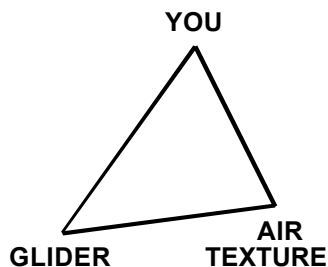


# Basic R/C Thermal Gliding Course

(By: A. H. Neerings)



## A Checks prior to instruction (done by instructor)

- 1 Glider structural strength, aerodynamic alignment, CG, control direction and amount, radio installation and range check
- 2 Weather conditions and training area
- 3 Test glide, set-up and trim for straight and level glide

Quote —

*To hear is to forget  
To see is to remember  
To do is to understand*

## B Actual instruction

(with demonstration of requirements prior to each phase)

- 1 Straight and level flight (into wind) (10 + flights, late afternoon)   
Fuselage level, wings level, stay into wind, no diving, no stalling, right amount and direction of control input, no ground loops, soft landings
- 2 Straight and level flight (left to right, right to left) (20 + flights spread over 2 - 3 days, late afternoon)  
All of above + controlled crabbing flight perpendicular to wind direction, no turning into wind or downwind
- 3 High flight instruction 1 (3 flights)  
All of above + speed control/attitude, straight and level flight, steady co-ordinated turns
- 4 High flight instruction 2 (7 flights)  
All of above + slow flight control, fast flight control, spiral dive, stall, spin, 3 consecutive figure 8s (cross wind) and 360s (drifting)
- 5 High flight instruction 3 (3 flights)  
Applying above + landing pattern, final approach height and speed to fly (threshold slope of 30°)
- 6 High flight instruction 4 (3 flights)  
Applying above + bungee launching technique, wind direction and strength, release technique

7 Solo flight test (2 flights)

Two consecutive flights under supervision, applying all the above and giving clear verbal narrative of decisions being made and executed — demonstrating decision and execution control with no instructor input

## C Important discussion

- 1 Eyes – depth of focus
- 2 Speeds to fly
- 3 Airmanship

## Notes On Basic R/C Thermal Gliding Course

### Equipment needed —

Rudder/elevator controlled glider with bungee. Typically a 2m wingspan, built-up balsa glider, built by student to allow student to fix the glider if it gets damaged during training. A 2ch radio on 27MHz (with normal alkaline batteries) for aircraft use (1m long receiver aerial). The bungee, if made up of Roinhardt 201 surgical tubing (8mm OD, 5mm ID, 30m un-stretched length), with 100m 15 kg minimum breaking strength monofilament fishing line — could be used for flying the G2K competition as well.

## A Checks prior to instruction (done by instructor)

### 1 Glider

#### a Glider structural strength

- ⇒ Wing bending strength, torsional rigidity, amount and layout of rubber bands holding the wing
- ⇒ Tail plane – torsional rigidity, fixing strength to fuselage, hinge fixing, control horn fixing
- ⇒ Tow hook position (and ring clearance), strength, fuselage reinforcement

#### b Aerodynamic alignment

- ⇒ Wing — no wing twist built/ironed in other than tip washout
- ⇒ Tailplane — fin perpendicular to stabiliser and in line with the centre line of the fuselage, stabiliser parallel to the wing

#### c CG

- ⇒ As per plan, or no further back than 33% of average wing chord from the leading edge and no further forward than 25% of average wing chord from the leading edge.

**d Control direction and amount**

- ⇒ Rudder — left movement on control stick shall result in rudder moving out to the left side of the glider to a maximum of  $30^{\circ}$  from centre position, and the opposite with right movement.  
With the control stick in the centre position (trim lever included), the rudder shall be in line with the centre of the fuselage.
- ⇒ Elevator — with the elevator control stick moved to the opposite end of the transmitter aerial (into the stomach as per full size aircraft), the elevator shall move up to a maximum of  $20^{\circ}$  from the centre position, and the opposite with the control stick moved towards the aerial.  
With the control stick in the centre position (trim lever included), the elevator shall be in line with the stabiliser.

