CD

BRITISH MODEL FLYING ASSOCIATION

THE R/C ACHIEVEMENT SCHEME

TEST STANDARDS for CHIEF EXAMINERS and CLUB EXAMINERS GUIDANCE for TEST CANDIDATES

THE CAMERA-DRONE CERTIFICATES (Basic Proficiency& A)

2021 ISSUE

(May 2021)

Achievement Scheme Information & Communication

The BMFA Achievement Scheme provides every RC flyer the opportunity to set themselves an achievement target to aim for, and then have their progress assessed and confirmed by an examiner.

It is important that All those involved in training, examining and preparing for the tests, are well informed and up to date with all that the scheme has to offer. To this end, and to aid communication, important information regarding scheme developments, as well as details of all of the tests and their associated guidance documents, are made available to everyone via a number of sources, which include:-

- The Achievement Scheme website - http://achievements.bmfa.org/
- The BMFA website - http://bmfa.org
- The BMFA News
- The Achievement Scheme closed Facebook group

It's important to appreciate that **ALL** of the scheme documents are reviewed and updated on an annual basis. Whichever document you are using, you will know if you have the right one, simply by looking at the date on the front cover. If it's not dated with the current year, it's the wrong one!

Most BMFA Clubs have Club Instructors/Examiners who will be familiar with the scheme and what is expected of anyone thinking of participating. If your club does not have a club examiner then each BMFA Area has an Achievement Scheme Coordinator (contact details can usually be found on the BMFA Area website) who can usually help in coordinating tests, or answering queries about tests etc. All BMFA Areas have Area Chief Examiners who would normally undertake Club Examiner tests, but are also available to help out with club tests, if requested. Importantly, they are also very knowledgeable about the scheme and its requirements. Area coordinators can often find an ACE that is close to your club, if you are having difficulty arranging for a test.

All BMFA Achievement Scheme & training documents are available to download from the BMFA Achievement Scheme website http://achievements.bmfa.org/. You can also register your email address with the Achievement Scheme website and receive email notification of any news flashes, notification of scheme events and updates to documentation etc. as soon as they are published.

The Achievement Scheme also has a closed Facebook group (you just have to apply to be included) where comment and queries can be posted and examiners/instructors and members of the Achievement Scheme Review Committee can answer questions, or offer clarification.

If you have any query about the scheme or constructive comment on the scheme you can contact the Power/Silent Flight Scheme Controller (RCPAS@bmfa.org), or the Achievement Scheme Review Committee, via the BMFA Office.

General

The Achievement Scheme is run by the BMFA as a National Scheme and it is open to all model flyers. Where a non-member wishes to participate in the achievement scheme the examiner who will be conducting the test must inform the BMFA office via email or telephone no later than the day prior to the test being carried out of the non-member's full name, address and the date that the test will be conducted. This enables the BMFA to extend insurance at suitable levels for the day of the test. If this procedure is not followed the test will be invalid.

The examination for a 'BPC' or A Certificate may be taken on application to any Registered Examiner.

The candidate must successfully complete the test schedules in one attempt. A maximum of two attempts at the examination are permitted in any one day.

Legal Responsibilities

Only pilots with a suitable model that are operating legally are eligible to take the test.

There are clearly defined legal requirements for the operation of Small Unmanned Aircraft (model aircraft), from passing a CAA (or BMFA) legal & safety knowledge test before piloting a model, to registering with the CAA as an SUA Operator (can also be done via the BMFA) if the pilot is also the owner and operator of the model aircraft, then ensuring the SUA Operator identity number is appropriately attached to the model. There are also restrictions on where a model can be flown and the heights and distances from people, property, vehicles or structures that the model can be operated. Finally, there is a legal requirement to operate the model safely e.g. ensuring the model is 'fit for safe flight' and the pilot is in a fit state to undertake that flight, as well as the site and weather conditions being suitable.

The test schedule is split broadly into five areas; the pre-flight safety checks, moving from the pits/start-up area to the take-off/landing area, the flying manoeuvres, the continuity & return to the pits, and the questions.

Basic Proficiency Certificate (BPC) & ‘A’ Certificate

The ‘BPC’ is a measure of flying ability and safety, which "may be equated to a safe solo standard of flying" for aircraft that do not meet the requirements for the A certificate.

The 'A' Certificate is a measure of flying ability and safety, which "may be equated to a safe solo standard of flying" and an increasing number of clubs use it as their 'solo' test.

The test for the BPC is exactly the same as that conducted for the ‘A’ test, however there is a specific test form for the BPC, this is available from the office and can also be downloaded from the BMFA website downloads page.

As an Examiner, the level of competence you should expect of a candidate should be based on that criterion; that is 'is this person, in your opinion, fit to be allowed to fly unsupervised'.

The candidate should have studied the BMFA Member’s Handbook and the associated Annexes and safety codes. As well as being an excellent guide to the safe flying of model aircraft, most of the questions asked at the end of the test will be from these sources.

Remember that the Member’s Handbook and associated annexes etc. are now ‘active’ documents published on the BMFA website. https://handbook.bmfa.uk

Also be aware that you may ask questions on any local site rules that the candidate should be aware of and these may form an important part of the test questions you ask.

Outdoors

The test may not be flown indoors. It was designed to be flown outdoors and the text of the test manoeuvres highlights this. It is important to remind candidates that their ability to cope with various wind conditions is an integral part of the test.

The Model

The tests can be performed with virtually any stabilised camera dedicated multi-rotor, i.e. a camera-drone. A camera-drone for the benefit of this test is defined as a multirotor designed primarily for aerial photography. Whatever model is brought by the candidate, it must be suitable to fly the manoeuvres required by the test they are taking. You do not have the authority to alter the required manoeuvres to suit a model and if, in your opinion, the model is unsuitable for the test then you should explain this to the candidate and tell them that they cannot use that model. The selection of the model to do the test is the responsibility of the pilot and it is their ability you are testing, not the model.

On no account may the candidate use defects or limitations in the performance of the model as an excuse for poor performance on their part and you should make no allowance on this point. The type of model presented cannot be used as an excuse for not completing certain manoeuvres.

Electric Powered Models must be treated as LIVE as soon as the main flight battery is connected, irrespective of radio state and great care must be demonstrated by the candidate. The arming sequence should be clearly understood and discussed/demonstrated to you by the candidate.

For the ‘A’ certificate test, the model must weigh a minimum of 300g. There is no weight limit for the BPC.

Buddy Box Systems

Buddy leads and other dual control training aids must not be used during any achievement scheme test.

Gyros, Electronic Stabilisation and GPS

It is acceptable to use an electro-mechanical or solid-state gyro/s in a camera-drone being used to take the test as well as electronic stabilisation systems that are able to self-stabilise the aircraft on behalf of the pilot and achieve automated or self-levelled flight.

