CONTENTS

INTRODUCTION

This manual is intended as an introductory guide for new or aspiring jump pilots and as a reference guide for existing jump pilots. It does not set out to teach basic piloting skills. There is assumption that anyone wishing to become a jump pilot will already know how to fly an aeroplane and perform the basic tasks, both in the air and on the ground, which reflect good airmanship. The main purpose of the manual is to outline the practical and legal requirements and responsibilities which are attached to this particular piloting task and to provide a framework for reference. Whereas it will be an authoritative source of information as far as BPA regulations are concerned, it cannot supplant other statutory instruments with regard to general law.

If, therefore, any material contained within this manual appears to contradict requirements which are contained within the Air Navigation Order or any other statutory document and also the BPA Operations Manual, then such documents must be considered as taking precedence over the information contained in this manual.

This manual also only relates to the operation of parachute aircraft in Britain or in overseas locations that come under British regulation. It must be recognised that procedures and regulations in other countries will vary. At the time of writing this situation also prevails with regard to European countries. Although the process of European regulatory harmonisation is well underway, it has not yet encompassed all aspects of parachute flying.

It must also be recognised that as a generalised manual it cannot purport to provide information that is always applicable to every aircraft type or situation. It may well be that pilots encounter operational circumstances or requirements which are not covered by this manual

1. THE REGULATION OF SPORT PARACHUTING

1.1. Sport parachuting (or skydiving as it is now commonly known as) is regulated in the UK by the Civil Aviation Authority (CAA). The CAA has delegated much of its regulatory functions to the BPA under the terms of a Schedule of Approval. This means that the BPA, in effect, regulates sport parachuting within the UK but does so under a system which is audited by the CAA to ensure that the regulatory functions are correctly carried out.

1.2. The Air Navigation Order (ANO) places a statutory duty on the CAA to regulate parachuting. The general parachuting regulatory requirements of the CAA are outlined in CAP 660 (Parachuting). This document requires that all sport parachuting activity is carried out in accordance with an approved Operations Manual. The BPA Operations Manual (BPAOM) is currently the only approved manual in use for UK sport parachuting and is therefore the primary document which mandates how parachuting operations are to be conducted in the UK. The BPAOM is, therefore, essential as a working reference document and all jump pilots should be familiar with it generally and have specific knowledge of the flying section (section 9). It is attached as Appendix A to this manual.

1.3. There are currently around 22 parachute Clubs that operate within the BPA. There are none operating independently in the UK. The BPAOM requires that each Club produces its own local Standard Operating Procedures (SOPs) which are intended to detail any additional safety procedures which local conditions may necessitate.

1.4. Parachute dropping may only take place under the terms of a valid CAA parachuting permission which is issued individually to each parachute Club or display team.

1.5. At the time of writing, the CAA is in the process of handing over many of its regulatory functions to the European Aviation Safety Agency (EASA). At the moment UK sport parachuting continues to come within the national governance of the CAA but this is a situation that could change as EASA progressively gains regulatory control over European aviation.

1.6. It should be stressed that the BPA only regulates sport parachuting and military sport parachuting. Other forms of parachuting, such as operational military parachuting, commercial parachute testing, base jumping, paragliding etc. are all aspects which come under different regulatory regimes.

1.7. Within the BPA regulatory system, issues that relate specifically to pilots and jump flying are generally dealt with by the BPA Pilots' Committee, which is a sub committee of the BPA Safety & Training Committee (STC). The Pilots' Committee meets formally once a year but is also convened when necessary to deal with specific issues as they arise.

1.8. When circumstances require changes to the flying section of the BPAOM, the issues under consideration are usually presented by the Chairman of the Pilots' Committee to the STC, which is responsible for the structure and content of the BPAOM and whose members vote on whether or not to amend or change its content.

1.9. Pilots who have any difficulty or questions relating to regulatory issues would usually be advised, in the first instance, to contact the Chairman of the Pilots' Committee via the BPA Office.

2. BECOMING A JUMP PILOT

2.1. The task

The task of a jump pilot is simple to explain. His job is to fly the aircraft efficiently to a predetermined point over the ground, arriving at a given height and a given speed, in order to permit parachutists to safely exit the aircraft and optimise their chances of flying their parachutes back to a designated parachute landing area. He must then descend the aircraft and land as quickly as is safely possible, giving due regard to efficient engine management. The remainder of this manual is intended to explain the operational structure and procedures involved in achieving this task.

2.2. Qualifications

The qualifications needed to become a jump pilot are laid out in section 9.1.1 of the BPAOM. It will be noted that the minimum starting requirement is a PPL and 100 hours as Pilot in Command (P1). Jump flying is actually classified as Aerial Work and as such would normally require a CPL. The terms of the CAA Permission, issued annually to BPA Clubs, permits the work to be carried out by an appropriately qualified PPL provided he is not working for hire or reward and providing he has qualified as a BPA Approved Pilot (AP).

It should be noted that the PPL minimum requirement assumes a JAR PPL. Other nationality PPLs may not necessarily be recognised as equivalent and the privileges which are attached to these licences in the UK will need to be ascertained with the CAA prior to any involvement with parachute flying. The licensing requirements are also different where foreign registered aircraft are concerned (see section 3.3).

2.3. **Getting started**

In order to gain BPA AP status any aspiring pilot will need to approach an approved BPA Club, as the qualifying process can only be undertaken under the auspices of such an organisation. The addresses and contact details of these can be obtained from the BPA website (www.bpa.org.uk). Some Clubs may be prepared to train and qualify an applicant (in exchange for money) without necessarily providing a position at the end. Others may be in need of a pilot and may be prepared to train a pilot for free or on a conditional fee arrangement

2.4. **Motives**

There are several motives for wishing to become a jump pilot. Not least (and quite acceptably) is the need to build up hours in order to enhance a newly acquired CPL. Another is simply the need for a PPL holder to take his flying another step forward and engage in what is essentially a focussed job as opposed to aimless wandering in the sky.

Whatever the motive it should be understood that jump flying is a skill that has to be learned and maintained. Many pilots are surprised, when they start, at the workload that can be involved in the job and often report that there is more to it than meets the eye. For these reasons it is a job which requires commitment and one which cannot be approached half heartedly. It needs constant practice to become good and remain proficient.

Many pilots have approached parachute centres on the basis that they might be able to 'help out' now and then and have been surprised to have their offer rejected. The fact is that most parachute Clubs need pilots who can commit to regular flying because most will not want the trouble of training someone who then remains rusty at the job and never quite gets on top of it

3. THE AIRCRAFT

3.1. **Types**

Many types of aircraft are suitable for parachuting. Some have been designed from the outset to encompass this role. Others have been modified in order to encompass it. The defining criterion is whether the aircraft flight manual approves the role and gives appropriate operational guidance. If an aircraft flight manual, or a flight manual supplement (FMS), does not specifically approve the aircraft for parachuting then such approval must be obtained and incorporated into an appropriate FMS before the aircraft may be used for parachute dropping.

The approval procedure used to be handled by the CAA but has been transferred to the European Aviation Safety Agency (EASA). At the moment the procedure is complicated, costly and not easily progressed.

3.2. **Aircraft documentation**

The documentation required for parachuting aircraft is the same as for any other British registered aircraft, with the additional specific requirement for a FMS to cover parachuting operations if the normal flight manual does not already do so. Foreign registered aircraft also have additional documentary requirements (see 3.3 below).

The BPA Aircraft Document Checklist (form 246) is attached as Appendix B. This also lists the additional documents that need to be in place prior to any parachute operation. Some of these are dealt with as separate items in this manual. It is necessary to be aware, however, that when you board a parachute aircraft as its commander you must have on board the following documentation.

a) **Aircraft Flight Manual**
b) **Aeronautical Chart**
c) **Aircraft Checklist / MEL (if applicable)**
d) **Weight & Centre of Gravity Schedule .**
e) **Technical Log / Flight Log (including fuel uplift and quantity records)**

3.3. **Foreign registered aircraft**

Aircraft registered in foreign countries may be used for parachute operations in the UK provided that the operator of each particular aircraft has a Department for Transport (DfT) permit to operate it for this purpose. In order for a pilot to fly a foreign registered aircraft he must be approved to drop parachutists under the pilot licensing requirements of the state in which the aircraft is registered and it must also be operated for parachuting in accordance with the requirements of the country of registration.

The DfT permit may also impose additional requirements to the state of registration as may the BPAOM in terms of parachuting procedures. As a general guide, where there is a difference between the requirements of the DfT the CAA or the BPA and the country of registration it must be assumed that the more stringent rules will apply.