**e Radio installation and range check**

- ⇒ Servo installation — rigidity, servo leads/plugs
- ⇒ Battery installation — no loose connections, switch
- ⇒ Pushrods — free movement, stiffness under load, control horn installation, maximum stroke clearance (with trim max. positions)
- ⇒ Aerial position — prevent handling damage, full length extension up to fin

**2 Conditions**

**a Weather conditions**

- ⇒ Wind strength — zero to light wind
- ⇒ Rain — no rain, very bad for instructor's health

**b Training area**

- ⇒ Ground — should be level, 100mx100m minimum, with grass and without rocks and obstructions
- ⇒ Wind shadow — shall be avoided by training only when there is no tall obstructions upwind of the training area, like trees or stadiums/buildings, because the turbulence caused downwind of such obstructions make controlled flight very difficult
- ⇒ Obstructions — like poles, trees, cars, etc. are sure glider eaters

**3 First Flight**

**a Test glide**

- ⇒ Over the head, fuselage horizontal, wings level, with sufficient speed to glide out. If too slow, the glider will fall to the ground, if too fast, the glider will climb higher than launch height and probably stall.

**b Set-up and trim**

- ⇒ With the CG in the correct place, the glider set-up will be correct if the glider glides out with the fuselage remaining horizontal and the speed remaining constant all the way to landing with the elevator in the centre position. If the glider dives and speeds up, the elevator shall be

trimmed up till the glider maintains a constant speed glide out [alternatively the leading edge of the wing could be spaced up with strips of balsa until the glider glides out at constant speed]. If the glider climbs and slows down, the elevator shall be trimmed down until the glider maintains a constant speed glide out [alternatively the trailing edge of the wing could be spaced up with strips of balsa until the glider glides out at constant speed].

- ⇒ The glider should glide straight into wind with no consistent tendency to turn to one of either side. Rudder trim should be used to counter any consistent turning to one direction and get the glider to fly straight. Turning to one side is usually caused by a twisted wing (aileron effect), or a skewly mounted fin (built in rudder deflection), or one wing half heavier than the other wing half.

## B Actual instruction

- 1 This step is needed to get used to left/right and up/down control inputs, to see that the glider has its own gliding ability and to observe the effect that the wind has on the glider. The glider has to be launched into wind, away from the pilot so that the pilot stands behind the glider as it glides out into wind. The strength and direction of throw should be as per “test glide” description. It could be done a bit harder as the student gets used to controlling the glider, but the student shall level the glider, by giving sufficient down elevator as the speed of the glider drops whilst climbing out to prevent a stall so close to the ground.
  - a **Fuselage level** — most training gliders have a flat fuselage bottom, and can be used as visual reference to keep the glider at the correct angle of attack during the glide out, being level with the ground/horizon using the elevator control. Up elevator raises the nose of the glider, and down elevator lowers the nose of the glider. The bottom of the fuselage only is relevant during ground training, as the focus later moves to glider speed/sink rate in combination with fuselage attitude.
  - b **Wings level** — the wings have to be held level through the use of rudder inputs opposite to the turning direction caused by the angled wing. The wings shall be held level to prevent a wing tips from catching the grass/ground and causing the glider to ground loop with the possibility of damage to the glider
  - c **Stay into wind** — during ground training, do not allow the wind to turn the glider to either side, using rudder inputs to the opposite direction of the induced turn. Gliding into wind results in the slowest glider speed relative to the ground (important to remember that this is not the glider’s airspeed, as the airspeed has nothing to do with the ground)
  - d **No diving** — diving shall not be entertained as this throws away height unnecessary, and during ground training, usually ends up crashing the speeding glider into the ground resulting in damage to the glider.

- e **No stalling** — stalling happens when climbing/flying at nose high attitude at low speed, and the wing is unable to sustain flight. The glider then automatically rotates nose down and drops to pick up speed to start flying again. During ground training this results in the glider crashing into the ground before enough speed is attained due to being too close to the ground.
  - f **Amount, direction of control** — The glider when set-up properly, has a natural ability to glide, and the student only has to correct for inconsistent launches and the texture of the wind and its interaction with the glider. The student shall learn to input the correct direction of control and the right amount based on the results required and actually attained. The slower the glider flies, the more control input is needed to get the result in attitude change required to get back to a steady glide out.
  - g **Ground loops** — starts when the glider lands with one wing tip low, touching the ground first, this normally results in the glider cart wheeling over the ground and damaging the tail plane.
- 2 **This step is needed to learn left from right side of glider. Remember that the glider's left side, remains it's left side regardless in what direction the glider is flying, the same as up and down. Second to this, crabbing flight (cross wind) is experienced and the control inputs needed.** The glider has to be taken to either side of the student and launched across from left to right (or right to left) consecutively. The student stands facing the wind and controls the glider as it passes upwind of the student from left to right (or right to left). The glider has to be kept flying this line perpendicular to the wind direction and prevented from turning either into wind or downwind. Turning downwind has the added danger of ground looping at higher groundspeed as the gliding airspeed gets added to the wind speed as resultant groundspeed.
- a **Controlled crabbing flight** — the glider is flown such that the flight path over the ground is perpendicular to the wind direction. The glider's nose however is pointing slightly upwind and one should look at the resultant flight direction and not the direction the nose is pointing.
- 3 **This step is a very important transition from ground training to actual flight at altitude. The most important is to stop any diving before trying to rectify any turning deviations (i.e. spiral dive) should the student get into trouble during turns.**
- The glider has to be taken up the line on the bungee to normal launch height by the instructor, with control handed over to the student the moment the glider is flying level at constant gliding speed.
- a **Speed control/attitude** — the student has to learn that the glider cannot be controlled by watching the attitude of the fuselage when it is up in the air. The student has to learn to watch the speed of the glider, and as it speeds up conclude that it is diving and respond with the relevant up elevator, or as it slow down to almost a stop that it is stalling and respond with the relevant down elevator to get flying speed and preventing a stall.

