

Gliding Australia Training Manual

Trainer Guide



Unit 8

Sustained Turns, All Controls

Unit 8 - Sustained Turns, All Controls

AIM

The aim of this GPC Unit is to develop the knowledge and skill to:

- use all primary controls to enter, maintain and exit a sustained turn in a coordinated manner;
- identify and correct coordination errors in the turn;
- vary the angle of bank in a turn;
- describe the relationship between the angle of bank and the radius of the turn; and
- demonstrate smooth and coordinated entry, maintenance and exit of sustained turns at various angles of bank and speeds.

PREREQUISITE UNITS

- GPC Unit 6 Aileron Drag & Rudder Coordination.
- GPC Unit 9 Lookout Scan Procedures

COMPLEMENTARY UNITS

There are no complementary units for this GPC Unit.

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COMPETENCY ELEMENTS AND PERFORMANCE STANDARDS

ELEMENT	PERFORMANCE STANDARDS
1. Describes control usage in turns	<ul style="list-style-type: none"> • Describe: <ul style="list-style-type: none"> ○ How primary flight controls are used to turn the aircraft. ○ The requirement for lookout and scan procedures whilst in a sustained turn. ○ How coordination is maintained in the turn.
2. Enters a coordinated turn	<ul style="list-style-type: none"> • Demonstrate: <ul style="list-style-type: none"> ○ Targeted and full scan to maintain situational awareness. ○ Use of aircraft controls to enter a coordinated turn in both directions to various angles of bank up to 40 degrees. ○ Coordinated turn at various speeds from Minimum sink through to 70 knots. ○ Centralised aileron and rudder once desired bank angle is achieved.
3. Maintains coordinated turn with varying bank and speed	<ul style="list-style-type: none"> • Demonstrate: <ul style="list-style-type: none"> ○ Constant angle of bank for 2 complete circles. ○ Coordinated flight for 2 complete circles in both directions. ○ Aircraft airspeed by reference to attitude for two complete circles. (minimum sink speed through to 70 knots). ○ Targeted and full scan appropriately during turn. ○ Different turn rates at different angles of bank. ○ Application of controls to return aircraft to coordinated turns from an uncoordinated state.
4. Exits sustained turn on desired heading	<ul style="list-style-type: none"> • Demonstrate: <ul style="list-style-type: none"> ○ Targeted and full scan when exiting the turn. ○ Roll out to heading on horizon. ○ Use of aircraft controls to return the aircraft to wings level in a coordinated manner whilst maintaining aircraft attitude. ○ Return to wings level on roll out heading +/- 10 degrees.

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KEY MESSAGES

- Gliders spend most of their time aloft in sustained turns.
- Lookout is essential – before entering, during and before exiting the turn.
- Have a relaxed grip on the control column and controls adjusted correctly for reach during flight.
- Correct hand-over/take-over procedure and expected action and verbal response to each.
- There must be no confusion about who is in control of the aircraft.
- Lookout to clear any airspace before turning into it.
- Use of all controls must be coordinated. i.e. Control column and rudder inputs are simultaneous in the same direction, keeping the yaw string centred.
- Use elevator to maintain aircraft attitude and trim to relieve workload on the control column for each new configuration.
- Use moderate angles of bank whilst learning.
- It takes time to master coordination of controls.

Sub-gravity Sensation .

- Some people show a sensitivity to “sub-gravity” sensations. The sensitivity is to reduced gravity (sub-gravity) not negative gravity. You need to be aware of the condition and its consequences.
- A briefing is not strictly necessary. At no point in this exercise should there be any extreme attitudes.
- Firstly produce an extended sub-(reduced) gravity sensation – NOT a zero or negative gravity – using a gentle bunt. Some will enjoy the sensation and most will not be affected. Some will find the sensation disturbing and often will react by raising hands or throwing the head back. The test is only effective if the manoeuvre is as mild as possible while producing clearly reduced gravity for a period.
- If the student is sensitive
 - Discuss and reassure
 - Demonstrate and have the student execute the bunt until the response is controlled and expected. Such students may never be ‘happy’ but must understand the response and it must be controlled.
 - Be sure, in the following work on stalling that the student Clearly distinguishes sub-gravity from stalled flight.
 - Make an obvious note in the log book or other record and be sure to report to the panel.

LESSON PLANNING AND CONDUCT

Classroom Briefing

General

- Lookout is essential – before entering, during and before exiting the turn.
- Gliders spend most of their time aloft in sustained turns.

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- It is therefore important that pilots correctly understand the forces that cause a glider to turn and how to influence those forces to achieve the desired result.
- Learning to turn a glider follows logically from learning the primary and secondary effects of the controls.
- When the glider is banked into a turn, the lift force is tilted over with it; remember that lift acts at right angles to the airflow around the wing.
- This tilted lift force, as well as trying to balance out the weight of the glider, also "pulls" the glider in the direction the pilot wants to turn.
- You need more elevator in order to provide the extra lift required for the turn.
- The more the glider is banked over, the greater the rate at which the glider will turn.
- The basic principle is as simple as that.
- Remember that the primary turning controls are the ailerons, not the rudder.
- The ailerons are used to bank the glider and it is the bank angle which produces the force which turns the glider.

