



# **UKRA**

# **Safety Code**

**Edition 3.0**

This document is published by the Council of the United Kingdom Rocketry Association and supercedes all previous safety code versions. It shall also be valid with any authentic amendment slips provided by UKRA.

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# **UKRA Safety Code**

## Section 1      General Rules

### 1.01 Definitions

**Rocket Motor**      The motor which propels any rocket vehicle whether utilising solid propellant, liquid propellant or a combination of solid and liquid (hybrid) propellant. Rocket motors are classed according to the following table:

<b>Motor Type</b>	<b>Propellant</b>	
	<b>Fuel</b>	<b>Oxidiser</b>
Solid Motor	Solid	Solid
Hybrid Motor	Solid	Liquid
Hybrid Motor	Liquid	Solid
Liquid Motor	Liquid	Liquid

**Propellant**      The name given to the mixture of fuel and oxidiser which react in the rocket motor to produce exhaust gases. Some propellants may be classified as an explosive in the UK.

**Model Rocket**      Model Rocket relates to any rocket vehicle falling into all of the following categories:

- where the combined propellant mass of rocket motors used is less than 125 grams
- where all individual motors have a propellant mass of less than 62.5 grams
- where the maximum mass of the model at launch is less than 500 grams
- where the rocket motor employ's solid propellants only

**High Power Rocket**      High Power Rocket (HPR) relates to any rocket vehicle in any of the following categories:

- where the combined propellant mass of rocket motors used is over 125 grams
- where any single motor has a propellant mass over 62.5 grams
- where the maximum mass of the model at launch exceeds 500 grams
- where the rocket motor propellant is liquid, gas or a hybrid of these and solid propellant

**Rocket**      Rocket relates to any rocket vehicle whether a Model Rocket or High Power Rocket

**UKRA**      United Kingdom Rocketry Association

**Safety Officer**      A member of the UKRA acting as Safety Officer (must be certified as a qualified Safety Officer by the UKRA Safety and Technical Committee if overseeing launches of above G class Total Impulse).

**Launch Site**      This should be a suitable open area for launching and recovering rockets. It must conform to the minimum dimensions laid out in the UKRA Launch Site Dimensions Table.

**CAA**      Civil Aviation Authority

**NOTAM**      Notification To Air Men (issued by the CAA)

## 1.02 Safety

Safety is the concern of all members. Members causing serious damage / injury to third parties, livestock, vehicles or property whilst involved in Rocketry of any kind must report the incident in full to the Safety & Technical Committee, even if the UKRA codes of practice were not in force at the time of the incident.

The Safety & Technical Committee would appreciate reportage of minor mishaps, anonymously if preferred, to be included in any association magazine, for the education of other members.

## 1.03 Laws

All members of the UKRA must fly in compliance with the laws and regulations of the CAA, HSE, National and Local Laws, rules, regulations, statutes and ordinances.

Specifically, any member wishing to fly with motors or igniters requiring legal documentation shall ensure that they have such legal documentation, i.e. Explosive Licence, Registered Explosive Store and RCA. If in any doubt the member should obtain the UKRA document "Recommended UKRA Motor List" in order to check the requirements for purchasing / flying motors that the member may use. Your documentation should be carried with you to all launches in the event of inspection by the authorities.

There is a new set of legislation, brought in by the Directorate of Airspace Policy that specifically covers the area of rocketry and rocket flight. The new section that applies to rocketry is currently in draft and is article 76B of the ANO. The other, already existing section that applies to rocketry is Article 55 of the ANO. Both of these articles have been included at the rear of this safety code, in Annex A, for your reference. Please study them carefully as they are law and breaking them will have serious implications, not only for yourself, but for the whole rocketry community.

## 1.04 Certification

Any UKRA member wishing to fly any rocket using greater than G class total impulse whilst still being covered by UKRA insurance will require HPR certification from the UKRA. Certification requires a successful test flight performed before a UKRA certified Safety Officer and may also require the passing of a written multiple choice exam. Three levels of certification are currently issued by the UKRA:

- Level 1 - From H through to I Solid Motors
- Level 2 - From J through to L Solid Motors
- Level 3 - From M through to O Solid Motors

Full details of the certification process may be obtained through the UKRA Information Pack under Section 1 - Certification .

## 1.05 Insurance

UKRA cover / insurance is third party only. Members launch rockets entirely at their own risk, and are not covered for accidents to themselves.

All UKRA insured flights must follow this safety code and must not fall into the experimental flying rules of this code.

