several times on this and other flights, with counting the time taken to attain the above approach speed for safe manoeuvring and before the rope-break exercises are done low down. Always **fully brief** before any practice.

9) **ROPE BREAK** exercises after takeoff and at low heights. This exercise is to be demonstrated first - student following through - then practised by the student several times (sequence is important - primacy) as follows:

- just after liftoff (**maintain attitude** and land straight ahead on runway),
- at a low height that allows a safe landing on the runway straight ahead,
- at a height from which a safe downwind return to the runway is possible (min. 300 feet above ground), and
- at a height that allows an abbreviated circuit.

a) Warn towpilot and **fully brief student** — if any traffic hazards exist, don't practice;

b) When rope breaks, first lower nose to maintain or **increase** speed to a safe approach speed for manoeuvring and use pre-planned actions; if very low just above the runway, maintain attitude, then adjust for touchdown and open airbrakes very carefully;

c) If rope breaks below 300' agl, and at a slow speed, regain approach speed then plan a landing essentially straight ahead, with only small turns into wind; if speed and height are adequate for manoeuvring, assess Situation (use SOAR technique) and choose safest Option for an emergency landing (this may be an arrival or crash landing into bushes or tree tops if no suitable field is readily available);

d) If rope breaks above 300ft agl, regain approach speed then assess Situation. Land downwind if headwind less than 10 knots, or fly abbreviated circuit if height is adequate; when landing downwind select a new reference point on the part of runway closest to the approaching glider. **See also p. 66** for additional pilot decision-making or PDM notes using the SOAR technique.

NOTE on **TOWPLANE UPSETS –** see item 2) d) above, page 38.

An uncontrollable and fast upset (2 – 3 sec) of the tug can occur during the initial climb after takeoff; several factors make this more likely:

- Use of c.g. hook on glider or low hook location,
- Strong wind gradient,
- Rapid initial climb by the tug, leaving glider low and behind,
- Glider then over-rotating rapidly in attempt to catch up the tug,
- The elevator authority of the tug and glider could be exceeded, leading to a diverging **slingshot**, with no recovery possible.

This last effect can occur with e.g. a glider with a low hook location relative to the centre of drag, giving a positive nose up moment from the rope pull. If the glider is over-rotated the effect can over-power the elevator authority.
The effect may also be seen with a heavy water-ballasted glider. The wings bend, with the load raising the *cg*, and the rope pull could give an acceleration to the glider with a strong nose up moment; this effect can overpower the elevator also in this case, even with the stick fully forward!

WINCH LAUNCHING

Prior to takeoff go through CISTRSCO checks as usual, search area above and ahead for other traffic, and ensure runway is well clear of hazards.

1) On first demonstration launch, instructor flies the glider up the launch, student following through; on next launches student gives signals to ground crew, then is given control, takes off and climbs, instructor monitoring as required. Student is given increasing control on subsequent launches.

2) **TAKEOFF**

a) As glider starts to move keep wings level, attitude normal; with *cg* hook off the centreline of the fuselage, and in crosswinds apply rudder early, to prevent initial yawing or weathercocking;

b) If one wing drops to hit the ground, **release immediately**;

c) As glider accelerates, use rudder to keep straight while on the ground; forward stick pressure may be needed to prevent rapid rotation into full climb on some older gliders.

3) **INITIAL CLIMB** — below 150 to 200 ft agl.
Allow glider to climb gradually to about 150 to 200 ft agl — at minimum speed, Vs + 10 knots; monitor airspeed closely. Most modern gliders require stick in neutral position

4) **FULL CLIMB** — above about 200 ft agl.

a) Allow glider to rotate gradually to full climb attitude; if rotation appears slow, check airspeed is adequate before rotating the glider. Maintain the climb attitude as required. Continue to monitor airspeed;

b) If launch is too slow, give TOO SLOW signal (Lower the Nose);

c) If too slow persists, decrease rate of climb even more to reduce load on winch, and if speed does not increase — release and lower the nose immediately;

d) If launch is too fast, give TOO FAST signal (Yawing motion);

e) If too fast, don't increase climb rate, increased load on cable may break it and add additional stress to aircraft;

f) If porpoising occurs, briefly reduce stick backpressure.

5) **LAYING OFF FOR DRIFT**
If launch is out of wind, steer glider toward the wind with coordinated controls; (keeping windward wing low, and straight with rudder is less efficient).

6) **RELEASING**
At top of launch, lower nose to descending attitude, pull release, adjust airspeed, raise wheel as appropriate, re-trim. Assess height then cross check against altimeter, and look around before turning.