- b Straight and level flight** — The student has to concentrate on flying the glider in a straight line for extended periods of time keeping the glider at normal gliding speed and counteracting the effect of wind texture as it interacts with the glider.
  - c Steady co-ordinated turns** — the student has to watch the glider during turns, and prevent it from spiralling inwards by giving sufficient up elevator to maintain the speed and height the glider entered the turn with. Too much up elevator will result in slowing down the glider and could end up in a tip stall (if persisted without corrective action) on the inboard wingtip with a spin entry. Too little/no up elevator will result in the glider speeding up and losing height entering into a spiral dive
- 4 This step is needed to experience the gliders flight envelope, different flight conditions and how to control the glider in these different conditions.**
- a Slow flight control** — the student is asked to give half up-trim, (or more to get the glider flying on the edge of the stall) on the transmitter, and experience the sluggish glider response and the larger control inputs needed to control the glider.
  - b Fast flight control** — the student is asked to give half down trim, (adjusted to result in a steady high speed flight, no diving) on the transmitter, and experience the quick response to control inputs and the small control inputs needed to control the glider.
  - c Spiral dive** — the student is asked to turn with half rudder input, but without inputting any elevator, and experience the result of a spiral dive. One turn is sufficient, with the student asked to stop the rudder input and put in steady up elevator to get the glider back to level flight without loosing the wings due to high speed pull-out.
  - d Stall** — the student is asked to fly level and then slowly put in more up elevator until the glider slows down and it's nose drops due to a stall and experience the height loss of a stall. After the stall the student is instructed to get the glider back to level flight.
  - e Spin** — the student is asked to increase up elevator during a turn and progress to full up elevator and full rudder control input. The student will experience the result of a spin whilst holding full up elevator and rudder input. Up to three turns is sufficient, and the student is asked to release the previous control input allowing the glider to stop rotating, drop the nose and pick up speed, with the student getting the glider back to level flight.
  - f Figure 8s** — the student is asked to fly figure 8's with centre line perpendicular to the wind direction (upwind or downwind of the pilot position), making each turn into wind and adjusting the turns to ensure that the figure 8's centre line does not move downwind.
  - g 360s** — the student is asked to fly continues steady circles maintaining turning direction, radius and flight speed (attitude), whilst allowing the

glider to drift downwind. This should be done in both directions, i.e. left hand and right hand turns.

## **5 This step is needed to learn the discipline of landing approaches.**

- a Landing pattern** — the student is asked to fly a rectangular landing pattern starting with entry on the downwind leg, going into the crosswind leg (crabbing flight) on the downwind side of the landing area, and turning upwind and landing in the landing area.
- b Final approach height** — the landing pattern is to be adjusted at any point, to take account of flying through lift or sink. When flying through lift (the landing could be aborted and the lift exploited for what it is worth – depending on students skill level), the gliders path can be adjusted further away from the landing area. When flying through sink, flight speed shall be increased and the glider flown closer to the landing area so that it remains on an imaginary threshold that starts on the edge of the landing area and extends up and away from the landing area at 30 to the horizontal. When getting down to 10m anywhere during the landing pattern whilst being on the threshold level, the glider shall be turned into the wind to land on the landing area.
- c Speed to fly** — the student asked to adjust the glider's relevant ground speed by adjusting the flying speed with little up elevator control to slow the glider down and decrease the relative ground speed, or little down elevator to speed the glider up and increase the ground covered.