3.4. **Additional equipment and modifications**

Most parachuting aircraft will require some additional equipment or modification in order to be able to fulfil the parachute role. The types of equipment and modification will vary from aircraft to aircraft but the following list is a sample of what is likely to be encountered.

a) In-flight doors.
b) Door edge spoilers
c) Flap switch depressor plates
d) Static line strong points
e) Static line stowage bags
f) Floater steps and rails
g) Wheel steps
h) Floor panels
i) Jumper restraints
j) Jump exit lights

Some of this equipment will be optional and some will be mandatory. If the flight manual requires any additional equipment for the aircraft to be used for parachuting then this must be regarded as mandatory.

The BPAOM also requires some additional equipment to be carried whenever an aircraft is engaged on parachuting operations (see section 3.14).

3.5. **Preparation of aircraft for parachuting**

The necessary procedures involved in preparing an aircraft for the parachuting role will depend, obviously, on the type of aircraft but also the club at which it is operated. Some larger parachute centres will have their aircraft kept in permanent readiness for parachuting but others will be in a situation where they lease or hire different aircraft and will need to go through frequent sometimes complex procedures. The following are aspects which will routinely need to be attended to, but the list is not necessarily exhaustive.

3.6. **Door removal**

Most parachuting aircraft will require a cabin door to be removed in order to provide a means for the parachutists to exit the aircraft. This may sound obvious, but many aircraft, with the exception of tailgate varieties, do not have doors that are designed to be opened in flight. They either have to be removed or have doors specifically modified. The BN2 Islander has a sliding door manufactured for this purpose and the Cessna 180/182/185 varieties can have an upward opening door modification which does permit use in flight. For many aircraft, however, an appropriate door has to be removed and the flight conducted without it.

It is important to realise that door removal can only be undertaken if it is specifically approved in the flight manual. Some aircraft doors are actually designed to contribute to the structural integrity of the fuselage and their removal would be dangerous. On some aircraft door removal is prohibited because it would permit a build up of carbon monoxide in the cabin from engine exhaust fumes.

It is also common for flight manuals to specify airspeed limitations for door off operations which are often substantially lower the maximum normally permitted with the door on.

3.7. **In-flight doors**

Some aircraft will have a secondary in-flight door which is designed to replace the original door when the aircraft is used for parachuting. These are often specifically designed by manufacturers for parachuting purposes. Commonly these will take the form of metal roller shutters which can be lowered from inside the aircraft over the door opening. Sometimes they are made of fabric or clear plastic composites or a combination of these. Other types take the form of single piece ‘door plugs’. These are doors designed to plug the door aperture from the inside and sometimes rely on the differential between internal and external air pressure to keep them in place. These doors require careful handling. They are removed on the jump run and usually stowed securely in the cabin by the jumpmaster or other parachutists. It is obviously important that they do not fall out of the aircraft.

3.8. **Seat / seat belt removal**

It is quite common for all or some of the passenger seats and seat belts in jump aircraft to be removed prior to parachuting use. Seat belts are usually either attached to the seats themselves or to the cabin floor. When removing seat belts from a cabin floor attention must be paid to the remaining floor fittings which may need to be covered in order to protect them from snagging on parachutists’ equipment.

3.9. **Restraints**

In smaller aircraft it is common for parachutists to be unrestrained because the presence of belts/restraints on the floor would be hazardous to parachutists when exiting the aircraft because of their potential to snag parachute equipment or cause hang ups.

In larger aircraft, or where the Flight Manual requires it, it is common for alternative (usually single point) restraints to be provided where seats have been removed. These are usually attached prior to take off and disconnected prior to jumping. It would normally be the responsibility of the jumpmaster to ensure that restraints were utilised correctly, but ultimately it would be the responsibility of the pilot to be satisfied that there were an adequate number of restraints for the parachutists on board.

Where parachutists are utilising aircraft seating it would be usual for them to use whatever restraint belts came with the seats.

3.10. **Aircraft controls**

In some circumstances it may be necessary to remove the co-pilot's control column or wheel from an aircraft in order to facilitate parachuting operations. Such a circumstance would only prevail where the Flight Manual or other formal modification approval permitted it. In any event such work would have to be carried out by a licensed aircraft engineer and should not be attempted by an unqualified person.

3.11. **Floor coverings**

Some aircraft will have floor coverings to be installed after the removal of seats. This will be for various reasons; either to protect floor fittings or level out uneven floor configurations, or simply to provide more comfort for parachutists who will be seated on the floor. Floor coverings will generally be of wood, carpet or dense foam material or a combination of these. A recommendation by the BPA has suggested that energy attenuating foam is the most suitable material for floor covering in circumstances where floor covering is desirable and permissible. The recommendation was made as a result of research that indicated that such foam would provide superior vertical impact protection for cabin occupants as opposed to the more commonly encountered materials.

3.12. **Static Line strong point**

If an aircraft is to be used for static line parachuting (see section 13.2 for detailed information) it will need to be equipped with an approved static line strong point. This is the means whereby static line operated parachutes are attached to the aircraft so that their deployment is initiated immediately the parachutists exit the aircraft.

A strong point will normally be a webbing strop with metal D rings or hooks attached which will fix to seat belt or other suitable anchorage points in the cabin, or will be a steel cable incorporated into the cabin floor, roof or wall. It must be stressed that strong points for this purpose must be approved by the manufacturers or other formal aviation agency.

3.13. **Steps and rails**

Some aircraft will incorporate external grab rails and steps which are designed to enable jumpers to climb outside the aircraft prior to jumping. This enables groups of parachutists to exit closely together rather than in single file. Normally grab rails and steps have to be installed by engineers to approved designs and are not usually quickly or easily detached.

3.14. Ancillary cabin equipment

Parachuting operations require various items of ancillary equipment to be carried in the cabin. Among these are carabiner strops, knives, aerial photographs, stowage bags, stopwatches etc. It would normally be the responsibility of the jumpmaster to ensure that the necessary items were on board, but it as well that the pilot satisfies himself that a knife and carabiner strop are always carried. The need for these items is explained in more detail in section 12.6.

4. PARACHUTE FLIGHT PROCEDURES

4.1. General

The general procedures required for the execution of a flight to drop sport parachutists will be much the same at any BPA Club. Local variations and airspace requirements will always produce additional procedures which will be detailed in local SOPs (such as deconfliction procedures with other local activities like helicopter flying or gliding) but what follows here is an outline of what will generally be expected from a parachute pilot.

4.2. Command of aircraft

Ultimately the pilot is in command of the aircraft and all persons on board. The jumpmaster, however, must be regarded as having a primary role within the command structure, as in some situations he will be in a better position to make judgements with regard to some courses of action which may be necessary. Very often a pilot will wish to consult with the jumpmaster with regard to procedural choices (e.g. whether or not parachutists should jump out in low level emergencies). If, however, at any stage in a flight the pilot believes that safety is being compromised, he must not hesitate to conduct the flight in whatever manner he sees fit to maximise flight safety, even if this means aborting a flight and landing regardless of what other pressures there may be to proceed.

4.3. Pre flight procedures

The procedures outlined here are those that are specific to parachuting. There is an assumption that all the normal requirements necessary to any aircraft flight (weather checks, pre- flight aircraft checks etc.) will have been carried out as a matter of routine.

4.3.1. ATSU notification

Parachute Clubs are required to notify an Air Traffic Service Unit (ATSU) as designated in the UK AIP ENR section 5.5 via telephone at least 20 minutes prior to the commencement of dropping and also to notify when parachute operations have ceased. This is in order that the ATSU can give information on the activity status of a drop zone to the pilots of aircraft who are likely to transit through it.

It is a requirement that BPA Clubs specify in their Standard Operating Procedures (SOPs) the person who is responsible for notifying the designated ATSU. Many Clubs specify that the duty pilot is the person responsible, so this is a task that may well fall to you as an AP. It is usual to record the start and cease times on a BPA standard form (form 193) which is attached as Appendix C to this manual. The form also provides more detailed information on how and why this procedure is to be applied.

4.3.2. Local arrangements

Many Clubs have local arrangements (often contained in letters of agreement) where they have to notify other ATSUs, as well as their formally designated one. Many centres will also require this task to be performed by their duty pilots.

4.3.3. Manifesting

There is a requirement that all parachute flights are correctly manifested prior to take off and that a copy of the manifest remains on the ground. The manifest will record the names of all parachutists on board and will normally record the heights they intend to jump from and the nature of the parachuting exercise they are going to perform. It will also generally indicate the name of the pilot and jumpmaster.

The pilot would not normally draw up the manifest. It is usual, however, though not mandatory, for the pilot to be given a copy of the manifest so that he has a record of the various heights and number of passes that he will be required to make over the drop zone.

4.3.4. Weight & Balance awareness

This subject is dealt with separately in section 5.

