BRITISH MODEL FLYING ASSOCIATION

Code of Practice for the Operation of Gas Turbine Powered Model Aircraft.

Prepared by the Gas Turbine Builders Association and the Jet Modellers Association

Available free of charge from the BMFA

Issue 3 **May 2010**

Code of Practice for the Operation of Gas Turbine Powered Model Aircraft.

Prepared jointly by the Gas Turbine Builders Association and the Jet Modellers Association and adopted by the British Model Flying Association.

Definitions

Persons complying with the requirements of the Code must be aware that throughout the Code there are certain words which have specific meanings, defined as follows:-

must - Indicates an absolute obligation to comply. There are no circumstances under which the requirement could be relaxed.

should - Indicates an obligation to comply so far as is practicable but allows a relaxation of the requirement under exceptional circumstances. There has to be a very good reason why the requirement is not complied with.

may - Indicates a preferred course of action, based on collective experience. Non-compliance is not expected to result in an unsafe situation.

Introduction

Gas turbine engines and model aircraft powered by them share many of the safety issues of conventional model power-plants and aircraft. Those embarking upon the construction of a gas turbine or model aircraft powered by such an engine should first make themselves familiar with these safety issues, as detailed in (for example) the BMFA handbook. Specific safety issues relating to gas turbine aircraft in particular are as follows:

a. Danger of burns or damage caused by hot exhaust gases.

b. Danger of fire, after a crash, ignited by hot components and made more serious by the relatively high fuel loads commonly carried.

c. Danger of fire caused by overheating as a result of poor start-up procedures or engine failure.

e. Dangers relating to the relatively large size, power and wing loading of many (but not all) turbine powered aircraft. These dangers are of course shared with many other large, powerful models.

f. Problems of ground handling relating to the relatively high idle thrust of some engines.

g. Risk of injury caused by engine parts, which may be ejected at high velocity after engine failure.

To prevent or minimise risk from all of these possibilities there are four approaches.

i. Ensure that operators and pilots have a high level of skill, knowledge, and experience to enable them to avoid dangerous situations.

ii. Ensure that failures and incidents happen as infrequently as possible by paying detailed attention to reliability issues and by careful, systematic design procedures, operational procedures and maintenance.

iii. Provide fail safe and cut-off mechanisms whenever practicable to ensure that most failures follow a “low risk” path.

iv. Pay attention to where and when aircraft are flown (or engines are operated) to ensure the safety of people, property and the environment.

The total safety approach is a compromise between each of these factors, although (iv) remains the most critical.

Issue 1, Jan 2008 - Original Text with amended B.2.2.2 to clarify failsafe operation

Issue 2, May 2009 - Replace references to “event organiser” with “Flight Line Controller”. Appendix 2 (Flight Line Layout) added.

Issue 3, May 2010 - 2009 Text with minor amendments

The Code of Practice

The guidance given below is distilled from the Gas Turbine Builders Association 'Code of Practice for the Safe Operation of Model Gas Turbines' and the Jet Modellers Association 'Flying Event Safety Rules'. It is presented to provide a document relevant to the needs of individuals and groups (such as model flying clubs).

At club level the role of the Flight Line Controller should be undertaken by the club's Safety Officer or another designated club official, acting under club rules.

On any particular occasion, when none of these individuals are present, it is acceptable for the pilot to take on these responsibilities provided that:

a) He has the consent of all other club members present.

b) He acts in accordance with these guidelines and with any rules or standard practices that have previously been laid down by the relevant club officials.

For example, given a particular wind direction, the pilot might choose a suitable start-up area and taxi point from a small number of options that have previously been defined by the club safety officer.

Organisers of model jet flying events should refer to the JMA Flying Event Safety Rules, which can be seen at http://www.jmajets.co.uk/

Builders of homebuilt gas turbines or engine control units should refer to the GTBA Code of Practice for the Safe Operation of Model Gas Turbines, which can be seen at http://www.gtba.co.uk/

Article reference numbers are cross-referenced in Appendix 1 to the source documents. Topics are presented in a logical order for the achievement of safe and competent operation of gas turbine powered model aircraft.

