Slow Flight

There are a number of situations when the aeroplane must be flown at or near its minimum airspeed, for example, during takeoff, landing, a go around, or missed approach and in the stalling lessons.

This lesson is not for operational slow flight, but aims to improve the students' awareness of the characteristics of flight at slow airspeeds and provides practice in maintaining balanced flight at those airspeeds. It is another important coordination exercise, reinforces the lessons learnt during *Straight and Level* at varying airspeeds, and is good preparation for the stalling lessons and for the takeoff and landing phase of circuit training.

Objectives

To slow the aeroplane and maintain straight and level at low airspeed ($1/2V^2S$).

To maintain straight and level at low airspeed in various configurations.

To maintain a constant altitude while turning at low airspeed.

To return to normal operating airspeeds.

Principles of Flight

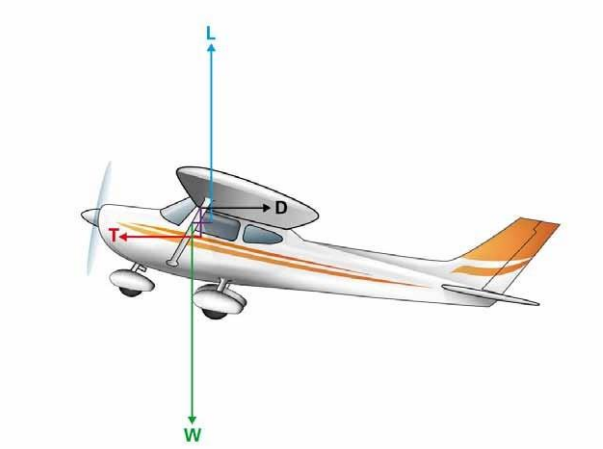
In normal cruise the angle of attack was 4 degrees and the airspeed _____ knots

From the *Straight and Level* lesson, lift is primarily controlled by varying either angle of attack or airspeed. As lift must equal weight to maintain level flight, as the airspeed decreases the angle of attack must increase.

Power + Attitude = Performance

In order to fly level at lower than normal airspeed, a higher than normal nose attitude is required, and once at that attitude, a small increase in power is needed to maintain the desired altitude.

Figure 1



Revise control effectiveness at slow speeds and the effects of slipstream. The controls will be sluggish and not as responsive as they would be at a higher speed and the reduced slipstream will require balancing with rudder.

Revise the effect of low airspeeds on control input and response. As was seen in the turning lesson a slower speed produces more adverse yaw.

Airmanship

Revise the 20 degree visual scan technique as introduced in the *Medium, Climbing and Descending Turns* lesson. Take into account the high nose attitude.

HASELL checks are carried out before stalling and aerobatics, and are introduced in this lesson.

H *Height (not altitude)*
Not less than 2500 feet above ground level.

Some organisations stipulate a height greater than 2500 feet agl, consult with your CFI.

A *Airframe*
State the configuration to be used.

S *Security*
No loose articles, harnesses secure.

There should be no loose articles in the cockpit at any time because of the potential for jammed controls. Explain that harness security is a good aviation practice consideration.

E *Engine*
Temperatures and pressures normal, mixture RICH, fuel sufficient and on fullest tank. Fuel pumps operated in accordance with operator procedures.

This is a routine systems scan to ensure everything is normal, before and during the exercise.

L *Location*
Not over a populated area and clear of known traffic areas, including airfields.

L *Lookout*
Carry out a minimum of one 180-degree, or two 90-degree, clearing turns, to ensure other traffic will not result in conflict.

Aeroplane Management

The use of smooth but positive throttle and control movements should be stressed. Even though more positive movement of the controls will be required there is no need to be aggressive with the controls.

Revise why carburettor heat may need to be used.

Be aware that operating at low airspeeds may raise engine operating temperatures.

Consider the position of the aeroplane three dimensionally within the training area.

Consider the warning symptoms of the approaching stall and be constantly aware of the aeroplane's configuration and flight phase.

Human Factors

There is a high level of concentration needed in this exercise, and is therefore quite a demanding lesson.