4.3.5. Pre flight briefing

The Jumpmaster is required to brief the pilot on all requirements pertinent to any particular flight. The brief would include an indication of the exit point or a request for a wind drift indicator (WDI – see glossary) to be thrown, the number of passes required, the size of the groups and the heights they are to jump from and any other special requirements such as particular run in speeds required or a change of run in direction.

4.4. Take off and climb

4.4.1. **The take off.** The take off and climb will be executed according to operator requirements and within the parameters specified in the Flight Manual. The pilot must also be satisfied that prior to take off the aircraft is loaded correctly and that parachutists are correctly restrained (when required), and that they are wearing head protection as required in the BPAOM. The jumpmaster will normally attend to these matters but it is wise for the pilot to check these items as well, if possible. It is also good practice for the pilot to obtain confirmation from the jumpmaster that the load is ready for take off.

4.4.2. **The climb.** The climb phase of the flight will again be according to the operator's and Flight Manual parameters. During this phase it is not uncommon for parachutists to move around in the cabin and the pilot must expect to make the necessary trim changes that this will entail. There may be directional requirements under local orders which prohibit climbing over certain areas. These will usually be for the purposes of noise abatement or avoidance of controlled airspace. Regardless of local orders it anyway makes good sense for pilots to fly in such a way as to minimise the noise impact on the local population as far as possible.

4.4.3. **Mixture leaning.** Many PPLs may not have been taught the importance of correct mixture leaning during their training. This is primarily because most PPL activity takes place below 5000 feet and many instructors do not believe that leaning is necessary for general flying below this height. As far as parachute flying in piston engined aircraft is concerned, it is very important. This is because parachute aircraft frequently go to heights where poor engine performance and rough running are likely to result if an engine is not leaned. It is also fundamental to the efficiency of a flight that the engined is leaned to ensure maximum power combined with best fuel economy.

Attention to the mixture control will be required throughout the flight. The progressively changing altitude will require a progressively changing mixture. How the leaning is performed will depend upon the aircraft and its instrumentation. An EGT gauge is the best instrument to govern the leaning procedure but a fuel flow gauge can be used to equal effect. The precise methods will depend upon the specific operational procedures for any particular aircraft.

4.5. Calculation of exit and opening point

4.5.1. **Spotting.** When parachutists exit an aircraft they will wish to do so at a point above the ground which gives them the best possibility of landing on their target area. This point will be worked out in advance in order to make allowance for the effect of wind on the parachutists whilst in free fall and under canopy. There are two principal ways of calculating the exit point. The first is done prior to flight by using meteorological information and the second is done during flight by the use of a WDI. The process of working out the exit point and then directing the aircraft towards it is the jumpmaster’s responsibility and is generally referred to as ‘spotting’.

4.5.2. **Pre flight calculation.** The most widely used wind forecast information source is the Met. Office form 214. This is obtainable over the internet and lists the forecast wind speed and direction for various altitudes from 1000 to 24000 feet at various locations in the British Isles. This information is used when calculating the exit point prior to take off.

This calculation is normally the responsibility of the jumpmaster, but pilots may become involved or be consulted with regard to the calculation. It is normally performed mentally by experienced practitioners rather than involving precise mathematical calculations. The calculation will take account of the exit height of the parachutists and the intended opening height of the parachutes. These factors will vary according to the nature of the parachute jumps being performed. The result will be an exit point usually given as a distance and bearing from the target.

4.5.3. **In flight calculation.** This is normally done using a WDI. The pilot will be asked to make a pass over the target area (usually flying into wind) at a given height (normally between 2000’ and 2500’). The jumpmaster may give corrections to the pilot to change the aircraft heading (see 4.6 below) and will normally aim to throw the WDI over the target. Once the WDI has been thrown it will be the pilot’s job to ensure that he flies the aircraft in a pattern that enables the jumpmaster to keep it in sight whilst it descends to the ground. With some aircraft this is quite easy if the pilot and jumpmaster are both able to keep the WDI in sight together. With some aircraft, however, (such as low wing types, or types where the exit door is on the opposite side of the aircraft to the pilot, the job is not quite so easy. The pilot may have to lose sight of the WDI for some of the time in order to ensure that the jumpmaster keeps a view of it from his position at the jump door. The pilot will then have to use his best guess as to where the WDI is as it descends. This aspect of the job will only be learned with practice and experience.

The WDI should descend at the same rate as an average parachute (approx. 1000 feet per minute). The jumpmaster will make a note of where the WDI lands on the ground and then work out the exit point according to the distance and direction that the WDI has moved from the point at which it was thrown.

The use of WDIs is mandatory on parachute displays or on the first flight when static line parachuting is taking place. They do not have to be thrown on subsequent flights unless the wind speed and direction change radically or if parachuting has been stood down for more than 30 minutes

4.5.4. **Throwforward.** Some spotting calculations may take account of throwforward. This is the distance that a parachutist tends to be projected forwards in the direction of flight once he exits. It is a function of the fact that at the point of exit he is still travelling forward at the same speed as the aircraft and will therefore tend to continue on a forward trajectory for a short time after exit. Many parachuting text books (particularly older ones) make a meal of this and provide mathematical formulas for calculating throwforward distance. In fact, such calculations are virtually never used in practical parachuting, but throwforward is a phenomenon which an experienced parachutist will take into account when necessary.

4.6. The run in

Sometimes referred to as the ‘jump run’. This is the phase of a parachute flight immediately prior to actually dropping. It is the point at which the pilot has assumed the required heading towards the exit point and has achieved, or is just about to achieve, the height and airspeed that will be required at exit.

Once established on the run in the pilot will obtain clearance to drop from the drop zone controller (see also section 8.2 Radio Procedures). When the pilot is satisfied that the aircraft will achieve the correct height and speed specified and is otherwise in the correct configuration for the drop, he will communicate the ‘clear drop’ status to the jumpmaster. The means whereby this will be done will vary according to the type of aircraft. In smaller aircraft it may be done by telling the jumpmaster directly.
In larger aircraft it may involve a signalling system using sound or lights. Sometimes in larger aircraft, without signalling systems, such messages are relayed via other jumpers. In these circumstances both pilot and jumpmaster must beware of the pitfalls of Chinese whispers. It is at this stage of the flight that the inflight door, if fitted, will be opened in preparation for the exit.

Once the run in has been commenced the pilot will need to maintain the correct track towards the exit point. This will either be done by reference to radio navigation instruments such as VOR or GPS (see section 11 Use of GPS) or by directions from the jumpmaster. Again these directions are given either verbally or by a system of light signals. The directions will be for heading changes (usually for changes of 5 or 10 degrees left or right, though sometimes more). At this stage these heading changes should be made, as far as possible, using flat turns rather than banking the aircraft. This will involve using crossed controls (i.e. applying the heading change with the rudder pedals and using opposite aileron to prevent the secondary effect roll).

The reason for this is to make the jumpmaster's job a bit easier. He is responsible for ensuring that the aircraft is over the correct exit point. On the run in he has to make assessments of the aircraft's vertical position in order to do this. If the aircraft is banked one way or the other during these heading changes, this vertical assessment is made much more difficult and is less likely to be accurate. The jumpmaster is, of course, in a much better position to make this vertical assessment than the pilot because he has access to an open door and is able to see vertically downwards, which in most aircraft is not possible for the pilot.

The run in is usually made into wind but could be along a line which simply represents the aggregate direction of the wind at differing heights. It does not necessarily have to be into wind and sometimes cross wind or downwind run ins may be ordered by the jumpmaster for various reasons; for instance it may be the only way that he is able to maintain visual contact with the ground.

4.7. **The exit**

It should be stressed at this point that the responsibility for exiting the aircraft at the correct exit point is entirely the jumpmaster's. It is not the pilot's responsibility. The pilot will be expected to set the aircraft up on its predetermined run in and maintain its correct track either visually or by using a GPS or other radio navigation instrument, or by executing heading corrections given by the jumpmaster. He may also be required to indicate the distance to run to the exit point.
The decision about when and where to actually jump rests solely with the jumpmaster. At the point of exit the jumpmaster will indicate to the pilot that he requires a 'cut'. At this point the pilot will reduce engine power to a predetermined level. This is in order to ensure that the propwash and airspeed are minimised (usually to approximately 1.1Vs) which enables the jumpers to exit the aircraft cleanly and with minimum turbulence.
At the same time an increased flap setting may be required. This can be for various reasons depending upon the type of aircraft. It may be in order to assist with flying at a slower airspeed or simply to decrease the possibility of jumpers striking the flap on exit from low wing aircraft (such as the PA32). In some parachuting operations a faster or 'no cut' exit may be requested. This is usually when immediate and quicker parachute deployments are required after exit. This is common in Canopy Formation jumps (see section 13.3).