A. **Operators Responsibilities**

B. **Gas Turbine Protection and Control**

C. **Fuel Systems**

D. **Gas Turbine Installation**

E. **Fire Safety**

F. **Test Running**

G. **Operations in Public**

H. **Maintenance**

I. **Flying Site Organisation**

J. **Pre-flight Checks**

K. **Flying Safety**

Appendix 1 **Source document cross-references**

Appendix 2 **Recommended Site Layout**

A. Operators Responsibilities

A.1 Manufacturer's or designer's operating instructions must be followed at all times.

A.2 Inexperienced operators should, wherever possible, seek the assistance of an experienced operator before running a gas turbine. If in doubt - seek help.

A.3 In order that the operator shall gain experience with the start-up procedure and the running characteristics of the engine, initial runs of any gas turbine must be carried out on a test stand. The operator must not attempt any operation of the engine in public until such experience has been gained.

A.4 Operators in the UK must comply with the requirements of the Civil Aviation Authority publication CAP658 "Small (Model) Aircraft: A Guide to Safe Flying" and the current issue of the BMFA Members Handbook.

A.5 Persons supervising gas turbine flying activities must also be qualified to a standard equivalent to the BMFA Power Achievement Scheme 'B' Certificate.

Gas turbine operation requires that operators must be aware of the flying characteristics that arise from the application of gas turbine power. Paying particular attention to:-

- The delay in response to opening the throttle.
- The high speeds, which can result from the available thrust not decreasing with increasing airspeed.
- The high thrust at engine idle speed, which makes for difficulties in slowing the aircraft down for landing.

A.6 The Pilot of an aircraft is that person who is operating the radio control transmitter whilst an aircraft is being prepared for or undertaking flight.

A.7 The ultimate responsibility for the safe operation of an aircraft rests with the Pilot.

A.8 All Pilots are expected to be competent to operate their aircraft. If the Event Organiser or Flight Line Safety Officer determines that a Pilot is not competent he will not be allowed to fly. Pilots must be competent to a standard equivalent to the British Model Flying Association Powered Fixed Wing Model Aircraft "B" Certificate of Proficiency.

At club or association events and where the general public are not present, pilots not holding a BMFA “B” Certificate of Proficiency (or equivalent) may, with the approval of a club official or Event Organiser, be allowed to operate an aircraft under the constant supervision of a holder of a BMFA “B” Certificate of Proficiency (or equivalent). The supervising pilot must have charge, at all times during the flight, of a ‘master’ transmitter from which control of the aircraft can be passed by the supervisor to a ‘slave’ transmitter held by the pilot under supervision.

A.9 Any Pilot determined to be suffering from the effects of Alcohol or Drug abuse must not be allowed to fly.

B. Gas Turbine Protection and Control

B.1 Start up and static running

Where engines are being run statically, on a test bench or during start up procedures in a model aircraft, boat or vehicle, a manual fuel shutoff mechanism must be provided. This mechanism may take any suitable form such as a fuel valve or electrical switch to cut power to the pump, but must be independent of the normal throttle control. Where a fuel valve is used in a liquid fuel system it should be located in the low-pressure part of the fuel line, between the tank and the pump. In a self-pressurised (gaseous fuelled engine) system it should be located as close as possible to the engine to ensure a rapid shutdown.

B.2 Operation under remote control,

The following paragraphs apply only to engines that are operated remotely, such that the manual control referred to in B.1 above is inaccessible.

B.2.1 Shutdown mechanisms.

The engine control function must include an independent fuel shut off device in addition to the valve (gaseous fuelled engines) or pump speed controller (liquid fuelled engines), as used by the throttle control.

The fuel shut off device could be a solenoid valve or a servo operated valve in the fuel line, in which case the considerations in regard of positioning given in B.1 above should apply.

Alternatively a relay, servo operated switch or additional transistor in the pump circuit may be used. Engine control units (ECUs) driving fuel solenoid valves should meet this requirement.

B.2.2 Failsafe operation

"Failsafe" device refers to any equipment or facility associated with the radio control system that is activated by the loss of radio signal or interference to the signal.

B.2.2.1 Gas turbine powered models must incorporate a radio failsafe, which is capable of shutting down the engine (preferably via both of the mechanisms described in B.2.1 above in the event of loss of signal).