The use of any autopilot and or artificial positioning features which are (or may be) designed into such units beyond the definition above (such as GPS) is not acceptable during the test for the 'A' certificate and is not permitted. **However, GPS will be required and is permitted to complete only the final manoeuvre of the 'A' test, which is the 'Return to Home' demonstration.**

For the 'BPC' test it is acceptable to use GPS assisted positioning for the entire test.

Candidates should be prepared to explain the capabilities of the system they are using and show that it does not take over control from the pilot and that automated flight will not be achieved during the test.

Whether the candidate takes a **BPC** or an 'A' cert depends entirely on what model they present for the test with;

- If the candidate presents with a model where the electronics are only "self-levelling" and the GPS system has been turned off (except for during the return to home exercise) they will take the 'A' test.
- If the candidate presents with a model where the electronics assist in positioning and height control (i.e. GPS) they will take the BPC.

Height and Speed

The 'BPC' & 'A' certificate candidate should be a reasonably confident pilot, even though they may have been flying multi-rotor for only a few months. Flying too high or too low is not the mark of a confident pilot. The test should be flown at the heights specified in the individual elements with little deviation.

Wind Direction

There is no requirement for the fixed positioning of manoeuvres relative to the wind direction in the camera-drone tests and you will find no reference to the wind in the text of either the test or this Standards Document.

This makes it absolutely ESSENTIAL that you discuss this with the candidate at length so that you are both aware of exactly how you want the manoeuvres to be presented and what limitations will be accepted if the wind direction is not favourable.

Consistency

Good use of the controls should ensure that the model stays at a constant height, and moves at a steady speeds suitable to each of the separate elements of the test. All deviations from these constants should be noted, and will form part of the judgment of the test.

Unnecessary varying of height and inconsistent lines are valid reasons to fail a candidate at this level as they give a good indication of the flyer's general level of competence and they must strongly influence your final decision. Poorly flown height or lines are a sure sign that the flyer has either not practiced the test or has not reached the required standard of flying and are legitimate reasons to fail them.

Continuity

For the 'BPC' and 'A' test the manoeuvres are set out in such a way that they are flown one after the other as a short sequence. You should discuss with the candidate before the flight the way in which you would like the various elements flown and the candidate should have a good knowledge of the test before the event. If the candidate is very hesitant during the test and is not capable of following the set sequence then you might conclude that they have either not had enough practice or that their basic flying skills are not yet well enough developed.

A pilot who transitions directly from one manoeuvre to the next is not to be penalised as this is quite acceptable, but watch out for the pilot who is not sufficiently practiced. Flying some of the manoeuvres in this manner can get them into some very awkward positions. The candidate should have a good knowledge of the test before the event.

It should be possible to fly the test on one flight battery (or tank of fuel) but if the model does have to be refuelled or the flight battery changed then the pilot must clear this with you before the test starts as required by the test procedure. It is allowable only once during the test and anything the pilot does during this time must be considered by you to be part of the test. This includes the way they land, retrieve, carry out and take off. With I/C models the correct re-fuelling and start procedures must be used, For electric models, isolating the flight battery before carrying the model in and not re-connecting until the model has been carried out to an appropriate safe point are important.

Trim

As the candidate will take the test with a self-levelling camera-drone, the model they use should not need trimming. If you see signs that the model is either out of trim or flying erratically and the candidate makes no attempt to rectify the matter, you may well question their basic competence. On the other hand, if they do need to re-calibrate the model and are making attempts to do so, you should make allowances for a short time of flight with a somewhat erratic path. This should not be penalised unless it puts the model in any dangerous situations or unless the model flies behind the pilot or into any other unsafe area. If the pilot does use the first part of the flight as a trimming exercise, they should be required to land as soon as they are satisfied with the trim and the test should then commence at manoeuvre (b). If a flight is abandoned prior to starting manoeuvre (b) because of trim problems it will not count as a test flight attempt.

Nerves

Quiet competence is what you are looking for during the flight, but most candidates may well be nervous and you should make some allowance for this. If the flyer is very nervous you should seriously consider abandoning the test for the time being and arranging a coaching flight or two to settle the candidate down before re-taking the test. This can be done on the same day and can really help those candidates who have trouble with nerves when flying in a test situation.

Repeating Manoeuvres

At ‘BPC’ and 'A' certificate level the manoeuvres are simple and the candidate should be competent to fly them with very few errors. If you see any major faults the test should be taken again. It may be, however, that the candidate will make a **minor** mistake on a manoeuvre and if you are not fully satisfied with what you have seen you should consider asking for the manoeuvre to be repeated.

Some judgement is called for on your part here. A major mistake is grounds for failing the candidate, especially if loss of control has occurred or a dangerous situation has arisen. You should definitely not let them have multiple attempts at each manoeuvre until they get it right but you must give yourself the best chance of assessing the competence of the pilot you are testing.

You should consider what you have seen the model do and if you think to yourself "could be better" than a request that the manoeuvre be repeated may be considered. Be extremely careful about using this option, however, as you could very easily be degrading the worth of the test. It must not, under any circumstances, degenerate into a series of 'practice' manoeuvres.

Repeating the test

The rules allow two attempts at the test in one day and if the candidate fails the first of these you must consider their performance in deciding what to do next. Many failures will be reasonably good or borderline cases and in these circumstances it may be appropriate to arrange one or two coaching flights before repeating the test. Remember that many of the candidates will be unfamiliar with flying under pressure and might do very well on the second test.

However, it will probably be obvious to you on many occasions that the pilot you are testing is simply not ready for the test they are taking. In this situation it is better that you tell them so quite clearly. It could then be extremely useful for you to arrange a demonstration test for them so that they can gain an understanding of the standard of flying that is required, especially if they are not clear about the manoeuvres and the positioning for them. This, possibly with a little coaching, is far more useful to everyone than simply telling the candidate that they have failed.

A flight which is abandoned for any reason prior to starting manoeuvre (b) will not count as a test flight attempt.

Interruptions to the Test

A possibility that may occur during a test is a motor failure part way through, which with multi-rotors could very well lead to a damaged model. If this is the case, then the test obviously cannot continue, and you should invoke the rule that the test should be performed in one flight and count the flight as one of the two attempts allowed during the day.

Genuine motor trouble or even motor-out situations during the test may be dealt with in one of three ways.

If the test was being generally flown in a satisfactory manner and the problem can be rectified quickly then the candidate may be allowed to continue the test from the start of the manoeuvre in which the problem occurred.

If the problem cannot be rectified quickly but you consider that it was a genuine unforeseen occurrence, you may annul the test and not count it as one of the two attempts.