7) **WINCH LAUNCHING EMERGENCY PROCEDURES**
Motto: plan ahead

a) If glider overruns cable on the ground, release immediately, shout "STOP", keep nose firmly down and open airbrakes;
b) If one wing strikes ground at start of ground run, release immediately;
c) If cable breaks; immediately lower nose to speed up to normal **approach** speed, then pull release. Do NOT open airbrakes;
d) At very low heights plan to land straight ahead. Use airbrakes normally after correct speed is reached;
e) Between 150 ft agl and 300 ft agl, lower-nose as before, pull release, assess height. Land straight ahead normally, or turn across wind to use up height, then turn to land into wind;
f) Above 300 ft agl, lower nose as before; pull release, assess height. Land at upwind end of field from extended base leg, or fly an abbreviated circuit. Do NOT attempt to land at launch point if low;
g) Gradual power loss by winch; emphasize to student this condition is more difficult to notice. Treat any loss in speed as a symptom of an emergency and lower the nose to maintain speed;
h) If cable won't release, winch will cut cable with guillotine. Start spiralling descent over winch, keep airspeed higher than normal to allow for trailing cable on glider, and land into wind if possible.

8) Student approach, land, instructor monitor as required.

9) **Review** the circuit planning, its flying and the approach, flare, the hold-off and landing; and what to modify next time. Also review the launch, and comment about planning ahead for an **interrupted launch**, the emergency actions and plans to recover and land.

CABLE BREAK PROCEDURES exercise at altitude (above circuit height)

This exercise should be performed at height several times; instructor demonstrate first, then the student to fly with instructor prompting. The objective is to get the recovery procedure ingrained in the student as an automatic reaction before a simulated cable break is given.
Motto: plan ahead.

a) At altitude, dive slightly to increase speed to approximately 70 knots, then raise nose to a normal winch climb attitude of approximately 40° nose up;
b) As speed drops through about 45 knots, call "break"; this is to simulate a cable break;
c) Immediately lower the nose to below the approach attitude and **wait**; start counting the time taken to reach a normal approach speed of 55 knots minimum;
d) Repeat exercise several times on this and other flights, counting the time taken to attain the above safe approach and manoeuvring speed, and before the cable break exercise is performed on a winch launch low down.
   - Always **fully brief** before any practice.

12) **CABLE BREAK** exercise from *failed* launch

This exercise is to be practised more than once

- just after liftoff (**maintain attitude** and land straight ahead on runway),
- at a low height that allows a safe landing on the runway straight ahead,
- at a height from which a safe downwind return to the runway is possible (min. 300 feet above ground), and
- at a height that allows an abbreviated circuit.

a) Warn winch operator and **fully brief student** — if any traffic hazards exist, don't practice;

b) When cable breaks, first lower nose to **regain** approach speed (and then pull release), start planning; then, if just above the runway, adjust attitude for touchdown and only open airbrakes very carefully;

c) If cable breaks below 300 ft agl, and at a slow speed, lower nose to below approach attitude to regain /maintain approach speed then plan a landing straight ahead on the runway;

d) If cable breaks above 300 ft agl, regain approach speed then turn away from the wind, assess **S**ituation. Look at **O**ptions, then act on best option; Land at the upwind end of the runway, into wind if space permits or downwind on runway if wind less than 10 knots, or fly abbreviated circuit; **see also p. 66** for additional notes.

STEEP TURNS
& ADVANCED THERMALLING

1) **ROLLING IN**

a) Perform good LOOKOUT for other aircraft, then increase speed required for the steep turn (45 to 60^{o} angle of bank);

b) Look over the nose to a point on horizon, then roll with a coordinated turn entry, to desired angle of bank.

2) **STAYING IN**

a) Control angle of bank by reference to horizon straight ahead; keep yaw string (and ball) centred;

b) Control speed by keeping pitch attitude constant using elevator normally. Notice extra backpressure needed to do this. Re-trim in the turn;

c) Keep looking ***up*** (and hence along the horizon) to maintain an adequate lookout in the direction of turn;

d) If speed seems difficult to control, reduce bank, re-adjust speed, and then resume steep angle of bank.

3) **ROLLING OUT**

a) Look ahead and under **high wing** for other aircraft,

b) Roll out of turn in normal way with reference to the horizon;

c) Notice nose will tend to rise; counteract this with forward stick pressure, and re-trim as necessary when straight and level.

4) **FAULTS** in **STEEP TURNS**

a) Failure to adequately increase speed before starting the turn;

b) Failure to adequately look out – including under the high wing – before rolling into and out of the turn;

c) Tendency to enter too quickly;

d) Tendency to allow bank to increase – some aileron may be needed to *hold off* the bank;

e) Failure to apply adequate *back pressure* to the stick to control speed in the turn;

f) Initial attempts at steep turns should be limited to less than one revolution before resuming a more normal medium turn;

g) Tendency to look down into the turn instead of along the horizon.