B.2.2.2 In the event of loss of signal the initial failsafe setting must be that the engine will either go to idle or shut down, depending on the pilot's wishes.

If the engine is set to idle on initial failsafe then, after a maximum of 3 seconds, the engine may either remain at idle or shut down, depending on the requirements of the Flightline Controller.

However, the use of idle as the 'post 3 seconds' failsafe setting must be authorised by the Flightline Controller. The Flightline Controller may also specify a shorter delay time.

B.2.2.3 This failsafe mechanism must be correctly programmed and in no circumstances should it be left at the default setting without checking. Where both fuel cut-off mechanisms are operated by a single control unit then this unit should be configured so that an internal failure will activate at least one of the mechanisms.

B.2.2.4 It is the responsibility of the pilot to demonstrate these functions on request.

B.2.2.5 The settings of failsafe devices must be checked prior to each flying session to confirm compliance with these rules.

B.2.3 Kill switch

Radio transmitters used for the control of gas turbine powered models should incorporate a control that will instantly shut the engine down when operated. This control should be easily accessible and must operate in a single action, independently of the throttle lever.

C. Fuel Systems

C.1 Where possible fuel tank(s) should be located in a separate compartment from the engine. The tank(s) must be protected from the heat of the engine.

C.2 The fuel tank(s) and fuel system components must be adequately secured and protected to minimise the risk of rupture in the event of a crash.

C.3 Flexible fuel tanks, including plasma bags, should only be used where it is impractical to use any alternative form of fuel tank. If such tanks are used, they shall be placed in a separate compartment, or protective 'shell', the construction of which shall not compromise the integrity of the tank, and be leak-proof and be fitted with a drain to route any spilled fuel overboard.

C.4 Fuel lines, connectors and associated equipment must be tested to show the ability to withstand the pressure imposed without leakage or failure when the engine is operating at maximum safe speed. A drainage hole should be made in every part of the model where fuel could collect as a result of a leak.

C.5 Fuel lines and associated equipment must be made from materials suitable for the intended service and which can adequately cope with the environmental conditions of the installation.

C.6 Separate feed lines for starting gas and liquid fuel should be used to avoid the dangers of migration of the starter gas back into the liquid fuel system.

C.7 The fuel tanks of liquid fuelled engines should not be subjected to any form of high pressure pressurisation. Low pressure pressurisation is permitted, in systems of a suitable pressure rating, up to a maximum of 5 psi (0.35 bar) for the purpose of aiding fuel movement between tanks and to fuel pumps.

C.8 Tanks for gaseous fuel are pressure vessels and must be certified as such.

C.9 All tanks and fuel lines should be regularly checked for deterioration and renewed where necessary, paying particular attention to the possibility of hardening of flexible pipes and seals in the vicinity of joints which are subjected to high pressures.

C.10 Only clean, filtered fuel should be used and measures taken to prevent contamination of fuel systems.

C.11 The oil content of the fuel must be as specified by the designer or manufacturer.

C.12 An appropriate oil suitable for use in gas turbines should be used.

D. Gas Turbine Installation

D.1 Engines must be securely mounted and attached in a manner to ensure that they remain so for all operating regimes.

D.2 All components anywhere in the vicinity of the engine must be adequately secured to prevent ingestion.

D.3 The engine should be protected from Foreign Object Damage (FOD) by suitable screens or by virtue of the position of the air intake(s).

D.4 Pipes, lines, wires, control cables etc., should be routed away from the hot parts of the engine or be suitable for the temperatures arising.

D.5 Until experience has been gained in operating gas turbines, engines powering aircraft or other vehicles should be mounted externally.

D.6 For internal turbine installations adequate heat protection from the hot exhaust gases must be provided.

D.7 The idle thrust of a gas turbine can be very high. If the model does not remain stationary with the engine at idle, positive measures must be taken to restrain it. Note that the behaviour of the aircraft may vary depending upon the nature of the runway surface.

