

## Exercise No 4 Effects of Controls

**Aim: To teach the effects of the controls in forward flight**

**Airmanship:**

- **LOOKOUT not to focus on the instruments but keep a good 3D lookout for other Aircraft using the clock code.**
- **Handing over the controls using the correct terms  
“I have control” – “you have control”**

This exercise can be seen to be rather bitty but the purpose is to demonstrate the use of each of the controls and to observe their effects. It is very important at this stage that you not only understand how each of the controls work and what they do but even more important that you observe their effects and characteristics. This will lead to a better understanding and once you get to exercise 6 you will be able to anticipate the aircraft movement and be a much better pilot with much smoother flying. The main controls are the cyclic, collective, throttle and pedal which although vary from aircraft to aircraft all have the same characteristics in each aircraft type.

### Controls

**The Cyclic Stick:** The cyclic in the R22 is a T bar which allows both yourself and the instructor to share the controls. It is free to teeter around a central control, this does nothing to the flying but simply gives a more comfortable position for the pilot. The ideal position is holding the cyclic in your right and moving its position low down so it rests it on your leg. This will mean that your inputs will come from your wrist rather than your elbow.

The cyclic controls the disc attitude and therefore the fuselage attitude. Pushing the cyclic forward pushes the rotor disc forward which is followed by the aircraft. The rotor disc is what we call the area shaped by the moving rotors. The cyclic is very sensitive and does not provide a lot of feedback, i.e. it is not a lot harder to push it further forwards. It does not self centre and we never tend to let go of it in flight. The cyclic gives the aircraft its basic manoeuvres of faster, slower, left and right. It can move in any 360° direction.



### Inputs, movement and effect

**Lateral (turns) : roll in normal sense to left /right**

**Forwards**

**Nose down Attitude**

**Descend**

**Speed Increase**

**Roll to the left**

**Yaw Left**

**Back**

**Nose up Attitude**

**Climb**

**Speed Decrease**

**Roll to the right**

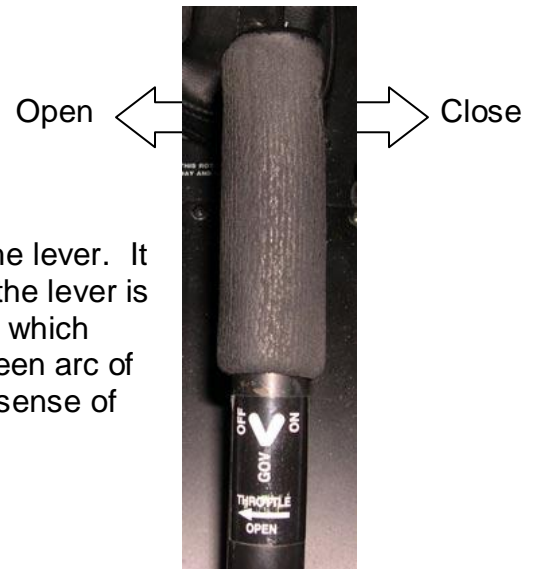
**Yaw Right**

**Collective:** This is a lever held in your left hand, it is generally a stiffer control and can be let go in flight for short times to allow you to adjust radio and instruments. It has a twist grip foam throttle located at its end. This has about a 180° movement, opening the throttle to the left, closing to the right. It can be held closed in what is known as the detent position. The lever action increases and decreases rotor pitch i.e. the angle of the rotor blade in relation to the air. We call this the angle of attack. We will cover this more in Principles of Flight. The throttle is controlling the engine revs.

When you raise the lever you increase the angle of attack thus increasing lift. The downside to this is that it also increases drag slowing the blade down. You therefore compensate by opening the throttle to increase engine revs and therefore rotor revs. The R22 however has a governor. The governor is best thought of as a cruise control. It maintains rotor revs through the throttle and engine regardless of the collective position. We read the rotor and engine revs on our instrument panel as a percentage in a Robinson. With the governor on this would be 104%. This will be further discussed in your pre flight briefing. The governor switch is located on the end of the collective.

### Inputs, movement and effect

<b>Lower</b>	<b>Raise</b>
<b>Nose down attitude</b>	<b>Nose up attitude</b>
<b>Reduces Man Pressure</b>	<b>Inc Man Pressure</b>
<b>Descend</b>	<b>Climb</b>
<b>Yaw left</b>	<b>Yaw right</b>



**Throttle:** A variable twist grip in your left hand at the end of the lever. It is very sensitive and requires very little movement. In a R22 the lever is connected to a correlator and there is also a governor both of which help to maintain the Rotor Revs Per Minute (RRPM) in the green arc of 104%. The throttle when worked independently works in the sense of left increase, right decrease.

<b>Open</b>	<b>Increases RRPM - Increases MP-Yaw Right</b>
<b>Close</b>	<b>Decreases RRPM- Decreases MP- Yaw Left</b>

**Tips:** *The throttle should be held very lightly. This gives you a comfortable grip and also allows the governor to do its job. Cup your hand under the cyclic so you can lift rather than pulling it up. This will give you better control and require less effort*



**Pedals:** These are your foot controls and work in the sense that when you press one the other comes up. They counter the torque reaction of the main rotor system. They have maximum effect in the hover. When you enter a state of forward flight the air moving over the body of the aircraft passes over the tail fins helping to keep the aircraft facing in the right direction. We use them to maintain balance, called trim. In the hover we can use them to turn on the spot or face any way we want to. Because they are mainly anti torque their use is directly related to the power we are using. The power comes from lifting the collective and is read as manifold pressure. Increasing the collective is therefore followed by left pedal and lowering right pedal

**Left      Yaw left – Reduces RRPM**

**Right     Yaw right – Increases RRPM**



**Air Exercise:**

- **Cyclic Stick**
- **Collective lever**
- **Twist Grip Throttle**
- **Use of governor**
- **Yaw Pedals**
- **Cyclic Trim**
- **Carburettor heating**
- **Effects of disc loading - RPM increase**
- **Effect of Airspeed - RPM increase**
- **Further effects of Collective - Auto rotation**

**Discussion Points**

- **Mixture Control**
- **Carburettor Air Temperature Gauge & Control**
- **Rotor Brake**
- **Governor**
- **Torque Reaction**

**NOTES**