See also faults in medium turns, page 19.

5) **ADVANCED THERMALLING** exercise

In this technique, steep turns for approximately three quarters of a full circle are required;

a) As the glider is circled in a thermal at a medium angle of bank, watch for increase in climb rate, or the area of strongest lift;
b) When the glider flies into the strongest lift, pick a point well ahead, and simultaneously increase angle of bank to that of a steep turn;
c) Keep adequate lookout, and note a definite back-pressure on the stick is needed to control the speed;
d) Continue steep turn for 270 degrees of a circle, i.e., until the reference point is in line with the lower wing tip; then
e) Resume the medium angle of bank;
f) Repeat the manoeuvre until the thermal is centered;
g) Mixing the earlier technique (Page 19) with this technique may be found more advantageous if you are flying in sink for most of the first circle or two.
h) Review how to safely **enter** a thermal with other gliders, also **collision avoidance** techniques, see Notes – and rules of the air.

6) Student to plan and fly the circuit, instructor to monitor and prompt with comments as appropriate. Closely monitor the approach (from normal final turn height), the flare and landing.

7) **Review the flight**, starting with the circuit, approach and landing, then review the steep turns exercise, and any thermal flying.

NOTES TO INSTRUCTOR ON COLLISION AVOIDANCE

At any time, point out other aircraft and try to predict their flight paths: Will the glider join the thermal, or go to land? Is the jetliner converging onto a collision course, etc? Discuss how best to avoid a collision conflict and how to keep adequate spacing, e.g. when thermalling. The greatest hazard is another aircraft at the same height, which is apparently not moving with respect to a point on the canopy, but is getting larger. This is on a collision course! The fastest way to gain separation is by a rapid descent/dive. It does not necessarily have to be gliders converging on straight lines. Also beware of gliders **above** when entering a thermal. Stay clear of major airports, airways and the approaches to active runways. Extra care is needed to see and avoid, and to maintain a very good lookout. The fastest way to gain separation is by a rapid descent or diving turn.

SPIRAL DIVES & FURTHER STALLING

1) **SPIRAL DIVE —** Note aircraft is not stalled, airspeed increases in a spiral dive.

a) Carry out CALL check before starting exercise;
b) Enter spiral dive from a steep turn by deliberately letting the nose drop and speed increase;
c) As nose drops and speed increases, try to reduce speed using backward stick-pressure;
d) As stick is moved further back, spiral tightens and speed increases — this is the SPIRAL DIVE. Point out to student the increasing speed, airflow sound and *g* loads, also the heaviness of the controls, especially the ailerons, i.e., the controls are effective;
e) Spiral dives can also start e.g., from a **spin attempt** when the glider fails to enter a spin but instead enters a spiral dive with the speed increasing very rapidly. In this case it is important to recover quickly. (Instructors should demonstrate this, and ask the student to recognise the differences the spin and spiral once the student is familiar with spin recoveries).

2) **RECOVERY** from **SPIRAL DIVE**
a) Reduce backpressure on stick to reduce *g* loads;
b) Start to level wings with coordinated ailerons and rudder; also use care not to deflect both controls fully at the same time, especially in turbulent air;
c) Pull out of dive gently.

3) **BENIGN SPIRAL** – A steady descending spiral to lose height rapidly. Carry out CALL check before starting exercise;
a) Start a well coordinated medium turn, re-trim at steady speed, then fly hands off;
b) Slowly open the airbrakes to fully open and monitor the descending turn but with hands and feet off the controls; note sink rate;
c) The glider may oscillate in speed and angle of bank, but will remain close to the original angle of bank and airspeed; after a steady descent, resume normal flight.

FURTHER STALLING exercises: These exercises are designed to enhance the student's understanding of the slow flight regime, and to prepare the student for unexpected responses of the glider close to and at the 1*g,* and several accelerated stall conditions. Note that the emphasis should be on stall avoidance, not the stall itself.

- Never perform the following exercises with students before they are comfortable with recovering from 1g stalls, including wing-drop stalls as on pages 14 - 16; see also pre-requisites on pages 4 and 5.
- Students sometimes fail to fully stall the glider when asked to perform a stall and recovery. Be clear about what kind of stall is required by you.
- Students may have difficulties with stalling because they think that the initial attitude is what causes the stall, do not start the recovery smartly, or they allow the nose to drop before the glider is fully stalled because they are anxious, or are sensitive to reduced *g*.
- Watch converting power pilots closely when first performing these stall exercises.