Entering the Turn

- Ensure a good targeted LOOKOUT scan away from the direction of turn and then in the direction of turn.
- Then look ahead over the nose and apply aileron and rudder together in the appropriate direction.
- Correct coordination can be checked by noting whether the nose moves smoothly around into the turn as the bank develops.
 - If the nose "hesitates" before moving in the direction of the turn, insufficient rudder has been used in conjunction with the ailerons.
 - If the nose moves noticeably in the turning direction before any bank has developed, too much rudder has been applied.
- The most common fault in the early stages of learning turns is insufficient rudder.
- Yaw string indicates success.
- Elevator is utilised as required to maintain aircraft attitude. Explain with the use of the diagrams above, why the nose will drop in a turn if no backstick is applied.
- Higher angles of bank require greater control inputs.
- Aileron and rudder must return to neutral at desired angle of bank.
- Resume targeted scan. Scan regularly inside the turn along the horizon, not the wingtip and back to the nose. Each time you scan ahead, also check the nose attitude.

Sustaining the Turn

- During the turn, monitor and if necessary control bank angle with **Aileron**, suitably coordinated with **Rudder**. Maintain correct nose attitude with **Elevator**. Remember the little mnemonic A-R-E. "ARE we maintaining a correct turn?"

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- Maintain targeted scan and regular full scan to maintain situational awareness.

Correcting Coordination or Attitude Errors in the Turn

- Uncoordinated flight is indicated by the yaw string and is corrected by use of the rudder.
- Any change in attitude is indicated by referencing the nose to the horizon.
- The nose should remain smoothly tracking at the same angle to the horizon “like a well oiled conveyer belt” without nodding up or down.
- “The Nose Knows” telling you a change in airspeed before the ASI does, use the elevator smoothly to return the nose to the correct attitude/speed then use trim to relieve workload.
- Look around frequently!

Varying the Angle of Bank

- To change angle of bank, the control column & rudder move the same way, maintaining coordination.
- Use the rudder proportional to the ailerons and note the change in aircraft angle of bank on horizon.
- If there is a steep angle of bank, the outer wing is travelling faster than the inner, developing more lift; so there is a tendency for the glider to overbank, especially large wingspan gliders. If the glider is allowed to overbank, the nose will drop further. If this is corrected by more back pressure, the turn will tighten into a spiral dive.
- If the glider starts to overbank, demonstrate how to coordinate controls to take off bank to desired angle.
- Check “A-R-E”.

Exiting the Turn

- Note the point on the horizon where we want to exit the turn, then conduct a targeted scan to the outside of the turn and then in the direction that you will exit to maintain situational awareness.
- Before that point is reached in turn use simultaneous use of aileron and rudder to reduce angle of bank.
- Adopt wings level position just before the desired heading is reached (remember the glider has some inertia)
- Relax the back pressure on the elevator to counter the nose rising on exit of the bank.
- Coordinated flight is indicated by centering the yaw string.
- Use elevator trim for the new configuration.
- Maintain cruise scan and regular full scan to maintain situational awareness.

PRE-FLIGHT BRIEFING

- Cover instruments if required and brief for maintaining view outside the cockpit.
- Explain the plan to conduct multiple sustained turns of at least one/two complete circles.
- Reiterate coordinated use of all three primary flight controls.

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FLIGHT EXERCISES

Turn Entry

- Targeted and full scan.
- Looking straight ahead using the horizon as attitude.
- Turn with simultaneous use of aileron and rudder.
- Control column & rudder move the same way maintaining coordination.
- Roll the aircraft to the desired angle of bank.
- At the desired angle of bank, centralise the aileron and rudder simultaneously.
- Move the control column aft slightly to maintain attitude.
- Check coordinated flight indicated by yaw string.

Sustaining the turn

- Complete regular targeted and full scans to maintain situational awareness.
- Angle of bank & attitude maintained by reference to horizon.
- Feel apparent G-force straight down through the seat. Check coordinated flight indicated by yaw string.
- Check "A-R-E".

Correcting coordination or attitude errors in the turn

- Uncoordinated flight is indicated by yaw string.
- Use of rudder to correct coordination.
- Change in attitude indicated by reference to horizon. (The Nose Knows!)
- Use of elevator to return to correct attitude.
- Use of trim to reduce workload.
- Varying the angle of bank.
- To adjust the turn, control column & rudder move the same way maintaining coordination.
- Use rudder proportional to aileron.
- Note change in aircraft angle of bank on horizon.
- Check "A-R-E".