## 1.06 Payloads

No UKRA member's rocket will ever carry live animals or any payload that is intended to be flammable, explosive, or harmful.

## 1.07 Disreputable Behaviour

If UKRA members are discovered by the Safety & Technical Committee to be employing particularly dangerous practices that could bring the British rocketry fraternity into disrepute, they will be banned from the UKRA.

Any members found to be engaged in rocketry of a non-peaceful nature at any time, such as the fitting of explosives or incendiaries (except in very small quantities as part of a recovery / stage separation system, or as scientific payload with permission of the Safety & Technical Committee), aiming at targets, carriage of live animal payloads or members who have set out to harm others via rocketry, will face an immediate lifetime ban and may be reported to the authorities.

## Section 2            Equipment

### 2.01 The Rocket

#### (i)            Rocket Components / Materials

All rockets flown under this safety code shall be made of a minimum quantity of materials that possess suitable structural rigidity to withstand the flight stresses expected for a given rocket flight.

The Safety Officer has the right to decide, prior to a flight, that a given rocket vehicle is constructed in such a way that it is unlikely to withstand the stresses of flight and therefore prohibit the flight from taking place. In addition to the right to cancel any flight, the Safety Officer has the right to decide that a rocket is unflightworthy for the proposed power. This may be due to the rocket requiring additional structural reinforcement or the utilisation of a less powerful motor. It could also be due to the rocket being of too heavyweight a construction to be flown safely.

The Safety Officer also has the right to decide that the rocket is constructed in such a way that it must be classed as Experimental, see section below.

#### (ii)            Stability

Proper design procedures and tests must be taken to ensure the rocket's stability during the flight until recovery devices are enabled. For passive aerodynamically stabilised rockets (fixed fins) the Range Safety Officer must be satisfied of the stability of the rocket.

The minimum static stability margin is between 1 calibre stable (the CP should be behind the CG by 1 body diameter). Flyers should be aware of overly stable rockets weather cocking and that the relationship between the CP and the CG changes during motor burn.

#### (iii)            Structural Safety

The Range Safety Officer must be satisfied that the rocket is flight worthy and sufficiently robust to survive launch, aerodynamic, and recovery system loads. Particular attention must be paid to recovery attachment.

#### (iv)            Recovery Devices

All rockets must use a recovery system that will return it safely to the ground so it may be flown again. Rockets will use flame-resistant recovery wadding if wadding is required by the design of the rocket.

#### (v)            Electronic Devices

Where a rocket uses any electronic equipment, the utmost care must be taken when assembling, installing and testing. You should read the manufacturers instructions carefully and completely taking note of any specific points to be aware of and understand the devices limitations. The RSO is entitled to question you about the operation of your electronic devices.

(vi) Multi-Stage Rockets

For multiple stage rockets, each phase of the flight must be stable (e.g. for a 2 stage rocket, the 2 stages together must be stable as must the final stage on its own). The Range Safety Officer must be satisfied of the stability of all phases of the rocket

(vii) Lift Generating Rockets / Boost Gliders

Winged rockets, boost gliders and rockets generating net lift are known to have especially unpredictable trajectories and extra care must be taken when flying such devices. It is recommended that when calculating the launch site dimensions for such a flight, the flyer use the next larger motor on the launch site calculation table for the determination of the required launch site dimensions.

(viii) Active Stabilisation

Any rocket employing active stabilisation will be treated as experimental and will operate under the rules for Experimental Flights detailed below.

(ix) Water Recovery Devices

Any floatation devices used on the Rocket must be jettisoned / rendered inactive so that the rocket sinks four hours after splash down if not successfully recovered (or within one hour if the rocket is in danger of drifting into major shipping lanes).

## 2.02 Motors

Only the use of commercially made, UKRA recommended rocket motors is permitted. The motor must only be used in the manner recommended by the manufacturer. It is not permissible to alter the rocket motor, its parts or its ingredients in any way. The only exception to this is that it is permissible to change the volume of the ejection charge where the ejection charge is not an integral part of the motor.

Any flight that utilises a non-recommended or modified motor will be treated as an Experimental Flight and will operate under the rules for experimental flights detailed below.

If in any doubt the member should obtain the UKRA document "Recommended UKRA Motor List" to check that a motor is UKRA recommended and in order to check the requirements for purchasing / flying motors that the member may use.