4) **ACCELERATED STALL** while **CLIMBING** exercise

a) Before doing any stalls carry out CALL check; this exercise simulates a poor entry into a thermal from high speed, a high-speed task finish and climb, or a winch launch failure;

b) Increase speed slightly then pitch the glider up to a climbing attitude of about 30^{o}; maintain climbing attitude;

c) As speed decreases some symptoms may be absent or not obvious;

d) At the stall, nose drops sharply, even with stick fully back (note this by touching stick against the stop); note the ineffectiveness of the elevator at the stall;

e) To recover, *lower the nose*, i.e. reduce angle of attack by moving stick steadily forward even though the nose is already dropping;

f) As speed increases look up and forward to the horizon, and use controls normally to ease out of the dive: Note height lost;

g) Repeat the above but recover immediately the first symptom of the approaching stall is noticed. This action is to prevent a stall;

h) Emphasise that when the wings are stalled the elevator is ineffective at raising the nose – see d) above; the stick must be moved forward to unstall the wings first, then the nose can be raised again.

5) **ACCELERATED DESCENDING STALL;** perform CALL check

a) Increase speed to 55-60 knots then pitch up about 30°;
b) When nose stops pitching down, pull back abruptly and fully on the stick too soon and again emphasise this to the student;
c) Note buffeting and high sink rate; glider is fully stalled in a distinct nose-down attitude and at higher speed; note ASI reading;
d) Note glider accelerates rapidly when recovery action is initiated.

6) **ACCELERATED STALL** in a **TURN**; perform CALL check
This exercise to be used to teach stall avoidance for this situation.
a) Enter a turn at approx. 30° angle of bank and begin to reduce speed;
b) Note the unusual control positions needed to maintain angle of bank and pitch attitude;
c) At the onset of the pre-stall buffet note the airspeed – compare to the 1g stall speed;
e) At the full stall, recover as for wing-drop stall;
f) Repeat the above but immediately the pre-stall symptom(s) is noticed **recover** by relaxing backpressure on the stick ("lower the nose"). This recovery action is to avoid the inadvertent stall.

7) **EFFECT OF ANGLE OF BANK ON STALL SPEED** exercise
a) Instructor demonstrate; student observe and call out the airspeed when he detects the pre-stall buffet at each angle of bank;
b) Start with wings level, and slow only to the pre-stall buffet; student call out speed, instructor recovers;
c) Increase speed and repeat above at 20°, 40° and 60° (2g) angles of bank. Note the increase in stall speed with bank angle is not linear.
* Typical increases are 1 knot at 20°, 6 knots at 40° and 12 knots at 60° angles of bank assuming a 1 g stall speed of 32 knots.

Emphasize that as the angle of bank increases so does the *g* load – note this by raising the arms – and therefore the loads on the aircraft are higher, hence need for care when rolling to wings-level flight. [A common fault is not maintaining the required *g* loading to stay in the turn; the glider tends to spiral down and loses excess height as speed increases.]

8) Student plan circuit, making own decisions; instructor monitor.
9) **POST-FLIGHT REVIEW –** don't forget**!**

This page for notes

SIDESLIPPING

1) **SIDESLIP at ALTITUDE** exercise; student flying.
a) Perform lookout especially **ahead** and **below**; from a coordinated turn at approx. 30º angle of bank; note the angle of bank and pitch attitude in the turn, which will be the same when in the sideslip;
b) As glider turns, apply rudder to stop the turn;
c) Notice tendency to un-bank because of the glider's lateral stability; control angle of bank normally;
d) Note glider's track (towards the low-wing side) is now not along the heading (not in line with the fuselage);
e) Also note increased rate of descent (on later sideslips also use airbrakes); on some gliders, inaccurate ASI reading;
f) Control speed by maintaining constant pitch attitude;
g) Recover by levelling wings; control yaw;
h) Student to entry and recover from sideslips in a turn; then
i) Pick a reference line on the ground;
j) As glider turns towards this line, apply rudder to stop the turn to track parallel to this line.

NOTE: A sideslip also can be entered by:
- Applying bank and yaw simultaneously from straight and level;
- First banking the glider — adverse yaw will start the slip which can then be held with rudder; or
- Yawing first, then banking the glider.

These techniques should all be practised before first solo as the student gains competence, first without then with airbrakes open.

2) **SIDESLIP to COUNTERACT DRIFT** exercise
a) At altitude choose a reference line 90 º to the wind;
b) Note drift when flying straight and level, with the glider heading parallel to the reference line;
c) Initiate gentle sideslip into wind to counteract drift, and maintain glider's track parallel to the reference line;
d) Note that the angle of bank that is needed to counteract drift, is not as great as when sideslipping to deliberately lose excess height.