If the test up to the point of failure was not satisfactory, you have the option to cancel the rest of the test and count the flight as one of the two attempts allowed during the day.
Obviously, you will have to use your judgment on this matter as there will rarely be black and white situations but how they handled the emergency should be of great interest to you when you come to review the candidate's overall standard of flying.

General Manoeuvres and Hovering

All take-offs and landings should be smooth, without undue oscillations, and lifts and descents should be straight and controlled with the model a comfortable and safe distance in front of the pilot. In any stationary hovering the model should remain steady and should not oscillate unduly.

The standard 'brief' hover time is about five seconds. You should discuss this with the candidate before the test so that they know that you will want to see a positive stop with the hover long enough to show that the model is well controlled and steady with little wandering or oscillation. Stopwatch accuracy is not required.

The candidate should also be aware that the decision to move on is theirs and that you will not be asking them to commence with the next manoeuvre. However, during your pre-flight briefing, they may ask that you indicate when you are satisfied that they have completed their 'brief' hover times to help them decide when to move on. This is quite permissible if requested by the candidate.

Circuit and other 'flying' manoeuvres should be performed at the heights mentioned in 'Height and Speed' above. Movement of the model from one point to another whilst in the hover should be done at a steady walking pace.

Care should be taken in the flying manoeuvres that the line of approach and height each time is consistent and you should take particular note of performance in this area.

Intermediate Landing

Exceptionally, at a pre-determined point in the flight an intermediate landing may be permitted for the sole purpose of the fitting of a freshly charged flight battery. This landing may only be made with the prior consent of the Examiners. The pre-determined point may be either after a specific manoeuvre or at a specific time of flight, whichever is requested by the candidate and agreed by the Examiners.

Full pre and post flight checks are not normally required during an intermediate landing and take off unless the model suffered a hard landing. However, the candidate should give the model at least a quick visual examination whilst on the ground.

Stabilised Aircraft

Most modern camera-drones operate using electronic systems that require specific calibration exercises to be periodically performed. The ‘as and when’ of when these systems need checking and or calibrating will be specified in the owner’s manual for the specific aircraft.

The candidate should be expected to be able to either talk through, or if required, demonstrate how such systems should be checked or calibrated in line with the current procedures for failsafe and range checking.

Failsafe Settings

Due to the type of camera-drones that are being used for this test it is expected that the candidate has a good understanding of the various intelligent failsafe options that their aircraft is able to perform and is able to demonstrate a manually instigated ‘return-to-home’ failsafe.

Different aircraft from different manufacturers may have minimum requirements for the ‘Return-to-Home’ failsafe to work effectively, as well as different behaviours when performing the failsafe, and the candidate must understand these for their aircraft.

For example, some aircraft may not initiate the ‘Return-to-Home’ failsafe if the aircraft deems it is within a specific distance of the ‘Home Point’. Some aircraft may even default to another failsafe, such as ‘Descend and Land’, ‘Loiter’ or ‘Motor Stop’.

The aircraft may climb in altitude before turning to return to its home point and this is acceptable, however under no circumstances must this result in the aircraft exceeding a height of 400ft above the surface.

Although GPS should NOT be used for the general flying manoeuvres of the A-certificate test, it is understood that the ‘Return-to-Home’ failsafe will not work without using GPS, so the candidate should still ensure that their chosen aircraft has a suitable GPS Lock before taking off, even though GPS control may not be used until the ‘Return-to-Home’ stage of the test.

Helpers for Disabled Candidates, Young Candidates and Others who have Requested Help During the Test

When disabled or young candidates present themselves for the test it may be that they will not physically be able to perform all the actions that most candidates can. At times, other candidates may also request help with certain physical aspects during the test (they may, for instance, have an injured finger). There will be times when you, as an Examiner, will think 'how much can I relax the test requirements for this person'.

Some Examiners make the decision to make no allowances at all but this effectively bars many people from attempting the tests. If we think of the achievement scheme as a true national scheme then we must consider how we can accommodate candidates, not how we can stop them from participating.]

The answer, of course, is that you, as an Examiner, must make on-the-spot decisions about what you will allow during the test and, in such cases, you are within your authority to take such decisions. The guidelines set out below may help but at all times the two items at the end of this section must take precedence. They are not negotiable and mean that, whoever the candidate is, they have to convince you that they know what they are doing or what is happening for the full duration of the test.

For instance, a disabled flyer may have difficulty handling the model and may not be able to carry it out to the strip, release it for launch or retrieve it after the flight. The sensible use of a helper is certainly allowable in such cases but it is essential that they only do what the candidate asks them to do. Pre-flight checks and engine starting may be another problem area that can be overcome by a helper but you should expect the candidate to do as much of the work as possible themselves and they should be able to talk you through anything that the helper does for them. Be sure to discuss all this with the candidate before starting the test.

All of these comments can apply to younger flyers too but there is an added complication with engine starting. Many parents are very unhappy about letting their children near a running engine and will not allow them to start their own engines. This is a perfectly valid view and, again, is a case where a helper can be used. If this situation does occur with the younger candidates, however, you should insist that they do all the pre-flight and preparation work themselves, up to applying the starter to the engine. If they cannot do this then they should not pass.

After engine start, the helper can adjust engine controls and carry the model but only on the instructions of the candidate.

In all cases:

(1) If, at any time, the helper takes over the decision making process from the candidate then the candidate must fail.

(2) You can make no allowances whatsoever for anyone during the flying of the test. The candidate can either perform the flight manoeuvres as specified or they can't. If they can't then they must not be passed.

Make sure in your briefing that both the candidate and the helper are fully aware of both of these points.

The ‘BPC’ and A Test

(a) Carry out pre-flight checks as required by the BMFA Safety Codes and BMFA Multi-rotor Certification Appendix document. See appendix 4.

The pre-flight checks are laid out clearly in the BMFA Multi-rotor Certification Appendix document. The candidate should also go through the pre-flying session checks, laid out in the BMFA handbook. Ask the candidate to go through their checks as if the test was their first flight of the day.

The candidate should also be aware of any model specific calibration requirements before flying, such as compass calibration, as well as any model specific failsafe and geo-fence settings before flight.

Points to look for are that the candidate has a steady and regular ground routine, especially when connecting and initialising the aircraft. Nerves should not play a part in the pits, and you should satisfy yourself that the candidate is in full control of what they are doing whilst preparing the aircraft for flight.

The examiner should watch that the candidate ensures ALL elements of their model are fully calibrated and connected before flight. Many of the GPS equipped camera drones may take a short while to find a suitable GPS signal, especially if it is the first flight of the day.

A candidate MUST ensure their aircraft has a suitable GPS Lock before taking off, even if flying with the GPS modes turned off for the A-certificate test. A candidate that takes off before the aircraft has such a GPS Lock should be failed.