(i) Solid Motors

Recommended solid motors may be used according to the certification levels listed below:

- All Motors up to G class Total Impulse- No certification required
- From H through to I Total Impulse - Level 1 certificate required
- From J through to L Total Impulse - Level 2 certificate required
- From M through to O Total Impulse - Level 3 certificate required



The exception to this rule is during certification test flights when the person flying the rocket must be closely supervised by a UKRA member certified to at least the same level, to the full satisfaction of the Safety Officer.

Full details of the certification process may be obtained through the UKRA Information Pack under Section 1 - Certification.

(ii) Hybrid Motors

To fly hybrids, the following criteria must be met :-

1. The flyer must have passed the examination part of the standard level II certification process.
2. The flyer may only fly hybrids of the equivalent power to his current certification level. (For example - To fly an "H" powered hybrid, the flyer must be UKRA level I certified and have passed the written part of the level II certification. If the flyer then wanted to fly a "J" powered hybrid, they would have to have passed both the written part and flight test of the level II certification.)
3. The flyer, may, at the discretion of the RSO / Certifying Officer, use a hybrid to complete certification flight tests.

Full details of the certification process may be obtained through the UKRA Information Pack under Section 1 - Certification .

The hybrid must also conform to the following specifications :-

- i) All hybrid motors must have the ability to fill and dump remotely from the safe distance specified. This distance shall not, under any circumstances, be less than 100ft or 30m for both the operator, RSO and spectators. For hybrid motors of "I" and greater power, the established UKRA safe distances chart should be used in respect of anyone other than the operator and RSO. It is permissible for the operator and RSO to remain at the 100ft or 33m distance when the safe distances chart specifies otherwise.
- ii) All hybrid motors used at UKRA events must be commercially available units and should only be assembled and flown in accordance with the manufacturers instructions. It is not permissible to alter the rocket motor, its parts or its constituents in any way.

(iii) Liquid Motors

All Liquid propellant flights will be treated as Experimental Flights and will operate under the rules for Experimental Flights detailed below.

### 2.03 Igniters

The Safety Officer must be satisfied with the igniter system that is connected to the rocket motor. Any igniter should ignite the rocket within three seconds of the power being applied to the igniter.

Continuity tests on any ignition system should not be carried out whilst the igniter is fitted in the motor, unless the continuity test is an integral part of a count down sequence.

Rockets should not be left for long periods with the igniter in place. Igniter leads should be connected / twisted together until the igniter is ready to be connected to the launch control system to prevent the risk of premature ignition from stray RF.

(i) Hybrid ignition systems

Hybrid starting systems may not have igniters in the conventional sense. In these circumstances the Safety Officers must be satisfied that both they and the operator understand the ignition system and that it operates safely.

2.04 Weight & Power

Any rocket must not have a mass greater than the manufacturer's recommended maximum lift-off mass for the motors used if a single motor is used. An alternative way of ensuring this for commercial kit rocket kits is to only use motors recommended by the manufacturer of the rocket kit.

For all rocket flights, the average thrust of the motor(s) being used must be at least three times the weight of the vehicle at lift off. Lower thrust/weight ratios will be classed as experimental, see Experimental Flight section below.

2.05 Launch Controller

An electrical ignition system must be used which allows for remote operation of the igniter firing. The device should be operated from at least the minimum Safe Distance as determined by the total impulse of the Rocket Motor(s) according to the Safe Distance Table given below.

The launch controller must include a safety key to immobilise the system when removed. This key should only be in place at the time of the launch and is to be removed immediately after an ignition attempt, especially in the event of a misfire. The safety key must not be capable of being removed leaving the controller in a live firing mode.

The firing circuit must only be live for a brief period sufficient to fire the igniter and must then return to an open circuit. Where a firing button is used, it must return to the off position when released.

2.06 Launch Pad

All rocket launches will take place from a rigid Launcher / Launch Tower / Launch Pad that provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path. This Launch Pad must be sufficiently rigid such that the top of the Launch Pad will not sway / deflect noticeably in the strongest launchable winds. The launcher must incorporate a blast-deflector to prevent damage to the ground.

To prevent accidental eye injury, the Launch Pad should be placed so the end of the rod is above eye level or the end of the rod should be capped when approaching it. Always cap or disassemble the Launch Rod when not in use and never store the Launch Rod in an upright position

## Section 3            The Launch Site

### 3.01 Launch Sites

Launch sites should be a suitable open area for launching and recovering rockets. It must conform to the minimum dimensions laid out in the Launch Site Dimensions table.

UKRA holds a list of recommended launch sites. Clubs and individuals are strongly recommended to register their launch sites with UKRA, who can provide advice regarding the suitability of the site and maximum size motors which can be safely flown.