3) **SIDESLIP to INCREASE RATE of DESCENT on APPROACH**
When sideslipping on approach, always use airspeed as calculated

for the estimated wind and gust speeds: Approach speed = 1.3Vs + Vw (full wind + gust speed).

a) If obviously too high and an overshoot is inevitable, use a sideslip to fly down to the reference point;
b) Set up sideslip by yawing away from the intended path, the glider's track will then be along the runway centre-line (sometimes this is called a forward slip);
c) If there is a crosswind, lower the into-wind wing;
d) Use airbrakes to increase rate of descent as needed;
e) Recover to straight flight with adequate height (above minimum of 100 ft agl) to allow a normal flare, hold-off and touch down.

4) **SLIPPING TURN prior to LANDING** exercise

a) As sink rate can be very high, demo and practice first at height;
b) If too high on base leg, enter final turn normally but then gradually apply rudder to initiate slip inwards during the turn; maintain approach speed by careful attention to maintaining pitch attitude;
c) On approach recover with adequate height to straight and level for normal flare, hold-off and landing.

5) **SIDESLIP to COUNTERACT DRIFT on APPROACH**

a) Shallow angles of bank can be used to counteract drift when approaching to land in a crosswind;
b) Maintain aircraft heading along runway centreline, adjust angle of bank and apply rudder sufficient to prevent drift; maintain approach speed by control of pitch attitude;
c) Ease off the bank slightly if necessary close to the ground to allow adequate wing-tip clearance.

6) **FAULTS IN SIDESLIPPING**

a) Banking the glider too much, i.e. running out of rudder authority; the glider turns;
b) Poor speed control when ASI is unreliable by not maintaining the pitch attitude, i.e. allowing the nose to drop;
c) Poor understanding of functions of the controls to enter a sideslip; return to practising entering into and coming out of the sideslip from a well coordinated turn at altitude.

TAKEOFFS and LANDINGS in CROSSWINDS & ILLUSIONS CREATED by DRIFT

1) **TAKEOFF in a CROSSWIND** - Towplane can be placed slightly to downwind side of glider; sideways pull in rope helps prevent **weathercocking** of glider and helps keep tug straight.

a) Use rudder to keep straight as much as possible toward tug;
b) Hold upwind wing slightly low during ground run;
c) Keep glider on ground until airspeed is adequate, then allow glider to lift off;
d) After takeoff stay in line with towplane, or crab into wind to avoid hazards at edges of field.

2) **LANDING ACROSS the WIND — by CRABBING**

a) On FINAL crab into wind to stay on course along runway centreline, avoid slip or skid; keep yaw string straight;
b) During hold-off and just prior to touchdown straighten glider with rudder to head along runway, and lower into-wind wing slightly; steer on ground with rudder as before.

3) **LANDING ACROSS WIND — SIDESLIP METHOD**

a) Slip into wind as required to line up with runway;
b) Keep wing slightly low throughout flare, hold-off and touchdown; then keep straight with rudder. **NOTE**: Keep glider straight and wings off ground as long as possible, use wheel brake with caution on gliders with c.g. aft of wheel, to avoid tendency to ground loop.

4) **ILLUSIONS CREATED BY DRIFT** - Demonstrate whenever the chance occurs in stronger than normal winds.

a) Note apparent skid caused by drift, most noticeable at low heights;
b) Note drift when in circuit, especially on diagonal and base legs; resist temptation to remove drift by using too much rudder (spin possible) during final turn; and keep yaw string straight!
c) Stress the need for adequate speed, and well-coordinated and well-banked FINAL turn.

5) **POST-FLIGHT REVIEW**

When strong winds occur advise students to observe other pilots in the circuit to provide useful clues for their takeoffs and circuits. Immediately after takeoff in a crosswind, take control to debrief the student's takeoff. Debrief balance of flight after landing.

This page for Notes

SPINS

1) These exercises should be done from high tows. Height must be above 2000 ft agl minimum after recoveries, starting from at least 3000 ft agl. Centre of gravity of glider must be within limits equivalent to location when student will be solo. Lightweight pilots are to add ballast that must be adequately secured against coming loose under **all** conditions, including **negative-*g*** loads.

2) **APPROACH TO A SPIN** exercise

a) Carry out CALL check, then enter a gentle/medium turn;

b) Gradually slow down, notice symptoms of stall, but that the turn *looks* normal;

c) If one wing does not drop at stall, yaw aircraft slightly to induce the lower wing to drop.

d) As wing drops at the stall, autorotation will start as a prelude to a full spin.

e) To recover, immediately lower nose to un-stall the wings. As speed returns, level wings normally, and ease out of the dive; use stick and rudder together to level wings, i.e., rudder normally to control yaw. Note height lost in the recovery.

3) **FULL SPIN from an under-banked over-ruddered turn;** perform CALL check;

a) Enter spin from *normal* coordinated turn by allowing speed to gradually reduce – spin should start from what appears to be a normal attitude; point this out;

b) Hold-off bank as needed, slowly approaching stall speed; this reproduces the **slow final turn**; mention this point;

c) Before the full spin develops, one wing will drop and autorotation will start to yaw the glider and the nose will drop, try to keep it up with the elevator - next it will roll into a full spin;

d) Hold controls to maintain full spin;

e) Point out constant speed (and that the glider is stalled), the constant *g* force, also rapid spinning descent and high rate of sink.