A tidy flight box and a neat ground layout makes a good impression but bear in mind that that ‘A’ certificate candidates may not have been flying for too long and you should make allowances.

A poor performance in this area is not direct grounds for failing the candidate but can certainly be part of a cumulative fail if other aspects of the performance are below the standard you expect.

Pay particular attention to the way the candidate uses the local frequency control system and make sure that they fully understand it and use the correct sequence appropriate to their model. For 35 MHz, this is usually 'get the peg, Tx on, Rx on'. For 2.4 GHz, the candidate should be aware of any local transmitter usage limitations and if a flight peg is required, it must be obtained before the usual Tx on, Rx on sequence. Some radio equipment and, occasionally, a specific model requirement requires that the Rx be switched on first and, if this is the case, the candidate should explain this clearly to you.

The candidate should also be aware that many camera-based models use more than one frequency for control, such as a combination of 2.4GHx and 5.8GHz and the candidate should be expected to demonstrate they check ALL of the frequencies they are operating on.

With electric powered models, take note that the candidate is aware that the model is ‘live’ as soon as the flight battery is plugged in and that they take appropriate safety precautions. If a separate receiver battery is fitted, the candidate should have the opportunity to check the operation of the radio equipment before the flight battery is plugged in.

Watch carefully and take note that the transmitter controls, trims and switches are checked by the pilot.

All candidates are required to be aware of the local frequency control system and anyone who is required to use it but switches their radio on before doing so should be failed on the spot.

Electric powered models must be carried out from the pits area to a safe point before the flight battery is connected and they MUST be considered live as soon as the flight battery is plugged in. Great care should be taken at this point and any help available to the candidate should be used in the interests of safety.

If there is no one else available then there is nothing to stop you aiding the candidate by, for instance, carrying the model to the test area etc. but any such actions must be performed by you directly on the instructions of the candidate. You must not prompt them or carry out any actions of your own accord.

It is important that you talk these points over with the candidate in you pre-flight briefing.

(b) Complete the heading and drift control exercise, known as the 'Point-to-point' manoeuvre.

The selected points should be agreed between the candidate and examiner in advance, and should usefully utilise site features and or perhaps reference points on the site boundary or the horizon. Alternatively, some form of markers (such as small cones) could be used.

The selected points should be a minimum of approximately 30m away from the take-off and landing point, at least a minimum of approximately 20m apart, and within a safe flying area. (i.e. not behind a flight line for example or beyond visual line of sight).

There is no particular pattern that should be created by the points, the main aim is for the candidate to demonstrate that they are comfortable flying in all directions from themselves, i.e. to their right, straight ahead and to their left.

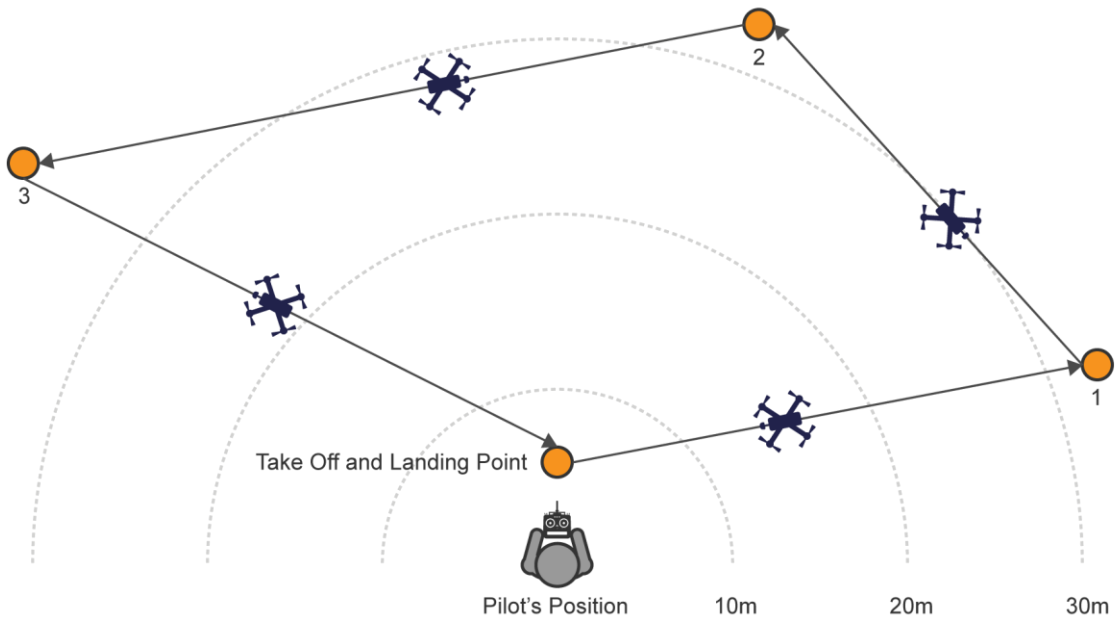
The candidate should take-off, climb to at least 10ft and check flight controls (small nudges in each flight direction to confirm the controls are aligned to the multi-rotor's compass) and then hover in position over the Take Off and Landing Point for about 10 seconds.

The candidate should then fly from the take-off and landing point and transition across the 3 selected points on the site, before then returning to the take-off and landing point.

Throughout the exercise the aircraft should be facing the direction of travel. The candidate should be expected to be able to track a straight path from point-to-point and only make minor adjustments to heading if necessary. The candidate should be expected to maintain a reasonably consistent height above the ground. (this allows for uneven sites on hills)

Once back over the take-off and landing point, the aircraft should be turned tail-in, hovered for about 5 seconds and then landed.

An example of the point-to-point flight can be seen below.



(c) Rectangular circuit ‘into wind’.

The candidate should take-off, climb to at least 10ft and check flight controls, then move forwards about 5m, before then turning 90 degrees to either the left or right and start flying a rectangular circuit into wind. *(Although wind direction for the purpose of the aircraft is not relevant, the examiner should test the candidate’s understanding of ‘in to wind’ as if matching into a club circuit flying environment).*