E. Fire Safety

E.1 Pilots operating gas turbines must nominate a competent Fire Person (see below) for the entire duration of the preparations to fly, the take-off, the flight and landing, to stand by with an appropriate serviceable fire extinguisher. The nominated Fire Person must assume responsibility, under the direction of the Pilot, for extinguishing any fires that may arise.

E.2 Fire Person (in respect of Gas Turbine operations).

E.2.1 The Fire Person is that person nominated by the Pilot to undertake the responsibility of dealing with any fire that may occur during the preparation and flying of the Pilot's aircraft.

E.2.2 The Fire Person must be familiar with the location on and around the aircraft of all equipment and substances that would represent a hazard in the event of a fire and be competent to deal with such hazards.

E.2.3 The Fire Person must, whilst on duty, have ready access to an appropriate and serviceable fire extinguisher and be competent to operate it effectively.

E.2.4 A Fire Person can only be assigned to one aircraft at any one time.

E.2.5 The Fire Person's duties will have priority over all other tasks and he will maintain an overview of all activities while the gas turbine is being operated.

E.3 Gas turbines must not be run if the surrounding environment presents a fire risk unless adequate precautions are taken to negate the risk.

E.4 Smoking or other sources of ignition are prohibited within a radius of 50 metres of decanting, venting or fuelling of flammable gases. Signs designating the fuelling areas should be displayed if a gas-fuelled engine is being operated in public.

E.5 Any venting of liquefied gas must be conducted in a safe manner, in particular venting must not be undertaken within a radius of 50 metres, and never upwind, of any other gas turbine which is running.

E.6 All fuels must be contained in appropriate vessels clearly marked with a description of the contents.

E.7 Fuelling of aircraft will only be carried out by competent persons nominated by the Pilot.

E.8 A nominated Fire Person in possession of an appropriate and serviceable Fire Extinguisher must be in attendance throughout all fuelling operations.

E.9 The Pilot or the nominated competent person must ensure that the fuelling equipment is fit for the intended purpose before fuelling takes place.

E.10 During refuelling, the engines(s) must be shut down.

E.11 It is strongly recommended that a manually operated shut-off device is fitted in the fuel supply line to the engine(s) to prevent inadvertent fuel flow to the engine(s) during refuelling.

E.12 Engine Fires constitute a major hazard and awareness of potential causes must be fully understood, they include:-

- Residual fuel in the engine leading to a "wet start".
- Incorrect starting procedure.
- Turbine rubbing.
- Excess lubrication oil introduced during the priming of the lubrication system.
- Debris partially blocking the air intake, reducing compressor performance.
- Blocked fuel jets.
- Expansion of fuel into the engine after shut-down of the fuel pump.
- Tail-pipes pointing into wind at start-up.

F. Test Running

F.1 A test bed should be used with the engine securely fixed and constrained and located in a controlled area.

F.2 The test area must be adequately ventilated.

F.3 During protracted ground running adequate eye and ear protection should be worn.

F.4 Mechanical abnormalities indicated at any time by vibration, unusual or excessive noise, excessive temperature, overspeed or any other unexpected phenomena must be investigated and corrected, before the engine is re-started.

F.5 During ground running, particularly in built-up areas, due regard must be given to preventing noise nuisance.

G. Operations in Public

G.1 An engine must only be run in public after the operator is fully familiar and competent with its operation. Private club sites are excluded from this rule, provided the remaining rules in this section are followed strictly.

G.2 All engine running must be conducted at a safe distance from non essential personnel with the jet pipe always facing away from them. When wind direction requires that tailpipes are directed towards people or property the distance from the tailpipe to people or property must be

increased to the point where jet blast and temperature effects are of no consequence.

G.3 No person must be allowed to stand close to an operating engine in the rotational plane of the compressor or turbine.

G.4 Particular attention must be paid to site husbandry and cleanliness to reduce the risk of foreign object damage to the gas turbine by ingestion and to prevent any loose articles being carried in the jet efflux.

H Maintenance

H.1 Engine maintenance must be regularly performed. The frequency and detail of checks and actions will depend upon engine installation, experience and any manufacturer's instructions; and will vary between external inspections prior to flight to major dismantling and inspection of the engine at predetermined intervals.