For many aircraft the exit is a particularly critical point in the flight. The aircraft is generally flying slowly at low power settings. For many aircraft, particularly those with low tail planes, the attitude is critical and nose up / tail low attitudes must be avoided in order to eliminate the possibility of jumpers striking the tail on exit. As jumpers exit the aircraft there is a considerable and rapid change in trim. On some jumps, groups of jumpers will want to climb out of the aircraft and hold on to the outside in order to exit together. This can prolong the exit process whilst they get into position. Initially their bodies will create weight and drag on one side of the aircraft which can initiate a tendency to roll. This will have to be corrected by opposite aileron which puts the aircraft in an out of balance situation and increases the stall speed. Sometimes the nose will have to be gently lowered to increase the airspeed in order to maintain aileron authority. Once a group has left the aircraft another group may then take up similar stations outside, only now there are no jumpers left in the cabin to counterbalance the rearwards leverage they are creating (see also section 5 Weight & Balance).

These circumstances have to be anticipated and managed; often by radical trim adjustments combined with gentle increases in airspeed. The general point to make is that the exit can represent a point of high pilot workload and is a phase of the flight which has a great potential for handling error and the possibility of stalling and or spinning from a poorly handled exit phase.

4.8. **The descent**

4.8.1. **Initial procedures.** Prior to commencing a descent, although it may sound obvious, the pilot must first ascertain that the exit phase has been fully completed. The pilot must be sure that all parachutists have exited correctly. It has been known for pilots to commence descents whilst groups of parachutists are still preparing to launch from the aircraft. This can be dangerous or disconcerting for the parachutists involved who may lose their grips on the aircraft and leave it in an uncontrolled fashion, perhaps with the danger of striking external aircraft surfaces. There may be parachutists still remaining in the aircraft (perhaps a tandem pair whose exit position has been altered). A sudden steep descent could make their exit difficult or dangerous.

Prior to descent it may also be a requirement that a particular ATSU is notified on the radio so that they can anticipate control directions to other aircraft.

4.8.2. **Engine management.** The method of execution of an efficient descent will obviously depend upon the type of aircraft involved and will be carried out within flight manual parameters. Good engine management is particularly important in the case of piston engined aircraft which can be subjected to rapid overcooling in descents. The engine will be hot, having worked the climb at a high power setting. The air temperature at jump altitudes can often be very cold.

These conditions can induce shock cooling if descents are made at high speed and low power settings. This can result in cracked cylinder heads which are costly to replace. It is important that descent procedures are planned to allow for gradual engine cooling and it is wise to have these procedures written down for any particular aircraft and incorporated into check lists.

4.8.3. **Collision hazard awareness.** Having dropped parachutists and commenced (particularly in the case of turbine aircraft) a high speed descent, the most important thing a pilot needs to be aware of outside the aircraft is the location of the parachutists that he has just dropped.

If the pilot is not aware of the movement of parachutists in free fall and under canopy there is a danger that the aircraft could collide with them. Remember that some aircraft can descend faster than a free falling parachutist.

The danger of collision with parachute canopies as an aircraft approaches to land is obvious. This is because in most circumstances the aircraft will be landing at, or very near, the same location as the parachutists. What is not so obvious is the fact that collision dangers can exist throughout a descent. Some parachuting exercises, such as canopy formation (see section 13.3) or wing suit flying (see section 13.4) can mean that a rapidly descending aircraft can encounter parachutists at a fairly high level in areas of the sky where the pilot might not be expecting them. Unexpected high speed encounters are much more dangerous than low speed encounters which are expected and being watched for, such as on the approach to land.

It is important that pilots familiarise themselves with the various scenarios that parachuting operations can present and be aware of what they need to take into account on each flight.

4.8.4. **Automatic activation devices (AADs).** It is important that pilots understand the hazards which are associated with AADs in aircraft descents. An AAD is a device which will activate a parachutist's reserve parachute when it detects a rate of descent which is above a safe preset limit for a particular height. The basic idea is that if a parachutist fails to operate his main or reserve parachute by a certain height then the AAD will do it for him. The parameters which an AAD is calibrated for will differ according to the experience level and task of the parachutist wearing it.

In a variety of circumstances a jumpmaster, a drop zone controller, or the pilot in command, will abort a parachute flight and return to base with some or all of the parachutists still on board. In this event the AADs can still activate if the aircraft descends at a speed above the AAD set limit. The consequences of this are highly inconvenient at best and disastrous at worst. If a reserve parachute were to deploy out of an aircraft door the result can be fatal.
Some AADs can easily be switched off in the aircraft but others cannot. Activation heights and speeds vary but are unlikely to be higher than 3500 feet or less than a descent rate of 1500 feet/minute. In the event that a lift is aborted, the simplest and safest procedure is to ensure that below 5000 feet the descent rate does not exceed 1000 feet/minute.

This will allow a sufficient margin to ensure that any AAD will not activate and will eliminate the possibility of mistakes being made in the effort to work out optimum descent rates for the AAD parameters believed to be on board.

4.9. **The landing**

There will be nothing unusual about landing an aircraft after a parachute flight. One point to bear in mind, however, is the enormous difference to the stopping distance required between an empty and a fully laden aircraft. This is worth mentioning as pilots will often get into a routine of familiarity by getting used to the landing characteristics of an aircraft at very low load weights.
They may go for months of constant landings with empty cabins and become very proficient at handling in this format only to be embarrassed by misjudging what is required when they have to bring down a fully laden aircraft after a flight has been aborted.

5. WEIGHT AND BALANCE

5.1. **Weight & Centre of Gravity Schedule (WCGS)**

The WCGS is a particularly important document as far as parachute operations are concerned and it is important that pilots understand its use. The WCGS is based on the information contained in a Weighing Report which is prepared by aircraft manufacturers or companies approved to weigh aeroplanes.

5.2. **Aircraft and fuel loading**

Parachute pilots, in particular, must be acutely aware of the load limitations applicable to any aircraft they are flying in parachuting operations. This is because aircraft used in parachuting are routinely flown at, or very close to, their maximum all up weight (MAUW).
This means that particular attention must be paid to the loading limitations outlined in the weight and centre of gravity schedule. In some aircraft, for instance, if the cabin occupancy is at a maximum then the aircraft cannot accept a full fuel load, or would exceed its MAUW if it did. In some aircraft a light load means that limitations might exist for the load distribution and in some aircraft cabins loading is restricted to certain areas of cabin space when only partially loaded.

5.3. **Weight and balance calculations**

Some aviation text books indicate that weight and balance calculations should be performed prior to every flight. In some area of commercial aviation it is, indeed, necessary.

As far as general parachuting operations are concerned, however, it is unrealistic to expect a pilot to do one on every flight, particularly in circumstances where he is required to conduct a series of back to back flights without even shutting the engines down.

It is advisable though, that pilots perform weight and balance calculations which cover all the loading scenarios that they are likely to be faced with so that they gain an ability to recognise abnormal or potentially dangerous loading situations.

5.4. **Potential hazards**

Pilots also have to learn to recognise situations which can present loading hazards in ways which are not always immediately obvious.

Loading difficulties can inadvertently develop even when the aircraft is well below its MAUW. When a certain number of parachutists have to climb outside an aircraft it can tend to shift its C of G rearwards. This may be acceptable if there are other parachutists on board at stations which will tend to counterbalance the tendency towards tail down leverage.
If there are no other parachutists on board, despite the fact that the aircraft may be relatively lightly loaded, the aft C of G could become sufficiently rearward to be outside the permissible envelope and place the aircraft out of control.

Some flight manuals do permit transitory out of balance situations where the rearward weight shift on exit can briefly place the aircraft out of balance but not out of control.

As already mentioned some aircraft have cabins areas which should not be loaded until other cabin areas have been loaded first. Such areas are often delineated with red lines or placarded with warnings. Pilots should not rely on parachutists necessarily adhering to these requirements and should be prepared to check on the loading and redistribute the load if necessary. In these situations a lot will depend upon the confidence which the pilot has in the jumpmaster's abilities.

When C of G calculations are performed it is usual to allocate an average weight for a parachutist and his equipment (usually around 90kg) which is a reasonable compromise between the extremes likely to be encountered. In some situations, particularly with smaller aircraft, it may be possible to inadvertently overload by relying on averages. A military display team of five large men, for example, with an average equipped weight of 110kg, could easily overload a small six seater aircraft which is otherwise within its limits with 'average' parachutists.

The pilot therefore needs to accumulate the necessary knowledge to ensure that such situations don't develop. It is important to recognise also that parachutists are not necessarily experts on aircraft weight and balance and cannot be relied upon to anticipate the situations they may be unwittingly creating.