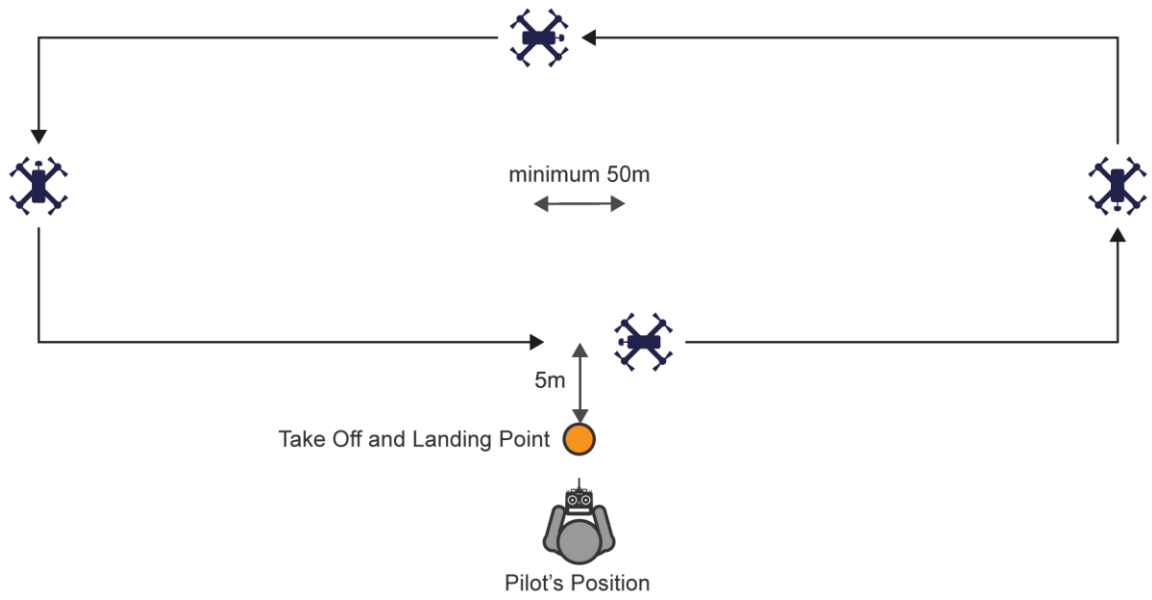
The height of the circuit is not critical, but must be consistent and may be flown at any height above 10ft.

The size of the circuit must be a minimum of about 50m on its longest side.

During the circuit the aircraft must be facing forwards and travelling forwards at all time. The corners should be a positive smooth 90-degree rounded corner, that uses both aileron and rudder input. The aircraft must not be stopped and pirouetted at each corner.

The circuit will end when the aircraft passes in front of the candidate.

An example circuit can be seen below for if the wind was from the right.



(d) Rectangular circuit ‘down wind’.

The candidate should still be in flight from the ‘into wind circuit’ and should now reverse direction and complete a ‘down-wind circuit’ in the opposite direction to the one previously flown.

The candidate may opt to simply pirouette to reverse direction or perform a procedural turn, any method of reversing direction is acceptable.

The height and size of the circuit should be consistent with the one flown into wind, but in the opposite direction.

The circuit will end when the aircraft passes in front of the candidate.

(e) Figure of eight.

The candidate should still be in flight from the ‘down-wind circuit’ and should now reposition to a point at least 20m in front of themselves to a centre cross over point for a figure of eight.

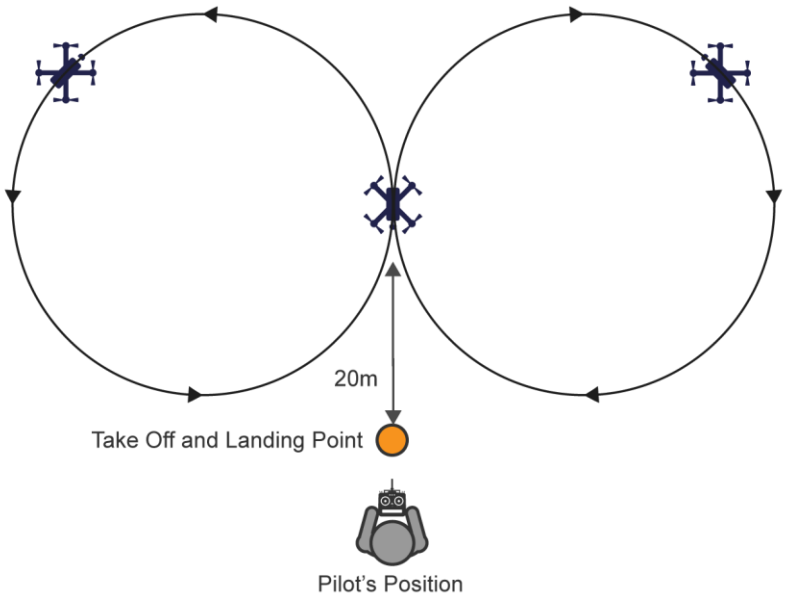
During the figure of eight, the candidate must be flying forwards at all times, both loops should be of a consistent size, with the cross over point being directly in front of the candidate, with the aircraft flying away from the candidate at the point of the crossover.

The candidate should not be penalised for the size of the loops, however a candidate that makes loops of an excessive size may not be using a mixture of rudder and aileron control and may not be to a suitable standard to pass. Under no circumstances must the loops come behind the candidate or cross the flight line.

The candidate may choose to fly the left or right loop first, but both loops must be flown back to back on one manoeuvre.

The height of the figure of eight is not critical, but must be consistent and may be flown at any height above 10ft.

Once the aircraft is back over the centre point, the candidate should reverse the aircraft back to over the take-off and landing point, hover for about 5 seconds and then land.



(f) 45-degree ascent and decent.

The candidate should take-off, climb to about 10ft and check flight controls, then move forwards at least 5m.

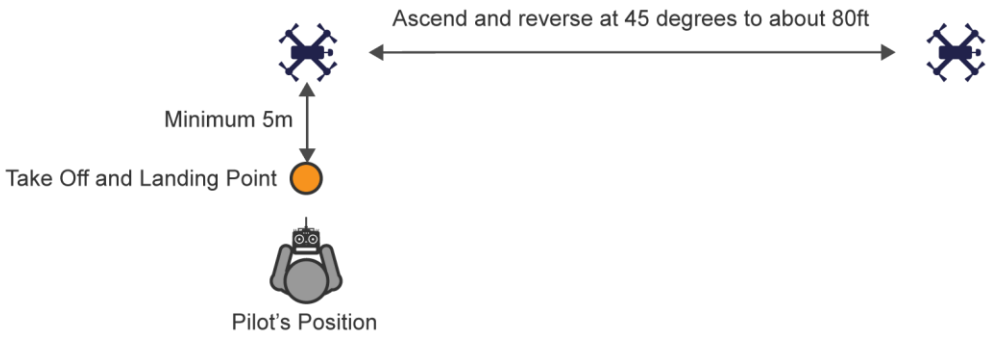
The candidate must then rotate the aircraft 90-degrees either left or right at their choice and hold for about 5 seconds.

The candidate should then reverse the aircraft and ascend at the same time to create a 45-degree climb backwards and upwards equally. The aircraft should be side-on in orientation to the candidate.

The climb should continue to about 80ft or two houses high, at which point the candidate should stop climbing and hold position for about 5 seconds, before then descending back down the reverse path at a 45-degree descent to return to about 10ft above the starting point.