Flying Site Organisation

I.1 Introduction

Most flying clubs will have a pre-existing flying site layout that is adapted to local conditions. Provided that this layout is broadly equivalent to the guidelines below it should be retained for jet operations since club members will already be familiar with it.

In other cases it may be necessary to revise the site organisation to allow gas turbine operations or declare the site unsuitable.

The guidelines regarding taxiing, the pit and start-up area safety rules and the guidance about afterburners will generally not form part of existing club practice and should always be heeded.

I.2 Crowd Line.

Note that the concept of a Crowd Line applies to events where the public is present. However the control principles set out below can be applied at club sites to keep those present, who are not directly involved in jet model operations, in safe areas. In these club site circumstances a physical barrier may not be necessary if there is adequate supervision from club officials, but the line must be designated by some means. Club sites should also employ the concept of a Display Line. The area that club members regard as safe and never overflown, (pits, club hut, car park etc., should be taken as the Public Area in the guidance below.

For club site situations in place of Event Organisers read club officials and for Flight Line Director read Safety Officer.

On any particular occasion, when none of these individuals are present, it is acceptable for the pilot to take on these responsibilities provided that:

a) He has the consent of all other club members present.

b) He acts in accordance with these guidelines and with any rules or standard practices that have previously been laid down by the relevant club officials.

For example, given a particular wind direction, the pilot might choose a suitable start-up area and taxi point from a small number of options that have previously been defined by the club safety officer.

I.2.1 The Crowd Line is a physical barrier that generally runs parallel to the Display Line in use and which is displaced at least 30 metres from that line. The Display Line is Air Side of the Crowd Line.

I.2.2 The Crowd Line is continuous and unbroken except for controlled Air-side access points.

I.2.3 Operators of aircraft, operators' nominated personnel and event organiser's nominated personnel are the only persons allowed in front of the crowd line.

I.3 Display Line

The Display Line is a line parallel to the crowd line. Aircraft must only be flown on the far side of the vertical plane that passes through the Display Line. The horizontal displacement of the Display Line from the Crowd Line must be at least 30 metres for aircraft under 7 kg. For aircraft over 7 kg the distance must be at least 50 metres but this may be reduced to 30 metres on take-off or landing only.

I.4 Air-side.

Air-side is defined as that area one side of the Crowd Line in which flying takes place. Pits and engine starting areas are sited in the Air-side area.

I.5 Safety Line.

The Safety Line coincides exactly with the Display Line.

I.6 Taxi Point

The Taxi Point is a designated point on the runway where aircraft are left by the Pilot's helpers at the commencement of a flight. The position of the Taxi Point will be specified by the Flight Line Director and will be such that the effects of crosswind and loss of directional control will not put any person at risk.

I.7 Pilots Box.

The Pilots Box is a marked area in which all pilots remain while their respective aircraft are in the air. It is advisable that the Pilots Box should, where practical, be physically protected by barriers, for the purpose of stopping errant aircraft.

I.8 Public Area.

The Public Area is all that which is not Air-side of the Crowd Line.

I.9 Pit and Start-up Area Safety Rules.

Note that for operations at club sites or other locations where the general public is not present, references to Crowd line and Airside can be interpreted to suit the site safety designations.

I.9.1 Starting and running of engines will only take place in designated Start-up Areas, which will be located air-side of the Crowd Line. The Start-up Areas will be separated from the general Pits area and will be used to prepare aircraft for flight.

I.9.2 At club sites where only a very small number of gas turbine aircraft are present a separate designated start up area may be dispensed with provided:

a) Only one gas turbine engine is operated at any given time.

b) Engines are not started in the vicinity of the general pit area used by other (propeller) aircraft.

c) Other safety rules regarding positioning, in this section and section G above, are observed.

I.9.3 An Engine Test Area will be established at a significantly greater distance from the Pits area than the Start-up Areas but remaining airside of the Crowd Line.

I.9.4 When starting and running an aircraft's engine(s) the jet exhaust should, wherever reasonably possible, be directed away from the Crowd Line. Gas Turbines, which require to be started with tailpipes directed downwind, must be located such that the effect of the jet blast on people and property is negligible.