**Any UKRA member wishing to fly from a UKRA recommended site should first liaise with the club / individual responsible for the site and should also insure that they have the land owners permission.**

UKRA Recommended Launch Sites must be on open, private ground and permission from the owner of the land must be obtained for access and for every launch. The site must be at least 5km from any active commercial airport.

No launch site may be used in an area where distress flares may be used by the public, such as near large lakes or mountains. Although such sites may be used if the local rescue groups / authorities, such as mountain-rescue, are given notice of the pending launch(es) and have acknowledged such notification.

The area around the location of any Launch Pad(s) at the site must be cleared of brown grass, dry weeds or other easy-to-burn materials to a radius of ten feet.

### 3.02 Safety Officer

A Range Safety Officer must be appointed for each launch session. This person must be a UKRA certified Range Safety Officer if acting as Safety Officer during any launch of above G class Total Impulse. The Safety Officer is not permitted to fly (or have a rocket belonging to them flown) during a period of duty

The Safety Officer should remember that he / she is in overall charge and is accountable for ensuring the safety of every launch. The Safety Officer has authority over and above all other persons present at the Launch Site and has the power to delay or cancel any launch until satisfied that it can proceed safely. Should other UKRA members feel that the launch would be hazardous, they should voice their concerns to the Safety Officer or persuade the owners of the rocket to cancel the launch.

### 3.03 Personnel

Only UKRA members may approach nearer the rocket than the minimum Safe Distance during or after an igniter is being / has been installed into the Rocket Motor(s). Members may only approach nearer than the Safe Distance with the approval of the Safety Officer. Only the minimum number of members necessary to do the required task should approach.

The minimum Safe Distance is determined by the total impulse of the Rocket Motor(s) according to the Safe Distance Table given below.

#### (i) Spectators

All spectators / onlookers / press at a UKRA launch must be kept at least the minimum Safe Distance away from the launch area as determined by the total impulse of the Rocket Motor(s) according to the Safe Distance Table given below.

All spectators / onlookers / press at the launch site must be warned not to recover any stage of the rocket as there may be live rocket motors and /or recovery devices onboard due to misfiring.

(ii) Minders

Any persons at the launch site who cannot watch the rocket, e.g. due to their monitoring of equipment must be protected either by a physical safety barrier or by persons beside them who can watch the rocket and issue a warning or take protective action.

(iii) Visual Rule

All persons at the launch site are to be made aware that for their own safety they must keep their eyes on the rocket from at least two seconds before launch until either the rocket lands or until visual contact is lost.

When visual contact is lost observations must be carried out until such a point as the rocket is deemed lost or until the rocket is sighted again.

(iv) Disabled Spectators

Special care must be taken to ensure that any disabled spectators are catered for, particularly minders must be provided for disabled persons to ensure that they are aware of pending rocket launches and have the best chance to avoid any incoming Rockets / debris.

### 3.04 Documentation

If any flights are taking place that use greater than G class Total Impulse, copies of the following should be available, preferably together in a folder, for inspection by the Police and other authorities that may arrive at the site unexpectedly:

- Ordnance survey maps of the launch site and downrange area
- Aviation charts of the area
- Insurance documentation
- The Safety Officer's UKRA Safety Officer Identity Card
- This UKRA Safety Code
- Documentation for motor class, ie. Explosives Cert, RCA and Registered Store Cert.

### 3.05 First Aid / Fire Prevention

A First Aid kit must be made available during every launch for minor injuries and burns, preferably with a qualified first-aid person on hand to assist.

During periods of drought or particularly dry weather, buckets of water, or preferably fire extinguishers must be available in case the ground catches fire. Pre-soaking the ground around the launcher should prevent this.

### 3.06 The Down Range Area

The Range Safety Officer must be supplied with Ordnance Survey and Aviation Charts of the downrange area including the expected recovery area if these fall outside the official Launch Site area and he / she must be satisfied that these areas are safe.

Consideration must be given to where all stages of a multistage rocket may land. The worst case scenarios of a stage misfire or recovery device failure must be considered.

Written permission must be obtained from the owners of the land on this downrange area for access and flying of any rockets.

### 3.07 Dimension Tables

#### (i) Safe Distance Table

All persons, except those required for the launch of a rocket must be kept at least the given minimum distance from the Rocket Motor during / after ingiter installation. The Launch Controller should also be operated from at least this minimum distance.

The RSO has the power to allow a flight of greater power than that which would be allowed by the minimum site dimensions table if he / she is happy that the proposed flight will reach an altitude equal to or less than the actual minimum site dimension of the site from which the flight is to be made. Any RSO in doubt of whether a flight can be safely made should refuse to allow the flight.