Once the aircraft is back over the starting point, the candidate should return to a tail-in orientation and reverse the aircraft back to over the take-off and landing point, hover for about 5 seconds and then land.

An example of the 45 degree ascent to the right can be seen below.



(g) Return to Home test.

For candidates taking the A-certificate test, the aircraft's GPS control mode may now be used.

The candidate should take-off, climb to about 10ft and check flight controls, once satisfied the aircraft is flying as it should they should fly the aircraft away to a safe location and then demonstrate that their Return to Home function.

As the method and approach for a return to home failsafe will vary from manufacturer, no specific description of 'how' this is to be done is provided, the candidate must be able to demonstrate this with their own machine.

As a general guidance, the aircraft should be flown a minimum of 30m away from the take-off and landing point, to a position in the main flight area.

As the aircraft is likely to take an 'as the crow flies' path to the home point, the candidate should ensure that the position chosen to initiate the return-to-home failsafe will not create a dangerous flight path.

(h) Complete post flight checks as required by the BMFA Safety Codes.

These are clearly set out in the BMFA Members' Handbook and BMFA Multi-rotor Certification Appendix document, but you should pay particular attention to the correct Rx off, Tx off sequence and ensure that the frequency control system in use is cleared correctly.

The Questions

Having successfully completed the safety and flying elements of the test, the candidate, if they do not have a current (post 1/1/2021) RCC, must then answer correctly five mandatory questions based on legal compliance, as well as a **minimum** of five further supplementary questions on safety matters, based on the BMFA Safety Codes for General Flying and local flying rules etc. for the for 'BPC' and 'A' certificate.

Remember that on **no account** can a good performance on the questions make up for a flying test that you considered a failure. If you have failed the candidate's flying you should not even start to ask the questions. On the other hand the achievement scheme is a test of both flying ability and knowledge. It doesn't matter how well the candidate can fly, if they cannot answer the questions they should not pass.

Mandatory Questions

From January 2021 it is a requirement of all tests that candidate's who do not hold a current (post 31/12/2020) RCC must answer correctly 5 questions taken from the list of mandatory questions based on legal aspects of model aircraft flying. (See Appendix 3) The examiner should only ask 5 questions and if the candidate does not know the answer to any question the test must be considered as a fail.

It is expected that examiners will select questions that are appropriate to the test being taken, however candidates should familiarise themselves with all of the questions on the list. Candidates are not expected to be "word perfect" with their answers but they should be able to demonstrate that they are fully aware of the legal controls for model aircraft flying.

The examiner should indicate on the test form which questions have been asked.

Supplementary Questions

How many supplementary questions you should actually ask will depend on the circumstances at the time. For instance, if the candidate has done a good flying test and answers the first five questions (eight for B certificate) with confidence then you need go no further. An acceptable test but with some rough edges can be offset to an extent by the candidate performing well in the first five questions.

A candidate who has done a test which you found only just acceptable and who hesitates on the questions should be asked a few more than five/eight and if you are not satisfied that they have actually read the safety codes, you should not hesitate to fail them.

As an examiner, however, you should prepare yourself thoroughly for any testing that you do and you may wish to sort out your own personal and private list of sensible questions. Don't forget that you can use any local rules which you know and which the candidate should be aware of.

Remember that the majority of questions you ask are to be BASED on the BMFA Safety Codes; you are not expected to ask them 'parrot fashion' and the candidate is not expected to answer that way either.
This opens up the possibility of asking a candidate if they can think of reasons behind specific rules. For instance, why is the club frequency control system operated as it is and what might go wrong? There is always the possibility that the examiner may use the supplementary questions to further explore the candidates understanding of the mandatory questions.

Administration

Completed forms should be sent to the Leicester office within seven days of the test and, whilst they must be filled in by the Examiner, they may be sent in to the office by either the

Examiner or the Candidate. Pass forms can also be submitted online by examiners via the Achievement Scheme website at https://achievements.bmfa.uk/ under the menu item “The Tests”. Passwords for the Achievement Scheme Website form submission are available to current registered examiners from the BMFA Office. You should take great care that all the details are filled in correctly, especially the successful candidates **NAME** and their **BMFA number** (this can save a great deal of confusion). If the candidate is not a BMFA member then it is especially important that you get their name and address correct and in full.

This is very important as what is seen on the pass form is what will appear on the final certificate. It is embarrassing for you to have to send one back to be re-done and it gives the candidate a definite impression of sloppy work by someone.

Please note that the A4 Certificate(s) and updated membership card are not routinely sent directly to the individual tested. However, the Leicester office will send the documents directly to the individual, upon direct and specific request from the Examiner concerned.

Appendix 1

Examiners and Candidates 'BPC' and 'A' Test Check List

The following is a short checklist of matters to discuss with the candidate taken from this document. This checklist can be used to ensure that all points raised above have been discussed with the pilot prior to any flights:

1	The BMFA Member's Handbook, associated Annexes and safety codes Local site rules (if applicable)	☐
2	Discuss whether the model is suitable in "these conditions"	☐
3	Any "no fly zones" need to be identified	☐
4	Remind candidate to talk you through anything that the helper may do for them as the test progresses	☐
5	Agree any manoeuvre requirements that need to be pre-determined by the Examiner and Candidate prior to the commencement of the test flights	☐
6	Clearly identify the take off / landing point and agree with the candidate the required hovering times that he will be flying and you will being looking for.	☐

Appendix 2

‘BPC’ & ‘A’ CERTIFICATE (MULTIROTOR)

Examiners Test Flight Check List

Candidates Name	BMFA Number	Date	Examiner

	FLIGHT TASK	COMMENTS
(a)	Carry out pre-flight checks as required by the BMFA Safety Codes. Await GPS Lock.	
(b)	Take off, hover over the take-off and landing point for 10 seconds, complete the agreed point-to-point path, hover for 5 seconds over the take-off and landing point, then land.	
(c)	Take off, move forwards about 5m, turn 90 degrees to side on and complete a rectangular circuit ‘into wind’.	
(d)	Complete a rectangular circuit ‘down wind’.	
(e)	Position the aircraft tail-in at least 20m in front of the pilot and perform a figure of eight circuit, with the crossover point in front. At the end of the figure of eight, reverse to the take-off and landing point, hover for about 5 seconds and land.	
(f)	Take off, move forwards at least 5m, rotate 90 degrees to side on and complete the 45 degree reverse ascent to a height of about 80ft, hold position for 5 seconds, then descend down the same path to the starting point, return to tail-in, reverse to over the take-off and landing point, hover for about 5 seconds and then land.	
(g)	Take off, fly to a safe position at least 30m from the take-off and landing point and manually instigate a ‘Return-to-Home’ failsafe.	
(h)	Complete post-flight checks as required by the BMFA Safety Codes.	
Answer five questions from the list of mandatory questions on legal aspects of model aircraft flying.		
Answer a minimum of five questions on safety matters from the BMFA Safety Codes and local flying rules.		