6. FUEL MAGANEMENT

6.1. Introduction

As has already been mentioned, fuel management is particularly important with parachute flying. Pilots coming from some flying school environments will be used to starting flying at the beginning of the day with full fuel tanks, doing an hour's flying and then filling the aircraft up again for the next sortie and so on. In some instances pilots have never flown below half tanks and because of this are perhaps patterned into an overconfident assumption that fuel is always on board an aircraft in abundance. This is not the case with parachuting and it could even be said that parachuting encourages the deliberate use of low fuel levels.

The reasons behind this are simple. The principal demands made on an aircraft and pilot by most parachuting operations are that the aircraft takes as many people as possible to jump height as quickly as is safely possible. To do this often means that fuel loads are limited by the fact that cabin occupancy is at a maximum and there is a need to gain altitude as quickly as possible. This latter requirement meaning that it is not economical in terms of time and money to haul unnecessary quantities of fuel up to altitude and only to fly them down again. Parachuting operations will therefore calculate fuel requirements more precisely than will say, training operations, where abundant on board fuel is the norm.

A busy parachuting operation will perhaps take on board the maximum permissible fuel for its cabin loading if it is anticipating doing a series of 'back to back' lifts. It will, however, then fly as many lifts as possible before approaching its emergency fuel reserve levels (see 'fuel reserve levels' below). If, at this stage, there only remains a requirement to perform one more flight, it would be quite normal only to fill to the level of fuel required to do that flight and no more.

Obviously requirements and practices will vary between different organisations, but it is sufficient to prepare new pilots for regimes where low fuel loadings will be commonplace rather than rare. There is nothing wrong with this approach, it simply means that pilots must become more focussed on fuel management and pay more attention to fuel monitoring than they may have been used to doing in the past.

6.2. **Fuel gauging**

Given the unreliability of fuel gauges in many aircraft, it is prudent for pilots to rely on other methods of gauging the fuel they have on board at any one time. It is a requirement of the BPAOM that "The pilot must have available to him/her in the aircraft, a record of fuel and oil uplifts made and the quantity of fuel on board prior to each flight or series of flights, to enable remaining endurance and fuel reserves to be readily calculated."

Dip sticks are often used in parachuting and are a reliable visual indication of fuel levels. If an aircraft is not equipped with a dip stick it is often prudent to make one. These must be used properly, however, and must be marked with an ID for the aircraft and the particular fuel tanks they are intended for (e.g. 'G-ABCD – 'inboard mains').

Errors can also occur when dipping some fuel tanks which contain rubber liners. Liners are known to sometimes ripple and form pockets of fuel in otherwise empty tanks. If a pocket is dipped it can give a misleading reading on the dip stick.
Whatever means are used to determine the amount of fuel on board the aircraft at any time, an important backup is the pilot's own knowledge of the expected fuel burn of the aircraft when performing in the role. By knowing what the aircraft should have burned on each sortie the pilot will have a mental gauging system which will act as a backup and enable him to make good estimates of current fuel load. This will help him to complete the mandatory record of fuel quantities which sometimes have to be estimated for flights taking place between refuelling stops. When estimating fuel levels in this manner it is important to take account of additional fuel burned on holds and go arounds and pilots must never hesitate to shut down and recheck fuel levels if they are unsure.

6.3. **Fuel reserves**

Every parachute Club should have a policy with regard to the amount of fuel it considers necessary to be kept on board an aircraft as an emergency fuel reserve. It is prudent to write this policy into the centre SOPs and essential that pilots then adhere to it.

Because parachute flying tends to keep an aircraft fairly close to its base, there is a tendency to disregard the need to strictly observe fuel reserves and to eat into them simply to complete a normal operational function. This is a mistake, and fuel reserve levels should always be calculated and maintained on the assumption that a situation may arise that prevents the aircraft from returning to base (incident on the runway, poor weather etc.) and permits it to be flown with a full load to a predesignated airfield that has appropriate poor weather approach facilities.

6.4. **Fuel station management**

Some parachute Clubs are based at licensed airfields and draw their fuel from professionally managed fuel stations which are the responsibility of the airfield authorities. Other centres, however, have responsibility for the management of their own fuel stations. These can take the form of small hand pumped trailer tanks, large powered bowsers, or full underground tank and pump installations.

In the latter case, where the installations are the responsibility of the parachute Club operator, they must be managed in accordance with the requirements of CAP 748 and also under the terms of a Local Authority petroleum storage licence.

It is important that pilots understand that may have a close involvement with this process at some parachute centres and that very often the routine quality testing and storage management processes are their responsibility. It is equally important that if they are not involved with this process, then they satisfy themselves that someone else is adequately fulfilling it.

7. HEIGHT LIMITS & ALTIMETRY

7.1. Height, altitude and flight levels

As is common within aviation and for the purposes of this manual, 'height' is the distance above ground level, 'altitude' is the distance above mean sea level and 'flight level' is an aircraft's altitude at a standard pressure setting of 1013 mb. (sometimes referred to as 'pressure altitude').

In general, parachutists will think and operate in terms of 'height'. If a parachutist requests a drop height of 10,000 feet, he will be expecting to have 10,000 feet of air between the point at which he exits the aircraft and his intended parachute landing area (PLA). Most parachutists will wear altimeters which will be set to zero feet at take off, assuming the intention is to jump at the same location, which in most cases it will be (otherwise refer to section 7.5).

When operating in controlled airspace care must obviously be taken to differentiate between height and flight levels. When the QFE set on the altimeter is lower than the standard pressure it is possible to initiate a level bust if attention is not paid to this.

7.2. Height limits

Except in emergency situations, or specially exempted circumstances, all parachute drops will take place from a minimum of 1500 feet and a maximum of 15,000 feet. The heights at which parachute jumps take place between these upper and lower limits will depend upon the nature of the parachute exercise being undertaken, airspace restrictions in the area the jumps are being made, and the performance limitations of the aircraft being used.

7.3. Use of oxygen

The requirements regarding height limits and the use of oxygen are slightly different for parachutists than for pilots. Parachutists may fly to FL150 without oxygen provided that they do not remain above FL100 for more than 30 minutes and above FL120 for more than six minutes. Parachutists wishing to jump above FL150 must apply for special permission and must include provision for supplementary oxygen tailored to the requirements of the jump.

Pilots are required to adhere to the requirements of the ANO, which as far as parachuting is concerned means that they must use supplementary oxygen if they remain above FL 100 for more than 30 minutes (rare in the case of parachuting operations) and at all times above FL 130.

Pilots must also note that the BPAOM requires them to be responsible for monitoring the time limits and flight levels that are applicable to the parachutists. If the time limits or flight levels are exceeded then the pilot must bring the parachutists down and land the aircraft. It is not permissible simply to resume operations at a lower flight level.

7.4. Jump height precision

In some parachuting exercises the precise exit height is not of great consequence.

Sometimes if a pilot arrives at a designated jump height earlier than intended (before he has reached the exit point) the jumpmaster may well tell him to keep climbing and achieve whatever extra height he can. Alternatively, a lower than anticipated cloudbase may cause a jumpmaster to order a run in at a lower height than previously requested. A pilot may also arrive at an exit point before achieving the height requested and the jumpmaster may elect to initiate the jump anyway (if it is not too far from the intended height). Most jump pilots will eventually encounter all of these situations but will hopefully aim to avoid them.

In other circumstances, however, the precise jump height is critical. This applies particularly to student static line jumping and early student free fall jumps, where free fall time is counted down verbally, rather than being checked on an altimeter.
It is important in these circumstances that pilots pay particular attention to achieving and maintaining the precise height specified by the jumpmaster. For instance, if a pilot allows an aircraft to lose height on the run in and exit phase of a low free fall jump, it is possible that the jumpmaster, who has already observed that the correct height has been reached, may turn his attention to other matters and fail to notice that the aircraft has inadvertently descended. The result of this may be that a parachutist exits and opens too low for safety in the event of a parachute failure, or does not have enough height to make it to a safe target area and is faced with a hazardous landing. In these circumstances the onus would be on the pilot to abort his run in and inform the jumpmaster of his error. Clearly the benefit of experience will help most pilots to avoid repeating such errors.

7.5. **Field elevation differentials.**

When pilots fly aircraft from one location to drop parachutists at another (as they often do on parachute displays) they will have to take into account the likelihood of different field elevations. Failure to do this can cause a potential danger. A pilot taking off at an airfield with a field elevation of 100 feet amsl and dropping parachutists at a target area with a field elevation of 1100 feet amsl needs to ensure that he takes account of this when he is runs in at the requested drop height. If he is unable to obtain an accurate QFE at the display location (which is often the case) then he needs to add 1000 feet to the run in height based on his take off point QFE (assuming no pressure differentials). Alternatively he needs to add 1100 feet to the run in height based on his display location QNH. Failure to do this could result in parachutists inadvertently exiting at dangerously low heights.