I.9.5 All gas turbine powered aircraft whose engines are being started should be positioned such that jet tail-pipes will exhaust over hardened surfaces away from any dry grass areas and complying with rule I.9.1 above.

I.9.6 All non-essential personnel are to be kept clear of the immediate vicinity of aircraft whose engines are being started and run.

I.9.7 The Pit and Start-up Areas must be kept clean and any loose items must be picked up or secured to prevent being sucked into a fan or gas turbine.

I.10 Aircraft are not to be taxied without restraint in or out of the Pit Area. Aircraft must be carried or restrained while being moved from the designated starting point to the Taxi Point ensuring that the jet blast is always directed away from the Pit Area. Aircraft returning from a flight must be stopped at the Taxi Point and the engine(s) shut down.

I.11 Aircraft powered by gas turbines consuming liquefied gaseous fuel will be fuelled in a designated area remote from the Pit Area.

I.12 Use of afterburners (reheat)Because of noise and flame hazards, afterburners must not be operated on the ground, other than on the designated runway during take-off. However, should afterburner operation need to be checked, before the start of flying, such checks should be made in a reserved start box, away from the normal starting and pits areas. All aircraft equipped with afterburners should be required thereafter to be started from this reserved start box. There are no restrictions to the operation of an afterburner once an aircraft is airborne.

J. Pre-flight Checks

J.1 Pilots are to ensure, before each flight, that their aircraft are airworthy and that their radio system is functioning properly and all batteries are adequately charged.

J.2 Where practical, the following gas turbine system checks must be made prior to every flight:-

J.2.1 Visual check of the fuel and oil systems for leaks.

J.2.2 Visual inspection of the compressor and turbine wheels for any signs of damage. Minor damage to a compressor blade, visible from the inlet, could indicate serious foreign object damage within the engine and must be investigated further before the engine is again operated.

J.2.3 Visual inspection of filters (if accessible and applicable) to ensure that they are contaminant free.

J.3 Mechanical abnormalities indicated at any time by vibration, unusual or excessive noise, excessive temperature, overspeed, or any other unexpected phenomena must be investigated and resolved before the engine is re-started.

K. Flying Safety

These requirements are written for public display circumstances but the principles must also be applied at club sites, in which case for Event read day's flying session. (See also the notes heading section I - Flying Site Organisation).

K.1 Pilots must remain within the confines of the Pilot Box for the duration of the flight.

K.2 Aircraft are to be flown in an area to the far side of the Display Line, which will be also be designated as the Safety Line. Pilots will be required to terminate a flight if, at any time, they allow their aircraft to pass over the Safety Line. A subsequent infringement of the Safety Line will eliminate the Pilot from the Event. The Safety Line for aircraft over 7 kg may be crossed for take-off and landing but at no time during an aircraft's operation must such aircraft come closer than 30 metres from the Crowd Line.

K.3 Any Pilot who allows his aircraft to over-fly the Public Area will immediately be required to bring the aircraft back to the runway and land. Any further flying by this Pilot for the duration of the Event will be at the discretion of the event control

K.4 Except during take-off and landing, low flying, below 3 metres above ground level, may only be undertaken with the aircraft flying on a constant heading in a direction parallel to the runway centre line.

K.5 High-speed manoeuvres must be made in a direction parallel to the Crowd Line or heading away from the Public Area. Such manoeuvres must be confined to the far side of a vertical plane, parallel to the Crowd Line, which is displaced 30 metres horizontally from the Pilots Box.

K.6 There will be no high-energy manoeuvres permitted that would bring the aircraft on a heading towards the Crowd Line.

K.7 Aircraft must be operated within the visual range of the Pilot who must also take into account the effects of the position of the sun.

K.8 Pilots must assess the effects of the weather upon their aircraft and not make a flight in conditions in which their aircraft would not remain under full control.

K.9 If an aircraft experiences radio interference or any other form of control malfunction it must be landed as soon as is practicable and not be flown again until all faults have been rectified to the satisfaction of the Flight Line Director.

K.10 If any part of an aircraft becomes detached in flight which was not designed and controlled to do so the aircraft must be landed as soon as is practicable and not be flown again until all faults have been rectified to the satisfaction of the Flight Line Director.