Appendix 3

Mandatory Questions List

Jan 2021

1. **Can you fly your model aircraft or drone out of sight behind trees?**
    - **No, because you must be able to see your aircraft at all times.**
2. **You should never fly above what height without appropriate permission or an authorisation?**
    - **400ft**
3. **What is the main reason for not flying above 400ft without permission or an authorisation?**
    - **Because the airspace above 400ft is used by other aircraft.**
4. **When do you need permission from an airport to fly a model aircraft or drone?**
    - **When you wish to fly in a flight restriction zone.**
5. **If you are flying your glider, which has a mass of more than 7.5kg but less than 14kg, from the top of a 150 ft high hill, how high can you fly from where you are standing?**
    - **400ft**
6. **You arrive at a site and want to get ready to fly your model aircraft. What four things must you check?**
    - **That the weather is going to be suitable for your flight.**
    - **That you are 'fit to fly'**
    - **That you make sure there are no airspace restrictions where you intend to fly.**
    - **That your aircraft is in a safe condition to complete the flight safely.**
7. **When can you fly your model aircraft or drone using First Person View equipment without a competent observer?**
    - **If you are flying at a drone racing event within a 'sterile area' and you do not fly above 160 feet (50m).**
8. **You are flying your model aircraft or drone using FPV equipment accompanied by a competent observer, what four conditions must you comply with?**
    - **The take-off mass of your aircraft must be less than 3.5kg**
    - **You must not fly above 1000 feet**
    - **You must not fly above 400 feet if you are flying a rotorcraft with more than one propeller.**
    - **Your competent observer must maintain direct unaided visual contact with your aircraft.**

9. **You are operating your model aircraft or drone safely at a safe height, but there are other people in the vicinity. You notice an air ambulance flying in your direction. What should you do?**

    - **Quickly fly your aircraft out of the way of the air ambulance and either wait or land safely.**

10. **You want to fly in an empty field near to an airport. The field is outside the airport boundary fence, so is it OK to fly there?**

    - **You must check that the field is outside the airport's flight restriction zone before you fly.**

11. **Who is directly responsible for the safe operation of an aircraft?**

    - **The Remote Pilot.**

12. **Before any flight can take place in the Flight Restriction Zone of a Protected Aerodrome, permission must be obtained from whom?**

    - **The Air Traffic Control unit or owners of the Protected Aerodrome.**

13. **Whilst flying, as a Remote Pilot, you should always comply with what two conditions?**

    - **Comply with the limitations of the Article 16 Authorisation or CAP 722.**
    - **Comply with any airspace restrictions.**

14. **Whilst flying, as a Remote Pilot, you should always avoid what?**

    - **Any risk of collision with any manned aircraft.**
    - **Flying close to or inside any area where an emergency response is taking place, without permission to do so.**
    - **Continuing a flight if it may pose a risk to other aircraft, people, animals, environment or property.**

15. **The Article 16 Authorisation stipulates that model aircraft with a Maximum Take Off Mass between 250g and 7.5kg cannot be operated within what separation distances?**

    - **Within a horizontal distance of 30m of assemblies of people.**
    - **Within 30m of any uninvolved person (this may be reduced to 15m for take-off and landing).**

16. **The Article 16 Authorisation stipulates that model aircraft with a Maximum Take Off Mass between 7.5kg and 25kg cannot be operated within what separation distances and above what height?**

    - **Within a horizontal distance of 50m of assemblies of people (this may be reduced to 30m for take-off and landing).**
    - **Within 30m of any uninvolved person**
    - **At an altitude of more than 400' without permission from the CAA.**

17. **Serious Incidents or other Occurrences must be reported to the CAA as a condition of our Authorisation, if they involve any of what four circumstances?**

- **Incidents involving manned aircraft.**
- **Operating above 400 feet**
- **Operating less than 50m from uninvolved people.**
- **Any instances of flight beyond the visual line of sight of the Remote pilot.**

18. **Any Model Aircraft or drone Operator making use of the Article 16 Authorisation must ensure that they comply with what three requirements?**

    - **They must be registered with the CAA.**
    - **They must clearly display their Operator ID on (or in) their aircraft.**
    - **They must be a current BMFA member, or a member of one of the other organisations named in the Authorisation**

19. **The Article 16 Authorisation permits you to give a 'trial flight' to a non-member providing you meet what three conditions?**

    - **They are under your direct instruction and supervision.**
    - **You meet the competency requirements and a valid Operator ID is on the aircraft.**
    - **You must be a current BMFA member, or a member of one of the other organisations named in the Authorisation**

20. **What does the Article 16 authorisation state with regards to the dropping of articles from a model aircraft or drone?**

    - **The Remote pilot must not cause or permit any article or animal to be dropped from an unmanned aircraft so as to endanger persons or property.**

Appendix 4

Camera Drone Pre & Post Flight Checks

(A) Checks before daily flying session.

1. For aircraft with folding arms, ensure the arms are fully extended and secure.
2. Check for loose or missing nuts and bolts.
3. Check that all rotor blades are in good condition with no damage and securely attached to the motors.
4. Check motors are secure and rotate freely.
5. Check all wiring is secure, clear of moving parts and not damaged.
6. Check that any servos, camera and any other payloads are secure.
7. Check that the receiver aerial is secure and in good condition with no chafing or damage.
8. Check that the flight controller is secure and that all aerials including GPS are secure and orientated in the correct direction.
9. Check all transmitter switches are in the right positions.

Once armed:

10. Ensure the aircraft has a suitable GPS satellite count and connection as per the manufacturer's guidance.
11. Ensure the aircraft is connected to the controller and application as required.
12. Ensure the aircraft's failsafe setting where applicable is set as required.
13. Ensure the aircraft's geo-fence setting where applicable is set as required.
14. Check the aircraft's location on the application map if applicable.

Multi-rotor Additional Safety Considerations

The following is a list of additional scenarios that multi-rotors can create, but is in addition to standard procedures for electric or I/C models and general safe flying practices. Due to the fast changing nature of multi-rotors this list should not be considered definitive.

Different multi-rotors will use a vast selection of propellers from soft plastic, through wood and up to carbon. In all cases the propeller should be suitable for the type and power output of each motor and metal propellers must never be used.

Many multi-rotors use the frame as a power distribution board, it is important to insure that all wires are secure and that there is no risk of short-circuiting. Multi-rotors can create more RF interference than the average model aircraft and although the use of ferrite rings might not be necessary with 2.4Ghz radios it is advised to carefully consider the positioning of any and all aerials and wiring.