4) **RECOVERY from FULL SPIN**

a) First apply **full** rudder against the direction of rotation (the force needed may be very high), at the same time centralize the ailerons;

b) PAUSE (half to one second);

c) Move the stick steadily forward to un-stall the wings; a firm *push* against the elevator forces may be necessary;
d) As spinning stops, centralize the rudder; look **up**, and
f) Pull out of dive using controls normally;
g) If speed increases excessively, start the pull up earlier, or be more vigorous in the pull up.

5) **SPIN ATTEMPT** but glider enters **SPIRAL DIVE;** CALL check
a) Repeat the above spin demonstration as in 3) above, but allow the glider to transition into a **spiral dive;** point out increasing speed and increasing *g* loads;
b) **Recover from spiral dive –** ease stick forward to reduce *g* loads, level wings normally then ease out of the dive.

6) **FURTHER SPINNING** exercises – These spin exercises are designed to provide the student with more complete knowledge of the glider's handling and spinning characteristics, and to better enable spins to be *avoided* in the first place – see also **Notes** on next page.

a) **Changing Effect of Rudder at the Stall –** misuse of rudder at the stall causes a spin;
b) **Spin to the left off a right turn**; and vice versa; start from under-banked turn;
c) **After Launch Failure**, from attempt to turn at normal gliding attitude after rope or cable break, when pilot tries to initiate turn, and adequate speed has not been re-established;
d) **The Pear Turn**; rapidly tightening FINAL TURN at normal speed after overshooting runway centreline;
e) **In a Thermal**; d) above can also occur in a thermal when the turn is tightened suddenly in stronger lift without first increasing the glider's airspeed.

It is vital in all these situations to recover before the full spin stage is reached. The two situations, b) and c) are the more critical as they usually occur very low down. See next pages for more detail on how to demonstrate and perform these exercises.

7) Student plan and fly CIRCUIT, making own decisions.
8) Review the flight, referring as needed to the Student Manual ***SOAR and Learn to Fly Gliders***.

NOTES TO INSTRUCTORS

- Very few pilots recover from an inadvertent low-level spin; Stall/Spin avoidance is our main aim.
- In a spin entry the nose drops and points down very steeply; it is the inability of pilots to take correct recovery action of moving the stick forward immediately (lowering the nose even further) that results in stall/spin accidents.
- First spin demonstrations of a few turns are to show the characteristics of the full spin, and the recovery actions.
- Spin training after this is with brief spins to recognise the situations that can lead to a spin, and to apply the correct recovery action after the spin or spiral dive is recognised.
- Failed attempts to spin should be used to recognise the spiral dive, and to compare it to the spin.

a) **Changing Effect of Rudder at the Stall.** Start at normal gliding attitude and speed; student's hands and feet off controls. Apply full rudder one way, then wait 2 – 3 seconds, then ask student to say what happened. Reply should mention lots of yaw and not much roll. Repeat at 1 knot above stall, wings level (glider not decelerating). Apply full rudder and wait... ask how much yaw and roll this time (abrupt and lots of roll, not much yaw). Recover (from wing-drop stall & start of autorotation) to wings level as required. Emphasise that misuse of the rudder near the stall will make the glider spin.

b) **Spin to the right off a left turn**; and vice versa. Start from an under-banked turn to the left. As the glider is slowed, and as the left wing is allowed to drop, slowly apply full aileron to try and lift the wing and full opposite rudder to prevent the yaw towards the lower wing – as the glider slows to the stall buffet, it may spin to the right. Use of the rudder here is in effect **anticipating the spin** – it is applied too soon, and this induces a spin in the opposite direction! Emphasise that in an inadvertent stall the **first action must be to unstall** the wings of the glider. In any stall situation the same recovery action is used for wings level or a wing drop at the stall.

c) **Spin after Launch Failure.** Describe the scenario: from attempt to turn at normal gliding attitude after rope or cable break or a towplane wave-off at a low height, when the pilot tries to initiate a turn, and adequate speed has not been re-established. Simulate this situation by raising nose as appropriate (aerotow or winch climbing attitude) then as speed decreases to just above stall, call "break" and positively lower nose to the normal gliding attitude (on aerotow this reduction of speed is to simulate a slow engine failure]. As soon as the attitude **looks normal**, start a medium coordinated turn and try to maintain normal gliding attitude. The glider will immediately stall and a wing may drop if controls are held for the intended turn. Allow a spin to develop when demonstrating, and recover (from the spin or spiral after it is correctly identified). Note height lost.
Emphasise that the attitude alone is not a reliable indicator that a turn can be started. Student should try this situation, but recover immediately the glider starts to enter the spin; note height lost in this case. Repeat again, this time making sure speed is regained before rolling into a turn. Refer also to the earlier exercises for rope break recoveries, see pages 40, 41, reminding the student of the long time taken to recover the glider to a safe manoeuvring speed after the break.