Total Impulse of all Motors (Newton-Seconds)	Equivalent Motor Type	Minimum Distance From Rocket with Single Motor in Meters (ft)	Minimum Distance From Rocket with Multiple Motors in Meters (ft)
0.00 -- 1.25	_A_A	2 (7)	3 (10)
1.26 -- 2.50	A	2 (7)	3 (10)
2.51 -- 5.00	B	3 (10)	6 (20)
5.01 -- 10.00	C	3 (10)	6 (20)
10.01 -- 20.00	D	5 (16)	10 (33)
20.01 -- 40.00	E	7 (23)	15 (50)
40.01 -- 80.00	F	10 (33)	20 (66)
80.01 -- 160.00	G	10 (33)	20 (66)
160.01 -- 320.00	H	15 (49)	30 (98)
320.01 -- 640.00	I	45 (148)	60 (197)
640.01 -- 1,280.00	J	45 (148)	60 (197)
1,280.01 -- 2,560.00	K	60 (197)	90 (295)
2,560.01 -- 5,120.00	L	90 (295)	150 (492)
5,120.01 -- 10,240.00	M	90 (295)	150 (492)
10,240.01 -- 20,480.00	N	150 (492)	300 (984)
20,480.01 -- 40,960.00	O	150 (492)	300 (984)

#### (ii) Launch Site Dimension Table

The Launch site should have the following minimum dimension (i.e. The launch position must be at least half the given distance from the edge of the launch site). Additionally the minimum site dimension should be equal to or greater than the predicted maximum altitude of the highest flight being made. The largest of these two dimensions should be used.

Total Impulse of all Motors (Newton-seconds)	Equivalent Motor Type	Minimum Site Dimensions in Meters (ft)	Equivalent Dimensions in km (miles/yards)
0.00 -- 1.25	_A_A	15 (49)	0.015 km (16 yards)
1.26 -- 2.50	A	30 (98)	0.03 km (33 yards)
2.51 -- 5.00	B	60 (197)	0.06 km (66 yards)
5.01 -- 10.00	C	120 (394)	0.15 km (130 yards)
10.01 -- 20.00	D	150 (492)	0.15 km (164 yards)
20.01 -- 40.00	E	300 (984)	0.3 km (328 yards)

40.01 -- 80.00	F	300 (984)	0.3 km (328 yards)
80.01 -- 160.00	G	300 (984)	0.3 km (328 yards)
160.01 -- 320.00	H	450 (1476)	0.5 km (492 yards)
320.01 -- 640.00	I	760 (2493)	0.8 km ( _ Mile)
640.01 -- 1,280.00	J	1600 (5,249)	1.6 km (1 Mile)
1,280.01 -- 2,560.00	K	1600 (5,249)	1.6 km (1 Miles)
2,560.01 -- 5,120.00	L	3200 (10,498)	3.2 km (2 Miles)
5,120.01 -- 10,240.00	M	4700 (15,420)	4.7 km (3 Miles)
10,240.01 -- 20,480.00	N	6445 (21,145)	6.5 km (4 Miles)
20,480.01 -- 40,960.00	O	8045 (26,394)	8.0 km (5 Miles)

### 3.08 Coastal Launch Sites

For launching out to sea, care must be taken to protect any shipping in the area and for any launchings near coast, the coast guard must be warned prior to launch in case the rocket vehicle is mistaken for a maritime distress flare. For this reason night-time coastal launches have to be banned unless it is November the fifth.

## Section 4 Flying

### 4.01 Launch Permission

Before launching, a UKRA member must obtain the permission to launch from the Range Safety Officer.

The Safety Officer must check the rocket until he / she is satisfied that the rocket is safe and flightworthy before giving permission to launch.

The Safety Officer must also satisfy themselves that the person in control of the rocket is competent to do so, e.g. not under the influence of any intoxicating substance.

If UKRA members without the Safety Officer's permission deliberately launch a rocket, the members in question will face a ban from membership of the UKRA.

### 4.02 Launching

Before flying a Rocket or commencing a launch countdown, all people in the launch area must be made aware of the impending rocket launch and must be able to see the rocket on it's Launch Pad.

All spectators should be at least the minimum safe distance from the rocket launch.

An electrical ignition system must be used which allows for remote operation of the igniter firing. The device should be operated from at least the minimum Safe Distance as determined by the total impulse of the Rocket Motor(s) according to the Safe Distance Table given above. Any ingiter should ignite the rocket within three seconds of the power being applied to the igniter.

