Phantom Quad copter - Hire Terms & Agreement

Due to the cost as well as the increased risk of loss and possible damage associated with this equipment, the quad copters are only available for hire after comprehensive training sessions.

Training sessions are available from staff in N425. These sessions will teach you how to correctly operate and setup the quad copter and transmitter. These sessions will include up to 3 hours of flying time, spread over a 5-day period.

Upon completion of these sessions, you will be asked to complete a final assessment before any hire will be permitted.

Whilst the quad copters are great fun to fly, you should consider how you plan to use it and what purpose it will serve in your project/coursework in advance prior to asking for a training session.

Please note: The School reserves the right to refuse hire even if you have completed the training sessions if we deem the purpose of hire dangerous or unsuitable.

Pre Setup Flight Checklist:

The following steps must be checked carefully every time before flight.

- Check that all parts of the multi-rotors are in good condition before flights. Do not fly with broken or damaged rotors.
- Check that the multi rotors are installed correctly and firmly before flight.
- Make sure that the rotation direction of each rotor is correct.
- Make sure the transmitter and flight battery are fully charged

Transmitter & Quad copter Setup Checklist:

The transmitter must always be turned on prior to inserting the battery into the quad copter. Only once you have landed and powered down the rotors on the quad copter and removed the battery, you can turn off the transmitter.

If you have moved location from the last time the quad copter was flown, then you will need to recalibrate the compass. It is good practice to do this if the quad copter has travelled over any large distance.
The following procedure outlines how to attach the battery and calibrate the compass:

1. Turn on transmitter.

2. Insert battery into quad copter with connection facing outwards – once connected the quad copter emits a sound to confirm battery connection, tuck the wires inside the copter and close the hatch.

3. Calibrating the internal compass is done via the right hand switch on the transmitter. Ensure the right hand switch on the transmitter is sitting in GPS mode. Flick the switch down and up between GPS mode to ATTI mode 10 times. Ensure that the switch is in GPS mode to start. The LED on the back of the quad copter will show a solid yellow light.

4. Pickup the quad copter - hold it horizontal and level and rotate your body around 360 degrees in a clockwise direction. The LED on the back of the quad will change to a solid green light.

5. Rotate the quad copter 90 degrees forward so that the LED is pointing upwards, rotate your body around 360 degrees. The LED should now go off and the green light will disappear, this confirms that the compass calibration is completed.

If you turn on the quad copter and the led flashes yellow/red/yellow/red a number of times, then this means the quad copter compass needs to be calibrated using the steps above.

**Before take off:**

1. Ensure that you have selected GPS mode on the right hand switch on the transmitter. The LED status light will flash green on the quad copter to confirm GPS is enabled.

2. Ensure there is adequate satellite coverage. To fly in GPS mode more accurately, the quad copter needs coverage from 6 or more satellites. The LED status light on the copter will flash red to indicate the number of satellites available.

   - 3 Red Flashes = Less than 5 Satellites found
   - 2 Red Flashes = 5 Satellites found
   - 1 Red Flash = 6 Satellites found
   - 0 Red Flashes = More than 6 Satellites found.

Once the LED has confirmed that the quad copter has found 6 or more satellites, you should leave the copter to sit for 10 seconds before starting the rotors, this is to ensure that the Return to Home function is initialized.
Once the quad copter has been calibrated and is showing a single blinking green light, you will know that you have good satellite coverage and the quad copter is ready for flight.

**Final transmitter settings:**

1. Ensure that the left hand switch on the transmitter is set to **HL mode** – this is the bottom setting of the switch.

2. Ensure that the right hand switch on the transmitter is set to **GPS mode** – this is the top setting of the switch.

3. Place the quad copter in front of you with the led facing you.

Before starting the rotors you should familiarise yourself with the controls sticks on the transmitter.

**Left Stick – This controls the vertical height and the yaw of the quad copter.**

Up and down controls the throttle stick to increase or decrease the vertical height. Pushing the stick up will increase the height, pushing the stick down will decrease the height.

Left and Right controls the yaw. The yaw is essentially the rotation of the aircraft. Pushing the stick left will rotate the quad copter anti clockwise; pushing the stick will rotate the quad copter clockwise.

**Right Stick – This controls the roll and pitch of the quad copter.**

Up and down controls the pitch of the quad copter. Pushing the stick up will move the quad copter forwards; pushing the stick down will move the quad copter backwards.

Left and Right control the roll of the quad copter. Pushing the stick to the left will move the quad copter to the left, pushing the stick to the right will move the quad copter to the right.

When no control stick is being used, the quad copter will hover in a horizontal position at its current position.

**Starting and stopping the rotors.**

- To start the rotors, push both sticks on the transmitter downwards and towards the center of the transmitter.

- To stop the rotors, follow the same procedure. Note, the quad copter should be landed prior to switching off the rotors.
### Aircraft & Transmitter Basic Operation

#### Definitions

- **Stick neutral position and stick released** means the stick of Transmitter is pushed to the central position.
- **Command Stick** means the stick of Transmitter is pushed away from the central position.