d) & e) **Spin from a "Pear Turn" and off a Steep Turn in a Thermal.** The first case refers to a rapidly tightening FINAL TURN at normal speed after overshooting the runway centreline; the second situation occurs from a tightening of a thermalling or medium and possibly un-coordinated turn. Both are to be avoided. Start with a 45°-bank angle at close to the stall speed for that angle of bank (about 39 knots for the L-13). Although this is considered a too-slow speed for the final turn, emphasize that it is the attitude that can mislead the pilot as the glider's flying attitude appears close to ***normal***. Do not explain what you are doing next other than trying to increase the rate of turn. While increasing the bank angle and maintaining the attitude normally, steadily apply more rudder (you may also have to pull up more on the elevator). The glider will enter a spin. Recover in the normal way.

Explain that tightening a final turn or trying to thermal more tightly low down with inadequate airspeed, is likely to result in a spin that cannot be recovered from before hitting the ground. Hence in any low-height situation, if the wing starts to drop the recovery action must be to unstall the wings as quickly as possible, and then to level the wings normally when flying speed is regained.

OFF-FIELD FIELD SELECTION & CIRCUIT PLANNING

1) Although the selection and planning of circuits into strange fields will be covered later in more detail when the pilot attends a cross-country clinic, going through the exercise now is an essential part of becoming a competent and safe early solo pilot. This instruction should form the prelude to the pilot's future flying and broadening of his or her horizons – to show that going solo is the beginning of better things to come!

2) These flights provide the essential practice for a student before a first solo flight, but under supervision. They will show whether the student remains calm under the increased workload, realising that if he gets out of range of the club when first flying solo, the workload and stress levels can increase to the point at which the pilot may panic and make poor decisions. The exercise should be repeated a few times until the student shows an understanding of the problems and can demonstrate good decision-making when low down and when time is at a premium.

3) The student should perform these exercises with the instructor providing feedback or mentoring advice as appropriate. The exercises may be varied over a wide range of situations, but care should be taken to provide as much reality as possible. These exercises may be flown equally satisfactorily with or without thermals.

4) **GROUND INSTRUCTION & PRE-BRIEFING**
Set the scene before the flight, with a thorough discussion of off-field landings, to include decision heights, inspecting of suitable fields, types of field, field surfaces, selecting a circuit to fly, hazards on the approach, etc. Include the assumptions to be made during the flight regarding returning to the club's airfield to land. Agree now that the instructor will make the decision to stop the exercise and return to the airfield to fly a circuit and landing.

Note that this exercise and the heights and other considerations such as suitable landing surfaces are described in detail in *SOAR and Learn to Fly Gliders.*

5) **AIR INSTRUCTION**

Towards the end of a flight, select an area with suitable landing fields adjacent to the airfield. Tell the student that he is to assume the flight is nearly over, and that the club airfield is also assumed to be unavailable for this part of the exercise (though it will be used for a normal circuit and landing later). Later exercises may be made more intensive by further restricting the choice of fields or starting at lower heights above the ground. The student's workload will increase by making the student work an imaginary thermal (continue circling).

a) Start at a suitable height above ground such as 1500 feet. State the situation as above, and ask the student to identify a suitable field in which to land; again assume a thermal is being worked if the student can handle the extra workload.

b) After a suitable field has been agreed, ask the student to plan a circuit into it, choosing the approach, his or her choice of an alternate landing area, and identifying any hazards on the approach to or on the field. Continue thermalling.

c) Debrief quickly when it is agreed the circuit and field are suitable for the current situation, then go to another area and repeat the above, now at a lower height and into a new field. This could increase the workload considerably.

TAKE CARE to ensure that a safe return to the club airfield can be made.

6) **POST FLIGHT DEBRIEFING**

Point out the need to make decisions by the pre-defined heights and that thermalling really restricts the view of any field below. Discuss good and poor decisions regarding choice of field and the planning of the circuit into it, and the need to choose an alternate landing area for any choice of field. To further confirm the choice of field go with the student by car to look at the approach to and the surface of the chosen field and any alternate landing area.

PRE-SOLO FLIGHTS

Two or three flights are a suggested minimum. Use the Association **RECOMMENDED SOLO STANDARD for GLIDER PILOTS** as a guide for assessing the student's flying and judgement skills before first solo.