One person must initiate the actual launch only.

The launch person must give the Safety Officer a clearly audible countdown of at least five seconds, alternatively the Safety Officer or any person recognised by all present as responsible for the countdown and authorised by the Safety Officer may announce the countdown.

#### 4.03 Misfires

If a Rocket suffers a misfire, no one must be allowed to approach it or the Launch Pad until it is certain that the Safety Key has been removed and / or that the battery has been disconnected from the ignition system.

No one may approach the Launch Pad until a fixed time has elapsed. This time being, one minute for motors of G or less, or five minutes for motors above G, after the misfire. After this time the Safety Officer should give permission for one person to approach the Rocket.

Special care must be taken if the rocket employs any active electronics devices such as timers, altimeters, etc. In such cases only someone with detailed knowledge of the rockets design may approach the rocket.

#### 4.04 Launch Angle

A rocket must never be launched so that its flight path will carry it against a target. Any Launch Pad must be pointed within 20 degrees of vertical, unless the rocket is a boost glider design.

#### 4.05 NOTAM's

Where the rocket may encroach on controlled or busy airspace the relevant air traffic control centre should be notified. It is also preferable that a NOTAM be issued for the day of the launch.

#### 4.06 Air Traffic

All launchings must be carried out in conditions of good visibility and clear airspace unless suitable radar equipment is available. A visual scan of the sky must be made continuously, preferable by several persons, for at least one minute before launch and the countdown aborted if air traffic is spotted or heard.

It is the member's responsibility to obtain aviation charts of the airspace above any proposed Launch Site.

#### 4.07 Flying Conditions

Rockets may be launched only in light winds of less than 20mph. Also a rocket may not be launched under conditions where the rocket will fly into clouds. Rockets may not be flown when the flight might be hazardous to people, property or flying aircraft.

#### 4.08 Recovery

If a rocket becomes entangled in a power line or any other dangerous place, no attempt should be made to retrieve it. The appropriate authority must then be informed, as soon as is reasonably practical, in order to effect a safe recovery. No attempt shall be made to catch any rocket as it approaches the ground.

Care should be taken to minimise crop damage, ground erosion and worrying livestock by members of the recovery team and their vehicles.

Only UKRA members familiar with the rocket's design should recover any stages of a rocket. You should be aware that unfamiliar rockets may contain live motors, igniters and ejection charges which may have unpredictable results if handled.

#### 4.09 Night Time Flying

Launching after dark is more hazardous than launching in daylight for obvious reasons. Therefore, all night-launched vehicles must be illuminated. Where lights / flares would interfere with a scientific payload, for example on an astronomical mission, prior permission must be obtained from the Safety & Technical Committee for launching without lights.

The above night time rules can be waived on November the fifth.

## **Section 5            Experimental Flying**

Any rocket that has been classed as Experimental (by a Safety Officer, the Safety & Technical Committee or it falls into a class listed below) may be allowed to fly under UKRA insurance. To qualify for such insurance this Safety Code has to be adhered to in full. The flight has also to be fully documented to the Safety & Technical Committee for their review at least thirty days before the flight and approval granted.

Any flight involving any of the following will automatically be classified as experimental:

- Powered by a Liquid propellant engine
- Powered by any motor(s) above O Class Total Impulse
- Power by any motor that is not UKRA recommended
- Employing active stabilisation techniques
- Any home designed / built rocket of non-proven design specified as experimental by the Safety Committee or the Range Safety Officer.

The UKRA Safety & Technical Committee / Safety Officers have no obligation to give a member prior notice that a flight being undertaken by a member may be classified as an Experimental flight. It is the obligation of a member to check their proposed flight with the Safety & Technical Committee (giving at least thirty days notice). The decision of the Safety & Technical Committee must be considered as final in this matter.

As the guidelines above cover such diverse and potentially complex vehicles and techniques no specific safety or technical rules can be made. It is the responsibility of the member to provide the Safety & Technical Committee with sufficient documentation and relevant research material to enable the committee to decide on the safety of the proposed flight. The Safety & Technical Committee may allow the flight to go ahead, may insist on changes before allowing the flight or may prevent the flight from taking place. ). The decision of the Safety & Technical Committee must be considered as final in this matter.

## **Section 6            Flying Without a Safety Officer**



This set of instructions should be viewed as **recommendations only** and every attempt should be made to adhere to the UKRA Safety Code in full.

