Gliding Australia Training Manual

Pilot Guide

Unit 6

Aileron Drag & Rudder Coordination

Unit 6 - Aileron Drag & Rudder Coordination

WHAT THIS UNIT IS ABOUT

To

- explain how aileron drag is generated whilst applying aileron
- describe and demonstrate how aileron drag affects the aircraft;
- demonstrate use of controls to counter the effects of aileron drag resulting in coordinated flight at an angle of bank; and
- describe and demonstrate the secondary effect of rudder.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 5 Primary Effects of Controls

COMPLEMENTARY UNITS

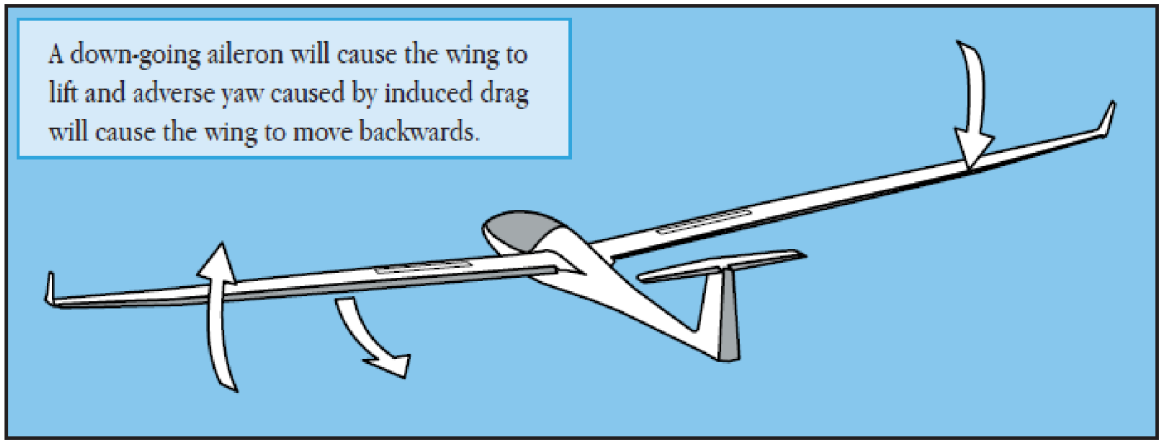
Nil

KEY MESSAGES

- The aircraft is flying in a coordinated manner when there is no yaw on the aircraft (yaw string is centered).
- Aileron drag is produced when the ailerons are used which impacts on coordination.
- Rudder is used to counter aileron drag and maintain coordinated flight.
- When the yaw string is off to the side, the aircraft is not coordinated. ("pull the string to bring it straight")

PILOT GUIDE FOR THIS UNIT

- Because of their long wingspan, relatively large ailerons and generally low operating speeds, gliders suffer from another effect of ailerons which becomes apparent as soon as they are used.
- When the ailerons are deflected to roll the aircraft, we get the results we want because the ailerons change the shape (aerofoil section) of the outer part of the wing. This in turn changes the amount of lift produced by each wingtip. For example, moving the stick to the left moves the left aileron up and the right aileron down. Lift over the left wingtip is reduced and lift over the right wingtip is increased. The glider therefore rolls to the left.



- Unfortunately, an increase in lift at the wingtip brings with it an increase in INDUCED drag, and the effect of this is to YAW the glider in the opposite direction to which it is being rolled. This unwanted yaw is adverse to the direction we want to roll in, and for this reason is known as ADVERSE YAW.
- Adverse yaw, caused by aileron drag, is present on all gliders and cannot be eliminated. Glider pilots must therefore learn how to cope with it.
- Glider designers try to reduce the amount of adverse yaw generated from aileron drag by providing a difference in deflection between the up going and down going ailerons – this is called 'differential ailerons'. Whilst this can reduce the adverse yaw it will not eliminate it. You can see this visually with your instructor by inspecting the use of an aircraft's ailerons on the ground.
- Rudder is used as the "balancing" control to cancel out the adverse yaw caused by the aileron drag.
- Every time the ailerons are used, the rudder is used in the same direction at the same time to prevent the aircraft yawing due to adverse yaw.
- This use of rudder in combination with the ailerons is known as "coordination". The coordination of the feet with the right hand is a very important part of learning to fly gliders.

FLIGHT EXERCISES FOR THIS UNIT

- The instructor will demonstrate the creation of aileron drag by using ailerons to roll the aircraft in flight. You will see how the drag occurs at the upgoing (lifting) wing – creating the drag in the adverse (opposite) direction to the intended roll.
- You will see that the induced drag creates a slip towards the lower wing.
- The instructor will demonstrate the induced drag (and effect) will be more pronounced at lower airspeeds.
- The instructor will demonstrate how rudder is used to counter the yaw created by the aileron drag.
- The instructor will demonstrate how the yaw string is used to indicate the amount of yaw on the aircraft.
- You will be given the opportunity to use the ailerons to create roll whilst also using the rudder to cancel the aileron drag and maintain aircraft coordination.

- Rolling on a point exercise
- Secondary effect of rudder exercise

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Actions required**
• Insufficient rudder used such that there is no, or minimal countering of aileron drag:	• Simultaneous application and removal of rudder force with aileron use. • Refer to the yaw string to check correct amount of rudder is applied. • Rudder often requires more force than that applied to control column –follow instructor through on the controls.
• Student continues to use rudder force when ailerons are returned to neutral:	• Centre the rudder when centering the control column.
• Glider nose swings backwards and forwards	• Ensure you move the rudder in the correct direction in time with the left/right movement of the control column. • Practice with less aileron and slower pace until you get used to it. • Rolling on a point exercise

HOW DO YOU DEMONSTRATE COMPETENCE?

- Ability to use the flight controls to achieve coordinated flight.

RESOURCES & REFERENCES

- Theory Lesson 2

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. What is aileron drag?
2. How is aileron drag produced?
3. What is the effect of aileron drag on the aircraft?
4. How can aileron drag be countered?
5. How does the pilot know when s/he has correctly countered any aileron drag?