K.11 If an aircraft touches the ground while in flight, other than by contact involving normal use of the landing gear, the aircraft must be landed as soon as is practicable and not be flown again until it has been checked and all damage has been rectified to the satisfaction of the Flight Line Director.

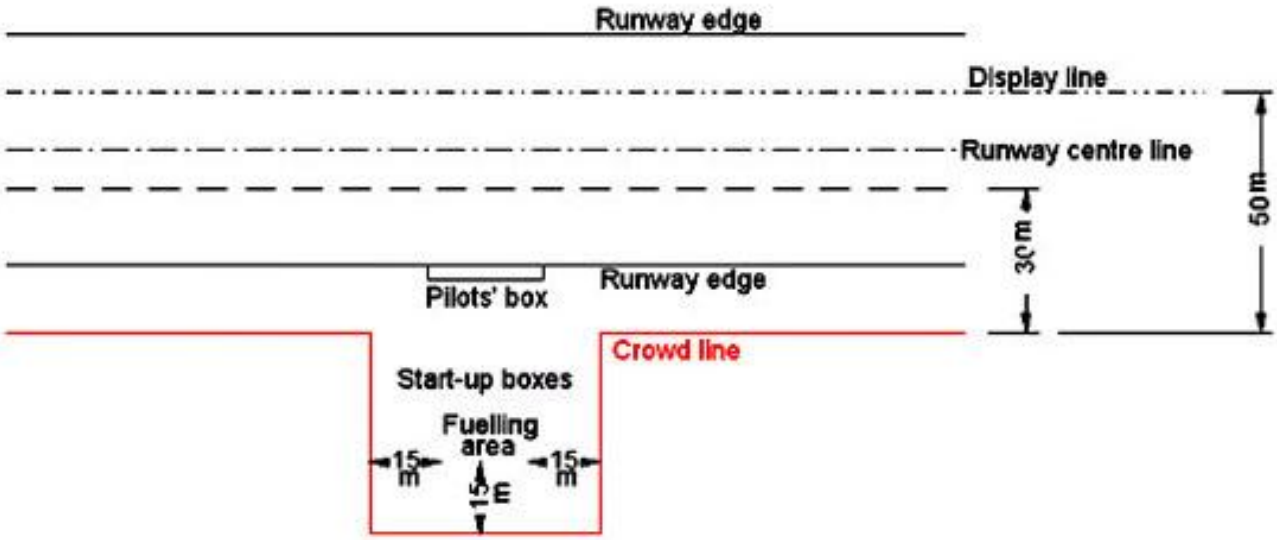
K.12 If an aircraft on the ground catches fire the Pilot must direct the nominated Fire Person to extinguish the fire. If as a result of a fire the aircraft crashes, or as a result of a crash an aircraft catches fire, only the nominated Fire Person together with the Mobile fire Vehicle and crew should attend the aircraft until the fire is extinguished.

K.13 Pilots must have a helper in attendance for every flight. The helper must maintain a lookout throughout the flight to warn the Pilot of any circumstances that may jeopardise the safe conduct of the flight.

K.14 Display Smoke

Aircraft may be equipped with exhaust smoke systems but operators must ensure that smoke is not generated at low flight levels (to ensure that persons or property on the ground are not adversely affected), nor in any way that interferes with the operation of other aircraft.

Appendix 1 Recommended Site Layout



This diagram is to a scale based on a runway 48 metres wide. The runway width is divided into three equal strips and the near-side edge of the central take-off strip is placed at 30 metres from the crowd line.

With a military runway of the width shown, the 50 metre line is over the runway. This is convenient for flight-line controllers and pilots alike.

The fuelling and start-up areas shown provide the approved separation from the crowd. There is an issue with starting engines pointing into wind (assume parallel to runway direction) and not cooking the crowd the simplest solution is to have the have the crowd on only one side of, and behind, the pits (as is used on the show line at the Nationals at Barkston Heath).

When a runway intersection is used for the pilots position, as is often the case, the start-up and fuelling areas should be positioned on the runway not in use.

In the case of smaller sites ignore the 'runway edges' and imagine the central strip as the whole runway with the near edge 30 metres from the crowd line.