Where this is not possible, the member should be thoroughly familiar with the duties and responsibilities of a Safety Officer and should seek, as far as is reasonably practicable, to integrate the roles of flyer and Safety Officer.

It is recommended that no -one should launch a High Power Rocket whilst unaccompanied.

In practice this means the following :

#### In Advance of the Flight

1. Ensure correct launch site dimensions. (See UKRA Safety Code)
2. Ensure the launch site is preferably not in controlled air space and where it is, the predicted height will not impinge upon the air traffic routes. If you think it will, then permission must be gained from the appropriate ATC.
3. UKRA can help members with assessing the suitability of flying sites.
4. Inspect the rocket, taking into consideration motor power, weight, stability and structural integrity. If at all possible show the rocket to another rocketeer, prior to the launch date, with a view to receiving suggestions and comments on features of the rocket you may have overlooked.
5. Ensure the correct functioning of all equipment especially the launch controller.
6. Ensure you have the permission of the landowner for launching and recovery.
7. Ensure the rockets total impulse is within the parameters of your current certification level.
8. Appropriate fire fighting equipment and first aid, should be on hand in the case of an emergency.
9. Ensure that there are sufficient numbers of people to keep track of all the stages of a complex vehicle. In the interests of safety, it is highly recommended that complex vehicles be launched at a UKRA event with a Safety Officer.
10. Ensure that your location and estimated timeframe are known to others.
11. Wherever possible take some form of mobile communication with you. (ie a mobile phone)

#### Immediately Prior to, and During the Flight.

12. Make a visual check of the skies, for any aircraft.
13. Ensure that the area directly around the launch site is clear of people or animals to the UKRA Safety Distance. (see UKRA Safety Code)
14. Always give a clear audible ten second countdown prior to launching you rocket.

#### After the Flight.

15. When retrieving your rocket please take into account your own personal safety when traversing difficult terrain or climbing trees.
16. Always leave the site free of litter and as you found it.(especially igniter leads !)

This does not make the Flyer a UKRA certified Safety Officer, but merely makes them aware of their duties and responsibilities. It will be deemed that the flyer utilising the above recommendations, is solely responsible for all activities concerning their launch.

## **Annex A            Proposed Changes to ANO**

DRAFT AMENDMENT

13 September 1999

## **Interpretation**

118 (1) 'Rocket' means a device propelled by ejecting expanding gasses generated in its motor from self contained propellant and not dependent on the intake of outside substances. It includes any part of the device which becomes separated during the operation.

'Small rocket' means a rocket of which the total impulse of the motor or combination of motors does not exceed 10,240 Newton-seconds.

'Large rocket' means a rocket of which the total impulse of the motor or combination of motors is more than 10,240 Newton-seconds.

## **REGULATION OF ROCKETS**

### Article 76B : Air Navigation Order

- (1) This article shall not apply to:
  - (a) an activity to which the Outer Space Act 1986 applies; or
  - (b) a small rocket of which the total impulse of the motor or combination of motors does not exceed 160 Newton-seconds.
- (2) The person in charge of a small rocket of which the total impulse of the motor or combination of motors exceeds 160 Newton-seconds shall not launch such a rocket:
  - (a) unless he has reasonably satisfied himself that the flight can be safely made;
  - (b) unless he has reasonably satisfied himself that the airspace within which the flight will take place is and shall throughout the flight remain clear of any obstructions including any aircraft in flight;
  - (c) in controlled airspace unless the permission of the appropriate control unit has been obtained;
  - (d) within an aerodrome traffic zone during the notified hours of watch of the air traffic control unit (if any) unless the permission of any such air traffic control unit has been obtained;
  - (e) for aerial work purposes other than under and in accordance with a permission granted by the Authority.
- (3) A person shall not launch a large rocket other than under and in accordance with a permission granted by the Authority.
- (4) For the purposes of this article a permission shall be in writing and may be granted subject to such conditions as the Authority thinks fit.

### Article 55 : Air Navigation Order

A person shall not recklessly or negligently act in a manner likely to endanger an aircraft, or any person therein.

## **CONDITIONS FOR THE LAUNCH OF A LARGE ROCKET**

A large rocket as defined in the Air Navigation (No2) Order 1995 may only be launched in accordance with the following conditions:

**Condition A.**

Where the anticipated apogee will exceed 66,000 feet above mean sea level (amsl).

Any person who intends to launch a rocket, the apogee of which will, or might, exceed 66,000 feet amsl may only do so under and in accordance with a permission granted by the British National Space Centre.