Exiting the turn

- Note point on horizon where we want to exit the turn.
- Targeted scan outside turn and then in that direction to maintain situational awareness.
- Before that point is reached in turn use simultaneous use of aileron and rudder to reduce angle of bank.

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- Wings level position attained as the desired heading is reached.
- Coordinated flight indicated by yaw string.

Student Practice

Student practices entering and maintaining a sustained turn in both directions:

- Instructor nominates direction to bank.
- Conduct FULL SCAN and TARGETED SCAN.
- Student smoothly rolls the aircraft to the desired angle of bank, maintaining coordination and attitude.
- Angle of bank in the turn is maintained.
- Turn is continued to monitor for correct coordination and attitude.
- Lookout is maintained.

Student practices exiting a sustained turn:

- Instructor nominates time to leave turn.
- Conduct FULL SCAN and TARGETED SCAN
- Student smoothly rolls the aircraft to wings level, maintaining coordination and attitude.
- Return to stable platform between practice.
- Practice at slow and fast airspeeds.

As student becomes more proficient:

- Conduct turns in one direction straight to opposite direction.
- Student identifies point on horizon to exit turn.
- Student identifies if correct exit heading has been achieved.
- Conduct turns at varying airspeeds at the same angle of bank.
- Conduct turns at varying angles of bank at the same airspeed.

Notes:

1. The student must have a relaxed grip on the control column and controls adjusted correctly for reach during flight.
2. Ensure lookout is maintained by all aircrew. Cover instruments in the student's view if necessary to discourage looking inside the cockpit.
3. If the student is reacting negatively to G forces do not try to 'inoculate' them by continuing to expose them to it. Rather continue with reduced movement or if turbulence is too great for this, land. Encourage the student by noting that this is a common issue for humans as we evolved in a 1G environment where rapid changes in G force was often associated with falling.
4. Depending on trim and CofG to maintain attitude at lower speeds may require back pressure on the stick.

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5. Be very careful with terminology and clarity of language. Make it clear when discussing control surfaces and control inputs (elevator, aileron, rudder), their effects in terms of motion (pitch, roll and yaw) and their effects in terms of attitude and flight path (attitude, bank angle, yaw angle or slip-skid angle).
6. Precision with terminology must be synchronised with demonstrations inflight. Patter must be concise and careful. Feedback from the student must be sought. "What did you see when...?"
7. If the student is still prone to airsickness, ensure that the flight exercise does not continue if they have indicated onset of illness, or fail to respond to communication.
8. Ensure that the student has been briefed on the correct hand-over/take-over procedure and their expected action and verbal response to each. There must be no confusion about terminology for transfer of control.
9. Remove all distractions from the exercise, for instance mute audio variometers.
10. Do not reference changes to flight instruments – at this stage of learning the student must learn with reference to external cues.
11. Do not reference compass headings for these exercises, due to compass lag and inertia it will be difficult for low experience pilots to come out of a turn to a compass heading, instead use a point on the horizon.

COMMON PROBLEMS

Problem	Probable Cause
<ul style="list-style-type: none"> Failure to look out properly before turning. 	Student may forget or be distracted. Do not let turns proceed without adequate lookout.
<ul style="list-style-type: none"> Insufficient rudder with aileron at turn entry. 	Student may use no or insufficient rudder. Check understanding of correct use of controls from GPC 6.
<ul style="list-style-type: none"> Grip too tight on the controls. 	Student may be nervous or unsure how to hold the control column. Brief use of two fingers and thumb as a means of a lighter hold.
<ul style="list-style-type: none"> Failure to remove rudder once bank achieved. 	Student may misunderstand how rudder is used in an aircraft. Check understanding of correct use of controls from GPC 6.
<ul style="list-style-type: none"> Failure to maintain back pressure in the turn. 	<p>Student is failing to monitor horizon. Emphasise need for constant nose attitude to maintain constant airspeed.</p> <p>Student looking at ASI instead of monitoring nose attitude</p>
<ul style="list-style-type: none"> No or insufficient use of ailerons in turns. 	<p>Student may misunderstand how rudder is used in an aircraft. Check understanding of correct use of controls from GPC 6.</p> <p>Brief student that we NEVER try to turn a glider in flight by using rudder alone.</p>

THREAT AND ERROR MANAGEMENT

- Risks associated with uncoordinated flight (either too little or too much application of rudder).
- Control risks associated with excessive angle of bank.
- Failure to maintain situational awareness during sustained turns.

TRAINING MATERIALS AND REFERENCES

- GPC Pilot Guide Unit 8
- Gliding Handbook: FAA 2013
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/glider_handbook/
- Gliding Basics: British Gliding Association 2019
- The Glider Pilot's Manual: Ken Stuart: 2nd Edition; Airlife 1999
- Understanding Gliding: Derek Piggot: 3rd Issue; AC Black 1996