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Aircraft</th>
<th>GPS ATTI. Mode/ATTI. Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Throttle Stick" /></td>
<td><img src="image" alt="Aircraft" /></td>
<td>Throttle stick is for aircraft up&amp; down control. The aircraft will hold the height automatically if the stick is centered. You should Push the throttle stick to the neutral position to take-off the multi-rotor. Note that the stick returns to the central position when released for the transmitter V3.5. For the version below 3.5, the stick cannot hold the central position when released.</td>
</tr>
<tr>
<td><img src="image" alt="command stick" /></td>
<td><img src="image" alt="Aircraft" /></td>
<td>Yaw stick is for aircraft rudder control. Command stick controls the angular velocity of the aircraft, with the maximum rudder angular velocity of 200°/s. Left stick command gives counter clock-wise rotation of the aircraft, &amp; vice versa.</td>
</tr>
<tr>
<td><img src="image" alt="Roll Stick" /></td>
<td><img src="image" alt="Aircraft" /></td>
<td>Roll stick is for aircraft left/right control and Pitch stick is for front/back control. Command stick controls the angle of the aircraft. Stick neutral position is for 0°, its endpoint is 35°. The roll and pitch sticks return to the central position when released.</td>
</tr>
<tr>
<td><img src="image" alt="3-position switch S1" /></td>
<td><img src="image" alt="Aircraft" /></td>
<td>3-position switch (S1) on the Transmitter for mode control. Only after Compass Module connection and Compass calibration, GPS ATTI. Mode is available. Otherwise, all switch positions are for ATTI. Mode. Pay attention because the GPS ATTI. Mode is dependent on the number of GPS satellites acquired by the main controller. Refer to the LED Indicator. When GPS signal has been lost for 3s, system enters ATTI. Mode automatically. You can enable the Manual Mode or FailSafe (also known as One-key Go-home) in the assistant software-&gt;Basic-&gt;R/C-&gt;Control Mode.</td>
</tr>
<tr>
<td><img src="image" alt="3-position switch S2" /></td>
<td><img src="image" alt="Aircraft" /></td>
<td>3-position switch (S2) on the Transmitter for Intelligent Orientation Control (IOC). Set the switch to OFF in basic flight. <strong>This function is defaulted to off</strong>, If you want to use this function refer to the advanced manual, and enable it in the assistant software. Use IOC when you are familiar with basic flight.</td>
</tr>
</tbody>
</table>

You can change the operation mode of the Transmitter according to the advanced manual if necessary.
Troubleshooting in the air:

If at any point you during the flight you feel you are losing control or orientation, release all controls and the quad copter will maintain a horizontal position. From the hover position, you should then slowly reduce the height of the quad copter before refamiliarising yourself with orientation of the aircraft before you continue flying.

If at any point you lose sight of the quad copter, you can use the return to home feature, this instructs the quad copter to increase its height to approximately 60ft, the quad copter will then fly back to the position that it registered before flight before decreasing its height and landing itself.

Turning off the transmitter activates the return to home function. This however should only be done as a last resort.

Note: The return to home function will only work if the quad copter was able to find 6 or more satellites in the initial setting up period, therefore you should always try to get good satellite coverage prior to take off.

Flying Restrictions:

The quad copter must not be operated in the following conditions:

- In rain or snowy conditions.
- In strong blustery / windy weather.
- In built up areas where you do not have a clear field of vision.
- In the dark or poor lighting conditions.
- Poor visibility – Fog & Mist.

Always fly the quad copter at least 3 meters above the ground and away from you, do not fly near or close to the following obstacles:

- Large crowds / Heavily populated areas
- High voltage power lines
- Areas of high aircraft activity – Airports / Flight paths
- Over large areas of water such as lakes or sea.

Additional Resources:

Further video tutorials on the initial setup and flight instructions can be found at:

http://www.dji.com/tutorial/phantom-tutorial/
Whilst the quad copter falls out with any restrictions for flight within controlled airspace, you should still consider the following points when operating the aircraft.

(1) A person must not cause or permit any article or animal (whether or not attached to a parachute) to be dropped from a small unmanned aircraft so as to endanger persons or property.

(2) The person in charge of a small-unmanned aircraft may only fly the aircraft if reasonably satisfied that the flight can safely be made.

(3) The person in charge of a small-unmanned aircraft must maintain direct, unaided visual contact with the aircraft sufficient to monitor its flight path in relation to other aircraft, persons, vehicles, vessels and structures for the purpose of avoiding collisions.

(4) The person in charge of a small unmanned aircraft which has a mass of more than 7kg excluding its fuel but including any articles or equipment installed in or attached to the aircraft at the commencement of its flight, must not fly the aircraft:
   (a) in Class A, C, D or E airspace unless the permission of the appropriate air traffic control unit has been obtained;
   (b) within an aerodrome traffic zone during the notified hours of watch of the air traffic control unit (if any) at that aerodrome unless the permission of any such air traffic control unit has been obtained; or
   (c) at a height of more than 400 feet above the surface unless it is flying in airspace described in sub-paragraph (a) or (b) and in accordance with the requirements for that airspace.

(5) The person in charge of a small unmanned aircraft must not fly the aircraft for the purposes of aerial work except in accordance with a permission granted by the CAA.

To put these restrictions into context, the RGU campus is situated within Class D controlled Airspace that has vertical dimensions that extend from the Surface to 15,000ft. Although the quad copter is incapable of such heights and weighs less than 1kg, you should not fly the quad copter out with your visual range or in areas which are heavily populated with either people or buildings.
I have read and understood the instructions above and fully understand I am solely responsible for the safe return of all equipment and associated items I borrow from the School. I also understand that I am fully liable for any damage or destruction to private property or personal injury to others and no responsibility can be passed to Robert Gordon University when using equipment on hire.

I understand that I must complete all training sessions prior to hire and I am fully aware that equipment hire may be refused in certain cases.

I agree to pay/reimburse the School the full cost of the items noted below should they be damaged, stolen or lost whilst in my care. This includes loss of equipment by accident due to crashing the quad copter.

- **Phantom Quad copter**: £499.00
- **GoPro Hero 3 Black edition**: £359.00
- **Sandisk Memory Card**: £45.00

Student Name & Matric Number               Student Signature               Date

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**Staff Signature**

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