The CIX VFR Club	Flight Training Notes	Exercise 7
For Simulation Purposes only. Not to be used for real World flight	CLIMBING	Issue 1.1 04/08/12

1 INTRODUCTION

This series of tutorials for the CIX VFR Club are based on real world flight training. Each document focuses on a small part only of the necessary skills required to fly a light aircraft, and by echoing real world training, you will be a better Flight Simulator pilot and get more enjoyment out of the hobby as a result.

These tutorials are written specifically for the Flight Simulator Default Cessna 172. Some details will be different for other aircraft.

You should read Exercise 6 before continuing with this tutorial.

2 OBJECT

The object of this lesson is to gain height at a steady rate and to level out when desired altitude has been reached.

3 DESCRIPTION

Just as a car needs more power to climb a hill than to travel on a flat road, an aeroplane needs more power to climb than to maintain level flight. We measure and control climb performance by using the "rate of climb".

The rate of climb is the rate that an aircraft gains height, and is expressed in feet per minute. The Vertical Speed Indicator (V.S.I.) referred to in the previous chapter displays the rate of climb or the rate of descent as appropriate. It indicates zero in level flight.

Fig. 1 Vertical Speed Indicator indicating a Climb of 600 Ft per Minute

The dial is marked in the manner shown above, with each division of the scale representing 100 feet per minute.

It is sometimes necessary to attain a specific altitude as quickly as possible, and for this to be achieved, it is necessary for the aeroplane to perform under certain conditions.

As would be expected, the maximum power authorized for the type of engine under climbing conditions will be required. This is specified in the Pilot's Operating Handbook, or in the case of Flight Simulator in the help or readme files for the aircraft. Maximum power however is not enough to create a maximum rate of climb.

If a climb is commenced at too 1ow an airspeed, with the nose high resulting in a steep climb, the rate of climb is poor, much as a car will struggle up a steep hill. In the real world the engine may also overheat because of insufficient cooling air.

The rate of climb is also poor at too high an airspeed with the nose too low resulting in a shallow climb. Somewhere between these two extremes lies the "best climbing speed". In fact the best rate of climb is achieved at a specific angle of attack – that at which the lift/drag ratio is highest. Because of airframe drag and engine performance issues, the recommended best climbing speed sometimes needs to be slightly higher than the corresponding best lift/drag.

Assuming the best climbing speed of an aircraft is 60 knots, it will be able to maintain height at this airspeed using a small power setting. Under these flight conditions there would be considerable extra power available to the pilot, and it is this surplus horsepower which is used to climb the aircraft. From this it follows that the greater the amount of surplus power available from the engine, the greater will be the rate of climb.

4 FLIGHT PRACTICE

4.1 Outside Checks

Look around and check that no other aircraft are in the clmbout path.

4.2 Cockpit Checks

1) Trim for straight and level flight.
2) Power set for cruising conditions.

4.3 Establish the Climb

Remember **Power – Attitude – Trim** (PAT)

3) Check wings are level and open the throttle to recommended climbing r.p.m. In small 2 – 4 seat aircraft, this is full throttle. Be prepared for the aircraft to swing due to slipstream effect and keep straight with rudder.
4) Raise the nose to the "best rate of climb" attitude, using a point on the aircraft as a reference against the horizon.
5) Hold the aircraft in this attitude until the airspeed settles, then if necessary move the stick slightly backwards or forwards to adjust the

attitude for the correct climbing speed, then trim so that there is no pressure on the yoke.

6) Check engine r.p.m. and adjust if necessary. Note the **climb instrument** readings which should indicate a steadily increasing altimeter, a constant airspeed and a constant rate of climb.
7) Note also the position of the Attitude Indicator. This is a vitally important in instrument flight, but in visual flight, it can be largely ignored, although it useful as a secondary check.
8) Keep a good lookout throughout the climb. During a lengthy climb, lower the nose every 500 feet or so to check that there are no other aircraft on or near your flight path.

Fig. 2 The Climb. Note the Horizon position and the Climb Instruments

In fig. 2 we can see the

Power + Attitude = Performance

rule at work in the FSX Cessna 172. With maximum engine r.p.m. set, (approximately 2400 r.p.m. initially, but this will fall to around 2300 r.p.m. once the climb is established) plus a high nose attitude (Much higher than in the real world – Microsoft have never got that right!) the performance

achieved is the best rate of climb of just over 700 feet per minute in a steady climb condition.

4.4 Return to Straight and Level

Remember that levelling out at the top of the climb, we apply the **Attitude – Power – Trim** (APT) rule.

1) At the required altitude add forward pressure on the yoke bring the aircraft into the level attitude.
2) Hold the forward pressure, maintaining climb power and wait until the airspeed has increased to cruise speed.
3) Reduce r.p.m. to cruise power, checking any tendency to yaw. In a real aircraft, you would immediately feel considerable reduction in the forward pressure on the yoke needed to maintain level flight, and you would ease off the forward pressure and trim for the cruise. In Flight Simulator you will only notice the tendency to commence a descent again which will instinctively make you release the forward pressure.
4) Retrim for level flight.
5) Finally, when the airspeed has settled to cruise speed, check the engine r.p.m. and adjust if necessary.