The high nose attitudes will be unfamiliar to the student.

Air Exercise

Straight and Level at Low Airspeed

Using the flight manual, or by conducting a stall, determine $1.2V_S$

A reference altitude is nominated and a reference point selected.

Power + Attitude = Performance

P *Power*
Is reduced (carburettor heat may be required) to approximately _____ rpm.

The resultant pitch change and yaw must be compensated for. Ensure smooth throttle movements are used.

A *Attitude*
With the elevator, adjust the attitude to maintain level flight.

The airspeed will decrease gradually. As the airspeed decreases the aeroplane's nose will want to pitch down, requiring subtly increasing back pressure on the control column to maintain the altitude. The wings should be kept level in relation to the horizon, and rudder adjusted to keep straight on the reference point.

Remind the student that during those phases of flight where power and/or airspeed are changing, a change in rudder pressure will be required to maintain balance.

T *Trim*
Promptly and accurately.

Maintain straight and level flight at the nominated airspeed, adjust power as necessary to maintain height and apply the mnemonic **LAI**.

L *Lookout*
In a scan loop, look out to the left (port) and scan 20 degrees for 2 seconds from left to right, passing over the nose of the aircraft.

A *Attitude*
Ensure the attitude is correct and, more importantly, constant. When the outside scan is complete, scan inside.

I *Instruments*
The instruments are scanned to confirm accurate flight.

If a constant altitude is not being maintained, use power as required and adjust attitude to maintain the nominated airspeed.

Power + Attitude = Performance.

If the correct level attitude has been selected the airspeed will be _____ knots (as nominated).

If the correct power setting is maintained the aeroplane will maintain level flight, and if the wings are level and balance maintained the aeroplane will remain straight.

Turning at Low Airspeed

Lift will need to be increased in the turn and this will produce an increase in drag. Power will need to be increased to combat the drag and maintain the nominated airspeed.

Revise adverse yaw from the *Medium, Climbing and Descending Turns* lesson. Adverse yaw is countered with rudder applied in the direction of the roll, maintain balance.

At low airspeeds the ailerons will need to be deflected further to achieve the same roll rate as at higher airspeeds. This will significantly increase the induced drag and require more rudder to negate the adverse yaw.

Returning to Normal Cruise

To regain normal cruise, the mnemonic **PAT** is used. Because of inertia, power leads the sequence to arrest any descent resulting from lowering the attitude.

P *Power*
Carburettor heat COLD (if applicable), and smoothly increase power to full power.

Correct the resultant yaw with rudder and the pitch up with elevator while:

A *Attitude*
Gradually lowering the nose and holding the level attitude. Maintain wings level with aileron, and balance with rudder (as airspeed increases).

T *Trim*
Remove obvious loads. When flaps have been raised (if applicable) and normal cruise airspeed achieved, set cruise power, and confirm straight and level is maintained.

LAI – trim accurately to hold the correct attitude.

Airborne Sequence

On the Ground

Ask the student to do the preflight inspection, and then to come to you afterwards if they have any questions.

Introduce more radio work, and ask the student to call and complete the checklists.

The Exercise

The student should be able to complete the takeoff by themselves.

On the way out to the training area, there is opportunity to practice climbing and turning.

The student then enters straight and level from the climb and is talked through the **HASELL** checks.

Demonstrate the entry to slow flight at the nominated airspeed and in the nominated configuration – with and without flap. The student should practice after each demonstration.

Demonstrate turning (at up to 20 degrees angle of bank) including reversing the turn direction, followed by student practice.

Allow the student to regain normal cruise, while talking them though the process.

Establish the aeroplane in the approach configuration in a descent at $1.2V_S$. Then establish the aeroplane in a climb, thereby simulating the go around.

On the way back to the aerodrome, discuss some more radio calls, and talk them through rejoining the circuit.

After Flight

The next lesson will be *Basic Stalling*, ask the student to read up on this.

Provide the student with a copy of the checklists and ask them to start learning the correct responses for the checklist items. Inform them that you will expect them to know the checklists from memory before they do their first solo flight, and the first step to memorising them is to learn the correct responses.