There is, of course, also an onus upon jumpmasters to ensure that this kind of mistake does not happen. They should ensure that the jumpers' altimeters are set at take off to provide a correct height reading at the target area. It is nevertheless prudent that pilots and jumpmasters both ensure that field elevations are taken into account and agree upon how this is to be done. The rule for parachutists is to set altimeters lower at take off for target elevations which are higher than take off elevations and to set them higher for target elevations which are lower than take off elevations.

7.6. **Uneven terrain**

An important consideration, apart from differential elevations between take off airfields and PLAs is the differential ground elevation that can be encountered once a target area is reached. In hilly or mountainous terrain it is possible to have an exit point which is much closer to the ground than the landing area. If, for instance the jump height requested by the jumpmaster is 3000 feet (meaning that he requires 3000 feet height above the target area) the subsequently calculated exit point, which can be over a mile away from the target, may be over the top of a mountain which is 2000 feet higher than the landing area. If this fact is not taken into account it now means that the parachutists are exiting at a height of 1000 feet above the ground. If they then perform even a short free fall delay, the result could be fatal.

In these circumstances it is incumbent upon the pilot to ensure that the jumpmaster is alert to the dangers inherent in the situation and to take the necessary steps to avoid them. In this particular situation the danger is avoided by jumping at a higher altitude if circumstances permit; or shifting the exit point, if the wind strength and direction permit; or aborting the jump if neither of these solutions is available.

7.7. **Jumpers' altimeter variations**

Occasionally jumpers or pilots may wish to cross reference jumpers' and aircraft altimeter readings in order to establish accuracy or for resetting purposes. An anomaly which is often encountered in jump flying is the fact that parachutists' personal altimeters will often read a few hundred feet higher than the aircraft altimeter whilst in flight, despite the fact that all altimeters have been zeroed on the ground.

This variation is due to the fact that the cabin air pressure in an unpressurised aircraft in flight is slightly lower than the external air pressure. This derives from the external airflow over the aircraft creating a pressure differential inside the cabin which is always lower than the outside. The aircraft altimeter static air source being outside the cabin will therefore register a different reading to a parachutist's personal altimeter inside the cabin. In effect a parachutist's altimeter starts to over read once the aircraft is flying but will become 'correct' once he jumps out.

The extent of the error will depend upon the type of aircraft and the speed at which it is flying, but will rarely exceed a few hundred feet. It is necessary to be aware of this phenomenon, however, in order to avoid creating altimeter errors by attempting to synchronise them when it is not necessary.

8. COMMUNICATION PROCEDURES

8.1. **Radio requirements**

The basic requirement as far as the BPAOM is concerned is simply that radio communication with the drop zone control is available when student parachuting is in progress. On all other occasions it is only mandatory that visual communications are available (see section 8.6 below). Thus it is possible for some parachuting operations to be conducted by non radio aircraft. This would be highly unusual these days and would not be permissible in circumstances where other mandates (such as local air traffic agreement or controlled airspace requirements) overlay the basic requirements.

Under normal circumstances parachuting aircraft will maintain radio communication with their drop zone control at all times and with any other radio station that is necessary, such as local airfield or air traffic service unit.

8.2. **Radio procedures**

Radio procedures will vary from club to club and will normally be the subject of requirements laid down in local SOPs. It is virtually universal within the UK that these requirements will include the need for the pilot to notify the Drop Zone Control (DZC) that the aircraft is commencing its run in or is a stated number of minutes prior to jumping and to receive a clearance to drop from the DZC and to notify the DZC when the jumpers have exited the aircraft.

8.3. Mandatory ATSU notification

The ATSU notification requirements are outline at section 4.3.1.above.

8.4. Transponder use

The BPAOM requires that pilots of transponder equipped aircraft should squawk 0033 (the standard parachute dropping code) with mode C at least five minutes before the drop commences until the parachutists are estimated to be on the ground, unless the pilot has been instructed to use another code by a controlling ATSU. The normal practice, however, is to employ the squawk for the entire flight unless otherwise instructed.

8.5. Mode S transponders

At the present time many parachute aircraft are exempted from carrying Mode S Transponders but these are likely to become mandatory within the next few years following a CAA consultation process. The latest information regarding Mode S can be accessed on the CAA website at *www.caa.co.uk/modes*

8.6. Visual communications

The BPAOM permits parachuting in certain non radio situations providing that a system of ground signal panels is used. The use of ground signal panels is anyway mandatory for all parachute operations (unless specifically exempted) in order that some ground to air communications can be quickly established in the event of radio failure.

If radio failure occurs during student parachuting the aircraft must anyway land without further drops taking place. It is well to remember here that the BPAOM defines tandem passengers as students (even though they are harnessed to an instructor) and this rule therefore applies to tandem pairs as well as solo students. In the case of experienced parachuting then the ground signal system will be used. The signal panels will be laid out in one of four shapes (an X, an I, a T or an L) which are intended to convey different messages as follows.

X	-	It is clear to continue with parachute dropping.
I -		Parachuting is temporarily suspended *(this is intended to signal the aircraft to remain aloft until further signals are made but is not a mandate as other factors, such as limited fuel, may mean that the aircraft cannot remain airborne for longer than would normally be necessary to complete the drop).*
T		Only those with specifically notified experience levels may jump.
L	-	The aircraft is to land and make no further drops.

9. DISPLAY PARACHUTING

9.1. General

Parachute displays are nothing more than parachute drops which are organised to demonstrate parachuting to members of the general public. The actual parachute dropping procedures are much the same as they would be at a regular drop zone. Displays normally take place at locations other than notified drop zones, such as major airshows at large airfields, county shows or village fetes. If display drops take place outside notified drop zones then there are special procedures which have to be followed before they can be legally undertaken.

The required procedures are detailed in section 13 of the BPAOM. Display drops may only be undertaken by registered display teams. Pilots require no additional qualifications other than their BPA Authorised Pilot rating (plus an IR if the display is in controlled airspace – see section 16.3). There are, however, additional considerations to note as follows.

9.2. **Display flight preparation.**

The pre display administrative procedures required by the BPAOM will normally be undertaken by display team members and pilots are not necessarily required to perform these functions, though they may be asked to.

It is important, however, that pilots realise that they are responsible for all aspects of the actual flight planning and that they must obtain NOTAM, weather and en route information that would be normal practice on any cross country flight. In addition they must be sure that they are acquainted with special display co-ordination requirements such as display control frequencies, holding areas, and entry and exit routes. These will normally apply to larger air displays but even small village fetes can have co-ordination requirements which the pilot will need to ascertain prior to take off.

9.3. **Smoke canisters**

One aspect of display parachuting that pilots do not normally encounter on regular drop zones is the use of pyrotechnic smoke generators. These are smoke canisters similar to those used in marine distress applications.

They are used on displays to highlight jumpers in free fall and under canopy, so that they can be more easily seen from the ground and to add a more colourful and spectacular effect to a display.

They are normally worn on the jumpers' feet and detonated immediately prior to jumping. Although there is normally a delay of a few seconds between the canister being activated and the commencement of smoke discharge, it does mean that on some occasions pilots may experience some smoke in the aircraft cabin. It is not normal for this to be anything other than a tiny amount which quickly dissipates and is detectable only by its odour. It is as well for new pilots to be prepared for the experience, however, as it can otherwise cause alarm.

Pilots should also be aware that display teams may plan to produce a smoke trail from the aeroplane by using a jumper to trail his foot and detonated smoke canister out of the aircraft door prior to jumping. In some circumstances the smoke can badly stain aircraft paintwork. A pilot could, therefore, unwittingly find himself responsible for damage to the aircraft by permitting the use of smoke in this way. It is, therefore, important that pilots are clear about what display jumpers are planning to do with smoke canisters and that this accords with the aircraft operator's wishes. If in doubt, the pilot, as commander of the aircraft, should not permit this use.

9.4. **Display regulations**

Pilots should be aware that air displays are subject to particular regulations under the

ANOs and that some aspects of display flying require a pilot to hold a display authorisation.
To simply take off and perform a normal parachute drop at an air display, or anywhere else, does not, of itself, require this authorisation. This is because the normal pattern of a parachute drop would not bring the aircraft within the proximity limits to large crowds that are the subject of the regulations. It would, however, not be permitted to perform additional manoeuvres, such as a low pass, which could be classed as displaying the aircraft itself without the necessary authorisation.