Appendix 2 Source document cross-references

Source document articles are prefixed GTBA and JMA for identification.

A.1	(GTBA 6.4.1)	E.2.4	(JMA 1.6.4)
A.2	(GTBA 8.1)	E.2.5	(JMA 1.6.5)
A.3	(GTBA 8.2)	E.3	(GTBA 6.1.2)
A.4	(GTBA 9)	E.4	(GTBA 6.1.3)
A.5	(GTBA 9.1) (GTBA 9.2) (GTBA 9.3)	E.5	(GTBA 6.1.4)
A.6	(JMA 1.5.1)	E.6	(GTBA 6.1.5)(JMA 4.10)
A.7	(JMA 1.5.2)	E.7	(JMA 6.1)
A.8	(JMA 5.1)	E.8	(JMA 6.2)
A.9	(JMA 5.2)	E.9	(JMA 6.4)
B.1	(GTBA 2.6)	E.10	(JMA 6.5)
B.2	(GTBA 2.7)	E.11	(JMA 6.6)
B.2.1	(JMA 7.2) (GTBA 2.7.1)	E.12	(GTBA 6.1.6)
B.2.2	(JMA 7.1)	F.1	(GTBA 6.2.3)
B.2.2.2	(JMA 7.3)	F.2	(GTBA 6.2.4)
B.2.2.3	(GTBA 2.7.2)	F.3	(GTBA 6.2.5)
B.2.2.4	(JMA 7.5)	F.4	(GTBA 6.2.6)
B.2.2.5	(JMA 7.6)	F.5	(GTBA 6.2.7)
B.2.3	(GTBA 2.7.3)	G.1	(GTBA 6.3.1).
C.1	(GTBA 3.1)	G.2	(GTBA 6.3.2)
C.2	(GTBA 3.2)	G.3	(GTBA 6.3.3)
C.3	(JMA 4.12)	G.4	(GTBA 6.3.4)
C.4	(GTBA 3.4)	H.1	(GTBA 7.1)
C.5	(GTBA 3.5)	I.2	(JMA 2.1)
C.6	(GTBA 3.6)	I.2.1	(JMA 2.1.1)
C.7	(GTBA 3.7)	I.2.2	(JMA 2.1.2)
C.8	(GTBA 3.8)	I.2.3	(JMA 2.1.3)
C.9	(GTBA 3.9)	I.3	(JMA 2.2)
C.10	(GTBA 3.10)	I.4	(JMA 2.3)
C.11	(GTBA 4.5)	I.5	(JMA 2.4)
C.12	(GTBA 4.7)	I.6	(JMA 2.5)
D.1	(GTBA 5.1)	I.7	(JMA 2.6)
D.2	(GTBA 5.2)	I.8	(JMA 2.7)
D.3	(GTBA 5.3)	I.9.1	(JMA 4.1)
D.4	(GTBA 5.4)	I.9.3	(JMA 4.2)
D.5	(GTBA 5.5)	I.9.4	(JMA 4.3)
D.6	(GTBA 5.6)	I.9.5	(JMA 4.4)
D.7	(GTBA 5.7)	I.9.6	(JMA 4.5)
E.1	(JMA 4.8)	I.9.7	(JMA 4.6)
E.2.1	(JMA 1.6.1)	I.10	(JMA 4.7)
E.2.2	(JMA 1.6.2)	I.11	(JMA 4.9)
E.2.3	(JMA 1.6.3)	I.12	(JMA 4.11)

J.1	(JMA 5.3)	K.5	(JMA 5.8)
J.2	BMFA	K.6	(JMA 5.9)
J.2.1	(GTBA 7.2.1)	K.7	(JMA 5.10)
J.2.2	(GTBA 7.2.2)	K.8	(JMA 5.11)
J.3	BMFA	K.9	(JMA 5.12)
J.2.3	(GTBA 7.2.3)	K.10	(JMA 5.13)
K.1	(JMA 5.4)	K.11	(JMA 5.14)
K.2	(JMA 5.5)	K.12	(JMA 5.15)
K.3	(JMA 5.6)	K.13	(JMA 5.16)
K.4	(JMA 5.7)	K.14	(JMA 5.1

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