**Condition B.**

Where the anticipated apogee will not exceed 66,000 feet amsl:

1. A rocket shall not be launched without written permission from The Directorate of Airspace Policy (DAP). The person in charge (sponsor) shall give DAP a minimum of six weeks notice of the proposed launch.
2. The sponsor must submit a safety case to demonstrate that the flight can be safely made. This shall include the following information:
  - a. The total impulse of the rocket motor(s) in Newton-seconds and nature of all propellants.
  - b. Details of the materials used in the construction of the rocket and its motor(s).
  - c. The predicted flight profile including details of allowances for meteorological variations with height.
  - d. The nature and radius of fragmentation in the event of an explosive malfunction of the motor(s).
  - e. Details of the system for destroying the rocket or ensuring a safe recovery in the event of a malfunction.
  - f. The nature of any residual hazard when the flight has terminated.
3. A means of electronic tracking shall be used when it cannot be assured that the rocket will remain within visual range of the point of launch.
4. The activity should be wholly contained within a Military range or training area with Danger Area status. Where this is not possible the person responsible must demonstrate that comparable safeguards will be established.
5. Where a launch takes place from Military or other Government owned land the sponsor must obtain a licence from the appropriate Land Agency and comply with any associated conditions.

**Annex B            Launch Site Guidelines****UKRA Recommended Site Guidelines**

Information Required:

- Full Affiliated Club Name or Host.
- Full contact details for club including Secretary, postal address, telephone number etc.
- Photos of the relevant flying site showing panoramic views from the launch point.
- Grid Reference Number. e.g. OS Grid Ref. Cranwell N5301.80 W00028.90  
Other 9nm NE of Grantham
- State if site is in Controlled/Uncontrolled Airspace. If proposed site is in controlled airspace please state what height restrictions apply. \*
- State if there are any hazardous areas. e.g. Areas of special interest including intense gliding activity, parachuting and typical distance. \*
- State maximum requested class of motor for site certification.
- State the times of year that the site may be used. e.g. All Year round, Spring etc.
- List any facilities on or near the site for members use. e.g. Toilets, telephone, car parking, pubs, shops etc.
- Full contact details for Landowners and/or Tenants if applicable.
- Permission from Landowners and/or Tenants to launch/recover rockets from the proposed site including confirmation that the proposed acts will not break local Bye Laws.
- List of local emergency services. e.g. Phone Nos. and addresses of Doctors, Police, Fire Brigade, Local Airports, Electricity, Gas, Water etc.
- Copy of up to date OS Pathfinder (4cm – 1km) maps for proposed site and immediate area highlighting/indicating the following information:
  1. All roads and public Rights of Way.
  2. Proposed launch sites and access points.
  3. Any Site Constraints. e.g. Flat, open, wooded, undulating, hedges, clear ground, arable, grass, shrub etc.
  4. Any Natural Hazards. e.g. Ponds, lakes, rivers, marsh or wet ground, trees and hedges.
  5. Any Man made Hazards. e.g. Overhead lines-size 240V, 33000V, telephone radio masts, towers etc.
- Information on which can be found on Air Navigation Maps.

For your convenience please see the attached form that outlines all the relevant information.

## UKRA Recommended Site Form

Full Club name or host.

\_\_\_\_\_

Full postal address of club secretary.

\_\_\_\_\_

\_\_\_\_\_

Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Grid reference number.

\_\_\_\_\_

**Is the site in controlled airspace? (yes/no)** \_\_\_\_\_

\_\_\_\_\_

If yes, state what height restrictions apply. \_\_\_\_\_

State if there are any hazardous areas.

\_\_\_\_\_

\_\_\_\_\_

What is the Maximum class of motor proposed to be flown from site. \_\_\_\_\_

State the times of year that the site may be used.

\_\_\_\_\_

List any facilities on or near the site that members can use. Where possible please indicate the positions on your site.

\_\_\_\_\_

Full contact details for landowners/tenants if applicable.

\_\_\_\_\_

\_\_\_\_\_

Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

**N.B. Remember to source written permission from landowners/tenants to launch/recover rockets from the site.**

**List of local emergency services.**

Doctor

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Police

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Fire brigade

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Local airports

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Water

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Electricity

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

Gas

\_\_\_\_\_  
Postcode \_\_\_\_\_ Telephone Number \_\_\_\_\_

**If you would like UKRA to assist with this process please attach relevant photographs and a copy of a map (4cm – 1km or larger scale) showing proposed site and the immediate area highlighting/indicating all roads, public rights of way, proposed launch sites and access points. Any site constraints or natural / man made hazards should also be highlighted.**