A pilot should, therefore, be careful about the way in which he does fly an aircraft at a display and would be advised to consult CAP 403 (Flying Displays and Special Events) if in doubt about the legality of a display format.

10. NIGHT JUMPING

10.1. **Night jumping regulations**

As well as the obvious requirement that the pilot will need a night rating as well as a jump pilot authorisation, there are other regulations relating to night jumps which are covered in section 8 of the BPAOM. These rules relate principally to parachutists and include qualification requirements. Pilots should be aware, however, that details of any night jumps must be notified in writing to NATS Airspace Utilisation Section (AUS) at least five working days prior to the proposed jumps and the notification copied to the BPA.

Pilots must be satisfied that this requirement has been complied with before undertaking such flights. If the notification has not been made then the appropriate NOTAM will not have been issued. This means that drop zone infringement by aircraft is more likely as drop zones are normally considered to be inactive at night.

10.2. **Night vision**

The effectiveness of night vision depends upon several factors (such as altitude, age, fitness, smoking) but in particular it depends upon restricted exposure to light. Night vision improves the longer a person remains in the dark, but this accumulated effectiveness is immediately destroyed if vision is then exposed to bright light. Pilots must be aware, therefore, that it is easy to ‘waste’ jumpers’ night vision by shining a torch at them, such as one might be tempted to do when being spoken to from the rear of a dark aircraft cabin.

10.3. **Collision avoidance**

The principal danger, as far as parachute flying at night is concerned, is the potential for collision with a parachutist. Although jumpers are required to carry lights, they are not particularly bright or readily seen at any distance. When descending from altitude it is, therefore, important to do so well upwind of the exit point so that the potential to run into parachutists (who may have inadvertently opened high) is minimised.

It is also important to remain away from the drop zone prior to landing until the DZ controller can confirm on the radio that all jumpers have landed and that it is safe to make an approach. In the event that communication is lost with DZ it may be necessary to allow a sufficient margin of time to elapse to be certain that the parachutists are on the ground before making an approach.

11. USE OF GPS

11.1. General

Prior to the introduction of GPS most jump flying was conducted as an entirely visual exercise requiring the co-operative skills of both the pilot and jumpmaster.
Over the past few years, however, the GPS has probably become the primary tool for establishing an aircraft on a jump run and indicating when the exit point has been reached.

11.2. Technique

The ways in which GPS can be used to establish a run in are various and will depend upon the actual equipment available. Most pilots with the experience necessary to become jump pilots should have no difficulty in using a GPS for this purpose. In the early stages of jump flying probably the most common mistake is to keep overcorrecting in an attempt to keep the aircraft flying along an indicated line. This results in the aircraft weaving left and right along the line rather than flying steadily along it. Practice will overcome this tendency and guidance on the best techniques appropriate to the equipment available should also be sought from pilots with more experience in its use.

11.3. Responsibilities

The use of GPS enables a jump pilot to position aircraft accurately on a run in and to indicate an exit point with great precision.

This means that a pilot will often be left to position the aircraft without interference from the jumpmaster and only to indicate to the jumpmaster when the aircraft is close to the exit point. In pre GPS days the jumpmaster would generally have the task of visually positioning the aircraft by physically ‘spotting’ through the open door. This was sometimes a prolonged and extremely cold process.

Pilots must remember, however, that the responsibility for exiting an aircraft in the correct place still rests with the jumpmaster. The advent of GPS has tended to shift the focus of this responsibility towards the pilot. The current regulations still require that a jumpmaster is able to see the ground between the opening point and the target prior to exiting the aircraft. All a pilot can do, therefore, is to indicate when an aircraft is on the run in and when it is over the exit point. If the aircraft subsequently proves to have been in the wrong place, or if the parachutists do not land on target, this is not the pilot’s fault or responsibility.

12. EMERGENCIES

12.1. General

Pilots should be familiar with the emergency procedures which relate to the specific aircraft they are flying and anyway be able to deal with general emergencies, such as engine failure, which are an ever present risk in any form of powered flying. If the drills for these emergencies are practised regularly then the outcome is likely to be less dramatic when the real thing occurs.

There are, however, additional considerations which come into play when dealing with emergencies during the course of parachute dropping and there are additional emergency situations which are specific to parachuting and are only likely to be encountered during the course of parachute dropping.

12.2. Engine failures

Engine failures in parachute aircraft present differently than other flights insofar as most of the persons on board have the option of jumping out. An engine failure at sufficient jump altitude will normally mean that the parachutists can exit the aircraft if they wish. It is a reasonable expectation that they would wish to unless they are over water or other inhospitable terrain.

In the event, the decision to jump still rests with the jumpmaster. It would not be expected that a pilot would order the parachutists to jump under these circumstances. The decision may be the result of a discussion between the pilot and jumpmaster but it is likely that the discussion will be brief. In some circumstances the pilot may well find that the decision to jump has been taken and executed before he actually gets the chance to enquire about it.

Height is obviously a critical factor in the decision to jump or not. Experienced solo parachutists may opt to jump from as little as 500 feet but student parachutists and tandem pairs would require more height. In some circumstances some parachutists may jump and others remain on board.

Pilots should be aware that although the payload is decreased if parachutists jump, this will not necessarily increase the glide capabilities of the aircraft. A lighter payload may, however, mean that aircraft manoeuvring during a forced landing in confined areas would be easier because of slower flight capabilities.

The fact that glide capabilities are not altered by payload differences is part of traditional aviation wisdom. This accounts for the fact that many aircraft flight manuals will only give one maximum glide speed for an aircraft without any reference to its weight. It is significant to note, however, that some aircraft manuals do, in fact, give differing glide speeds according to payload. It is particularly important, therefore, that jump pilots are conversant with differing glide speeds, if they apply to varying payloads, because jump pilots are always usually flying their aircraft at the two extremes of an aircraft's load envelope; usually near MAUW on the way up and virtually empty on the way down.

12.3. Preparation for emergency landing

An emergency or forced landing will make great demands on any pilot. There is a lot to think about and concentrate on under any circumstances. If parachutists are on board there are additional considerations. These are

a)	Weight distribution	*(see also section 5.4)*
b)	Use of restraints	*(see also section 15.3)*
c)	Adoption of brace positions	*(see also section 15.4)*
d)	*AADs*	*(see also section 4.8.4)*

These aspects are normally the responsibility of the jumpmaster, but if there is time it is important that the pilot reminds those on board to a) ensure safe weight distribution of remaining parachutists; b) ensure use of restraints if available; c) remind parachutists to adopt appropriate brace positions, d) ensure that AADs are turned off (if possible) if parachutists are remaining with the aircraft, or that the jumpmaster is ready to take safeguarding measures in the event of AAD firings.

12.4. Evacuation of aircraft on the ground

Once the aircraft comes to rest following an emergency it is important to evacuate the aircraft as quickly as possible. Again, this will be the primary responsibility of the jumpmaster, but circumstances may prevail where the pilot has to take charge of this. Evacuation of the aircraft may be a straightforward process but it is important to ensure that occupants are warned to be wary of propellers that may still be turning (particularly with turbine aircraft which may still be winding down). Normally occupants would be instructed to evacuate towards the tail end of the aircraft.

An additional problem with evacuation comes when static line parachutists are on board. The BPAOM requires that static lines are hooked up before take off and are only unhooked on the ground if the static line parachutists have been unable to jump for whatever reason. The jumpmaster should only consider unhooking the static lines if the student parachutists are definitely going to land with the aircraft in an emergency rather than jump out.

In the emergency circumstances prior to landing both the pilot and jumpmaster will be extremely busy people and the unhooking of static lines may not be a priority. If the static lines have not been unhooked and speedy evacuation of the aircraft is necessary, then the static lines will deploy the parachutes as the evacuees leave it. They will then have to drag the deployed parachutes away with them or pull their canopy release handles (if they have the presence of mind).

12.5. Premature parachute deployment

This situation occurs when a parachute deploys inside the aircraft or whilst a parachutist is still connected with the aircraft prior to jumping (such as being positioned on a jump rail on the outside). If the parachute deploys inside the aircraft then every effort must be made to prevent it from going out of the door. If it does deploy outside the aircraft then there is serious risk of damage to the airframe and injury to the parachutist. Such incidents have happened, and when they have there has not been much that the pilot has been able to do to influence events. A pilot may, however, be in a position to help prevent the likelihood of such incidents by intervening whenever he may be involved with parachutists planning or practising exits or apparently adopting practises within the aircraft that he believes are potentially dangerous and could perhaps result in a premature deployment. A jump pilot can play a worthwhile role on the ground in helping to educate parachutists about safe behaviour in aircraft.