Multi-rotors are predominantly electric, so all standard controls of electric models should be applied, especially the consideration that the model is live the moment it is connected. As a result models should not be connected in pits areas or car parks.

Models with GPS can typically be programmed to follow waypoints, at no point may the craft become fully autonomous, in other words the pilot should be in control as all times and capable of taking control and overriding any pre-programmed flight commands with the transmitter. The same applies to the use of the 'Return to Home' feature.

Models using Waypoints or Return to Home must consider the flight path of the model and

insure no obstacles will interfere with the model, as this type of flight is often ‘As the crow flies’.

Careful consideration must be taken with models with GPS and ‘Return to Home’ features as to where they are connected and or started, as this is often the ‘Return to Home location’ and must be set as a safe area, e.g. a safe distance in to the runway and not the pits or car park.

It is not easy to safely restrain a multi-rotor so when testing the failsafe it is necessary to remove the propellers.

GPS is typically very good at holding a model to within inches of its position, but is only truly accurate to within 5m of latitude, longitude and altitude.

GPS can take time to ‘find itself’, especially on the first initialization of the day, so time should be given to achieve a safe and stable lock before **EVERY** flight.

A descending multi-rotor is flying through its own prop wash and will often ‘wobble’ as it descends. Trying to descend too fast can cause a model to suffer too much wobble creating a tip stall. A great method to avoid excessive wobble is to descend while travelling, e.g. a 45deg descent.

A multi-rotor with too much gyro gain will oscillate in the air, where as too little will create a model that rocks or drifts excessively.

A multi-rotor that appears to “toilet bowl” (drifting around in a circle) is typically searching for a GPS lock.

Models with GPS that are armed too quickly can shoot off trying to return to their last known GPS position. This again refers to arming and flying before GPS is fully engaged.

Pre-test considerations / checks for examiners.

The following is a guide for examiners to assess that a pilot truly understands the aircraft they are flying and the modes it operates in.

Flight modes:

As mentioned in the earlier section of this document, multi-rotors can have numerous flight modes. The pilot being tested should be able to clearly explain what each mode is on their model and what switch it is assigned to. They should also be able to explain how the model will react in each mode and any special considerations that should be made for each mode. Again, you can refer back to the earlier section on flight modes for reference, but here are some key things to consider for each mode that the pilot should understand.

Things that need to be considered for each mode:

GPS:
GPS does not work instantly when a model is armed and may take time to arm, especially on the first flight. All GPS equipped models will have a warning LED indicating the GPS Status, i.e. is it locked, how many satellites it’s reading etc. Also many will not work indoors, under trees or near power lines. Failing to wait for a successful GPS lock can result in a model struggling to hold location or even a fly away. GPS units typically have an orientation and a pilot should be able to demonstrate that is in the right position/angle.

RTH – Return to Home:
A pilot using RTH should understand exactly when the model sets its home position. In some cases this is as soon as the battery is plugged in, whereas on others it is when the model is

first armed for flight. In either case, the pilot should explain this for their model and arm the model in line with this.

If equipped with RTH the pilot should be able to explain what will happen in this mode. Many models will stop where they are, gain height, then fly in a straight line as the crow flies to their RTH point before then entering a slow decent to landing. Others may simply fly back at the altitude they are starting at and some may then only loiter at a set height once reaching the RTH point and not land.

The pilot should also understand the legal implications of RTH. At this moment in time, RTH is not a legal option for failsafe (This is currently being discussed with the CAA and may change). RTH can only be used as a controlled mode of flight, i.e. the pilot can deliberately put the model in a RTH state, but then instantly regain control at any time. RTH is not legal if the model decides to enter RTH mode on its own due to say loss of signal or low battery, or if the pilot cannot re-take control once RTH's is initiated.

Compass Mode / Carefree Mode:
Carefree mode as mentioned earlier sets an artificial north for the model. The pilot should mainly be aware of the risk of setting an unusual or uncomfortable attitude for this mode. I.e. setting the mode while flying towards yourself will result in a model being set in a permanent 'nose-in' attitude. The pilot should be able to explain how to either exit this mode to normal flight or what they would do if this was accidentally set in flight.

Attitude / Stabilised Mode
This is mostly an idiot proof mode, however some of the earlier control units required the model to be positioned horizontally at point of arming to set the level point, i.e. arming with the model at 20deg will see the model always wanting to level to that angle in flight. As with many gyros devices, many control units don't like to be moved during the initial arming.

Gain adjustment.
Even a basic board that is only capable of manual flight mode can still have a switch assigned to adjust the gyro gains, essentially like a helicopter tail gyro having heading hold and rate mode. On a multi-rotor the behaviour difference between the two could best be described as high and low rates. With the gyro gain high the multi will be more docile / sluggish, where as with the gain dialled down it will be twitchy and able to rotate faster. A pilot should be willing to demonstrate to an examiner that both modes are still manual mode and that the 'low rate' mode is not in fact self-levelling.

Motor Arming:
Many control units have a safe mode, where the motors will not react to control inputs, requiring the transmitter to first use some set positions. For example this might be throttle down and full right rudder to arm, with throttle down and full rudder left to disarm.

Failsafe:
Multi-rotors are capable of various levels of failsafe, from the basic motors to idle minimum, to automatic flight modes. Such self flight modes are; **auto land**, where the multi-rotor self stabilises and goes in to a slow decent and **RTH** (return to home), in this mode the multi-rotor will typically climb by a set amount, turn and fly straight home to its initial arming point and land. Consideration should be taken in RTH mode as the craft typically flies in a straight line, so any obstacles in between such as trees or people may be hit.

Examination question suggestions:

Flight mode: The pilot should be able to explain all their flight modes and how the aircraft will

behave in each mode.

Failsafe settings: The pilot should be able to explain what will happen on loss of signal, i.e., standard motors to idle or slow decent or return to home. This can also be linked to switches.

Arming sequence: Most multi-rotors have a set stick/switch position to start or stop motors.

Switches: The pilot should be able to clearly explain what flight modes are assigned to each switch.

Specific craft considerations: A pilot should be aware of specific behaviours relevant to their multi-rotor. I.e. a motor failure on a bi-copter, tri-copter or quad will result in a crash, however on a hexa-copter or octo-copter the model will typically begin to pirouette, but still fly.

Compass calibration process: The pilot should be able to explain how to calibrate the compass on their camera drone.

IMU calibration process: The pilot should be able to explain how to calibrate the IMU on their camera drone.

BRITISH MODEL FLYING ASSOCIATION
SMAE Ltd
Chacksfield House, 31 St Andrews Road, Leicester, LE2 8RE
Telephone - 0116 2440028 Fax - 0116 2440645
E-Mail - admin@bmfa.org Website - http://www.bmfa.org