## **6 This step is needed to become totally self sufficient.**

- a Bungee launch technique** — the bungee gets set up by anchoring the surgical tubing to the ground, upwind from the landing area. The bungee then gets laid out in the downwind direction from this anchor point onto the landing area. From its free length, the bungee gets stretched by 80m, and if set up correctly, one should be at the downwind edge of the landing area. After the radio and the glider is switched on and checked for correct operation, the ring on the towline gets attached to the tow hook underneath the glider whilst holding the fuselage below the wing, but behind the tow hook. The glider gets launched as per normal test glide, but it will climb due to the towing action of the bungee. The student is asked to keep the glider flying straight by using only rudder inputs.
- b Wind direction and strength** — the stronger the wind, the more important it becomes to launch into wind, as wind coming from the side will cause the glider to veer of to the downwind side. If the cross wind is caused by a thermal cycle going through, it is better to delay the launch for a minute or two till the wind straightens up again before launching. If the cross wind is caused by a permanent change in wind direction, then it will be wise to move the bungee anchor point to upwind of the landing area, and lay the towline out again. If the wind is only slightly cross, the student shall hold the fuselage in the direction dissecting the angle between the

towline and the wind direction, with the upwind wing slightly lower than the downwind wing.

- c **Release technique** — under normal conditions, the tow line should release by itself, but if the wind is stronger, it might stay attached to the glider like a kite. The student shall stay into wind under tow, enter the glider into a slight dive, and pull up elevator to get the glider climbing at about 45. This will release the towline, and allow the student to return to level flight. The student shall not turn away from the towing direction whilst still under tow.

## **C Important discussion (done by instructor)**

### **1 Eyes — depth of focus**

- a Standard depth of focus when looking up at nothing specific in the sky is about 20m. Finding your glider once you have taken your eyes off your glider will require you to look at the horizon, or the edge of a cloud in the area where you last saw your glider. This will extend your depth of focus and you will find your glider again without much effort (so do not panic, but also keep your eyes on your glider).

### **2 Safety**

- a People are special, and our gliding activities shall not put anybody at risk. This includes spectators, fellow pilots, yourself and even car traffic around the flying site.
- b Each transmitter operates at a given frequency, and two transmitters on the same frequency will totally confuse a gliders receiver, making it impossible to control. An out of control glider can come diving out of the sky with high risk to injuring people, damaging property and totally destroying the glider. Each club has a control system that prevents transmitters of the same frequency to be switched on at the same time, but this depends on the pilots from that club applying the rules, and this includes you (peg on/peg off frequency board). SAMAA has set out legal frequencies in South Africa for flying model aeroplanes, in conjunction with the Post Office. Make sure your frequency is legal. Your transmitted signal and the receiver's ability to decode the signal and control the servos depend on the battery strength, make sure that the transmitter battery is above 9V and the receiver battery is above 4,5V when using normal alkaline batteries. If equal to, or below these voltages, the batteries shall be replaced before attempting any further flights.
- c Landings require a clear path with no obstructions in the gliders flight path, i.e. trees, buildings, fences, poles or stones. The people at the club also need to be kept from risk of being flown into, therefore the flight path shall not be over people (other pilots, spectators), cars or the clubhouse.

- d High speed flight is attained in a downwind direction dive and looks very spectacular in showing off the gliders speed past the pilot, but is very risky to the pilot and spectators should anything go wrong with the glider, or its control, putting everybody at risk. I have witnessed such a high speed impact of a homebuilt 2m glider with control problems going out of control and impacting a fellow pilot's leg and burying its nose above the knee from left to right through the muscle.....what a mess. This shall not be done and constitutes irresponsible behaviour by the pilot, putting himself and fellow spectators/pilots at risk.

### **3 Airmanship**

- a Airfield sharing — layout/wind direction, setting up.
- b Dangers — aircraft envelope, flying area.
- c Your skills — develop continually, enjoyment, competitions.
- d Your equipment — keep in good condition, batteries, switch harness, plugs/leads.
- e Criticism of others — do not indulge criticising other pilots, their aircraft or spectators.
- f Assistance is always valued by other pilots (setting up equipment, untangling tow lines), as well as spectators regarding information.
- g Irresponsible behaviour shall not be tolerated, and shall be stopped in firm but friendly manner: yourself, other pilots, spectators.