1) Before solo ask a different instructor to fly with your student to evaluate skills and readiness to solo; student must have a student pilot permit to go solo;

2) For a minimum of two flights prior to solo, student must not need prompting or assistance of any kind at any stage of the flights;

3) On these flights review any exercise student wishes, but don't rush or **overwork** the student just prior to solo.

4) **GENERAL REVIEW**

a) Adequate checks: CISTRSCO, Post Release, CALL, SWAFTS;
b) Adequate lookout: Prior to release, prior to turns, during thermalling, in circuit and prior to landing;
c) Review reasons for spin training – too slow final turn and too much rudder; also ***Pear Turn***, and low launch-failure scenarios;
a) Review cable/rope break procedures, and the additional aerotow emergency signals;
b) Review collision-avoidance techniques and need to stay very alert close to controlled airspace, airports, etc;
f) Give student the pre-solo exam, and sign their training record when they pass it.

5) **PRE-SOLO and SOLO FLIGHTS**

a) Normal instructor fly ***as passenger*** with student; then send student solo;
b) Monitor the solo flight, and debrief the student following the flight;
c) Keep tabs on your students and ensure they have regular dual flights before licensing, to monitor their progress and to teach more advanced items – including radio use, airspace structure, more spin-avoidance practice, thermalling, collision avoidance, review field selections and off-field landings, and so on.

POST-SOLO FLIGHTS

It is **important** to remember that student pilots may only fly under the supervision of an instructor, even when solo. This is easily ensured at most clubs where a **duty instructor** is present during flying. Your students will be flying sometimes when you are not there, so it is an excellent morale booster if you follow up when you can with the students that you taught, to ask about how they are doing.

There are a number of exercises that may not have been completed prior to solo but which must be done before licensing. This includes a flight with covered instruments, in which case the instructor is to have his instruments available. Newly soloed pilots should also be practising regularly prior to their licence check flights. This is where the instructor can assist in giving the students the encouragement they need, and to help with defining an objective for each flight.

Early solo flights should concentrate on practising coordination in turns, lookout techniques, and becoming comfortable with flying slowly and doing stalls and recoveries. Accuracy in flying the circuit together with good speed control and approaches with ½ - ⅔ airbrake setting, for example, are good objectives to suggest to the student. Later flights should include thermalling practice and other advanced exercises such as sideslips, spins, and steep turns. Spins and spin-avoidance exercises should be watched from the ground.

These flights should be interspersed with dual flights during which exercises such as spins and sideslips should be reviewed. Also show the student more advanced thermalling techniques, for example.

The **Bronze** Badge defines an excellent set of tasks that can be the basis for consolidating important exercises such as field selection and off-field circuit planning. Collision avoidance and the correct use of radio and the airspace around terminal areas also should be reviewed at this time. Such tasks can be very usefully covered during otherwise poor weather when thermal flights are not possible.

Circuit planning, good lookout and airmanship, use of the SOAR technique and quick but thorough performance of all checklists should be audited on each flight.

THE SOAR TECHNIQUE

This decision-making technique is used after an interruption to a launch. Similar steps should be taken for other situations before and during flying.

During the CISTRSCO checks, decide whether you would attempt a down-wind landing under the prevailing conditions. If the launch is interrupted **at a height of less than 300 feet above ground,** lower the nose immediately and land straight ahead (if very low to the runway, take care when lowering the nose). It is dangerous to attempt to turn around to land on the runway when ***very*** low, the first choice must be this ***automatic reaction***.

If the launch is interrupted at about 300 feet teach the student to use his or her Pilot Decision-Making abilities to make a safe landing. Assess the **S**ituation. What is the actual height, airspeed and the position of the glider relative to the runway, and what is the wind direction and speed?

Next consider the **O**ptions. For example, what will happen if you or the student starts a turn with adequate speed? Is there a possible landing area to the side and what is its surface like? What would happen if the turn were to be continued? Would it be safe to land on the runway?

Choose the safest option and **A**ct quickly, there is little time for hesitation.

Now **R**epeat the process. Is there still sufficient height to continue the turn, for example, and is the airspeed still safe for the conditions? If not, immediately act to correct it, and assess new options. Then act on the safest option, and repeat the process.

Notice that the automatic reaction to a low-level emergency can be modified safely by good judgement. The PDM or pilot decision-making technique, using the mnemonic **SOAR**, is shown being used above, to safely modify the normal automatic reaction to this emergency.

Use of the SOAR technique does not reduce the need to cover all Options during the pre-takeoff CISTRSCO checks. This will substantially reduce the time for decision making when the launch is interrupted. By having all options covered, pilot stress is also reduced, an important safety consideration when accurate flying is needed.

Also refer to *SOAR and Learn to Fly Gliders* for more on PDM and using the SOAR PDM technique.