12.6. Parachutist hang up

This occurs when a parachutist becomes unintentionally attached to the outside of the aircraft (hung up) either by a deployed parachute, a static line or another part of his equipment or clothing.

This is a situation which has occurred several times throughout the history of parachuting and is clearly one that pilots will not welcome. Parachutists have been hung underneath aircraft by static lines which have failed to operate correctly. They have been suspended by partially deployed parachutes from aircraft tail wheels or other parts of the airframe. Sometimes the outcome of the scenario has been an aircraft crash with fatal results; sometimes the situation has been resolved successfully.

Under some circumstances the jumpmaster is able to resolve the situation by cutting the parachutist away with a knife, which is kept on board for the purpose. In some situations the jumpmaster has climbed down the static line and has cut himself and the suspended parachutist away. A carabiner strop is required to be carried on board to facilitate this exercise should it be necessary.

Whatever the nature of the hang up the pilot's first job is to keep the aircraft flying and, if possible, gain height. This will give the jumpmaster a better chance of resolving the situation himself. The pilot should also attempt to keep the aircraft in the vicinity of the drop zone but in particular should keep away from built up areas. He will, of course, inform drop zone control of the incident.

If the situation cannot be resolved, then the pilot will have no choice but to land the aircraft with the parachutist still hung up on the outside. The conceivable variations to this scenario are too numerous to be able to set down a coherent set of drills for a pilot to follow. It would, however, make sense, where possible, to arrange a landing on grass with medical assistance ready on hand.

Land as slowly as is safely possible and hope for the best. If it is any consolation, this situation has actually occurred with a successful outcome, resulting in only minor injuries.

12.7. **Airframe strikes**

Sometimes a parachutist or a parachute can strike the airframe on exit causing damage to the aircraft which can result in control problems. Again, the only drill a pilot can follow is to do his best with whatever this particular circumstance throws at him. What jump pilots should be aware of, however, is that such events can often be of their own making and can therefore be avoided in the first place.

Airframe strikes have been caused by pilots stalling aircraft whilst parachutists are exiting. This has resulted in jumpers striking the tailplane. They have also been caused by pilots flying an aircraft at too high an airspeed for the particular exercise being undertaken. It is possible to cause strikes from a deploying parachute if a static line exit speed is too high (see section 13.2) or if the speed is too high for a Canopy Formation exercise (see section 13.3)

13. SPECIAL PROCEDURES

13.1. **Special procedures**

There are many different disciplines and types of parachuting which each make special demands on parachutists and instructors. Some of these also require a jump pilot to have extra awareness of the demands they make in the way a jump aircraft is flown. The following are parachuting procedures which require additional pilot attention.

13.2. **Static line jumping**

Static line parachuting is a means of deploying a parachute canopy quickly and automatically when a parachutist exits an aircraft. The static line is a length of tubular webbing, one end of which is attached to a strong point in the aircraft whilst the other is attached to the parachute container carried by the parachutist.
The static line is configured to open the parachute container and extract the parachute in

order to initiate its immediate deployment. Most static line systems are designed so that the static line and a parachute deployment bag (which initially contains the parachute) remain with the aircraft after the parachutist has jumped. It is the job of the jumpmaster to retrieve the line and bag by hauling it back into the aircraft.

Static line jumping used to be widely practised as the means whereby beginners were introduced to parachuting. Many years ago in the UK just about every parachutist did their first jump on a static line system. These days it is utilised with decreasing frequency and most first jumps are made as Tandem or AFF jumps (see glossary).

Nevertheless, many jump pilots will still be required to fly static line jumpers, so there are a few issues which need to be considered.

13.2.1. **Airspeed.** The airspeed at exit is a critical factor for static line jumping. In general the speed requested will be around 1.1 Vs (stall speed plus 10%), in other words quite low. High airspeeds can adversely affect static line parachute deployments, which is particularly undesirable as static line jumpers are generally novices. Pilots who are new to parachute flying and who may be initially apprehensive about flying at low speeds must nevertheless get to grips with this. Whilst emphasising the importance of slow flight the one overriding rule is 'above all, don't stall'.

13.2.2. **Height loss.** It is equally important that the precise height requested when static line parachuting is adhered to. At slow speeds and low power settings there is a tendency to 'sink out' if attention is not paid to this. If there is more than one parachutist on a pass the tendency to sink out is prolonged. It is particularly important that height is not lost. When the last parachutist exits he does not want to be lower than his expected height for his calculated opening point. If he is, then he may not be able to make it back to his target area.

When circling for multiple passes it is also prudent to keep an eye out for students who are remaining high because of thermal activity. Although relatively rare this is nevertheless a regularly observed phenomenon.

Pilots must also realise that whilst the height at which a static line parachutist is dispatched is critical and is, in the first instance, the responsibility of the jump master, they may have a more immediate knowledge of height errors. A jumpmaster, once satisfied that an aircraft is at the correct height, may be focussing his attention on other aspects of the dispatching process and may not notice critical height loss. In these circumstances it is incumbent upon the pilot to recognise his own error and alert the jumpmaster accordingly.

13.2.3. **Static line length.** Pilots should also be aware that the length of static line and deployment bag assemblies can be critical to aircraft safety. An assembly whose overall length is too long for the particular aircraft being used, particularly when flown with excessive airspeed, may be liable to strike the tailplane or elevator and cause structural damage. A correctly configured assembly will be a few inches short of the tailplane when fully extended. Be aware, however, that a few inches short is sufficient and that the physics of static line deployment also means that static lines which are too short can also cause deploying parachutes themselves to strike the tail.

13.2.4. **Static line spotting.** When setting up for a run in during static line dropping, pilots must expect the procedure to be a visual process for which the use of GPS might not be appropriate. It will involve the use of WDIs (see section 4.5.3) and is more likely to involve verbal heading corrections from the jumpmaster. Also be aware that multiple passes may be involved (often one separate pass for each parachutist) and that the jumpmaster may request a time delay between passes in order to allow good vertical separation between the jumpers in the air. This is normally to facilitate the talk down procedure and prevent confusion over instructions issued to students from the ground.

13.3. **Canopy Formation**

Canopy Formation (CF) is a particular type of parachuting in which jumpers will deploy their parachutes immediately, or very shortly after exit. They will then engage in linking the deployed parachutes together in various formations and in competitive CF will be doing this against the clock. The discipline is still often referred to as CRW. This stands for Canopy Relative Work, which is the older term which has been dropped in favour of Canopy Formation, though the old acronym still persists.

Jumpers engaging in CF will often request high run in and exit speeds because a high exit speed will assist with a rapid deployment of their canopy, which is what they require.

Pilots should be aware that high exit speeds increase the chance of airframe strikes by jumpers or their canopies. An accident has occurred in the past when a pilot gave a high run in speed which had been specified by the jumpers but which proved to be too high and resulted in a canopy strike. Pilots should become familiar with the maximum exits speeds permissible on the type of aircraft they will be flying and not allow jumpers to persuade them to exceed it. It should also be noted that CF exercises often involve high altitude exits and deployments. This means that in the process of descending the aircraft the pilot may encounter parachute canopies at a much greater height than he would expect normally. Pilots must, therefore, take care to organise their descents so as to ensure that they descend in areas that are likely to be clear of descending canopies. It is important that the pilot understands what the jumper's intentions are and has planned accordingly. Finally if the pilot is receiving an ATS he should advise the ATC that parachute canopies are opening high

13.4. **Wing suits**

Some jumpers will wish to jump wearing wing suits. These are specially designed jump suits which have wing areas (often with good aerofoil design) between the jumper's hands and feet and between their legs. They enable a jumper to 'fly' more efficiently during the free fall phase of his jump.
The chief advantages are that he will prolong the time he is in free fall and will greatly extend the range of area that he is able to fly across whilst in free fall. Jumpers will often fly wing suits as a group, which is often referred to as a flock.

As with Canopy Formation (where open canopies may be encountered), the pilot now needs to be aware that he may now encounter free fall parachutists during the course of his descent. These are not so easy to see and will be faster moving than a parachute canopy. Pre planning is important and the usual procedure is for the jumpers to brief the pilot on the areas where they expect to be flying so that the pilot can avoid them in his descent.
If the pilot becomes aware that wing suits are on board his load and he hasn't received any briefing, then he should take steps to ensure that he does.

13.5. **Water jumps / Flights over water**

Some jumps are organised specifically as jumps into water. From a pilot's perspective there is very little difference to this from flying any display jump away from base. The jumpers are dressed for water entry and do not usually require (or want) great altitude. They are required to wear flotation gear and there are requirements for boat provision in the water. This may mean that that the numbers who jump on each pass are limited and the time taken between passes is extended according to the extent of boat provision. The aim is not to have jumpers in the water who cannot immediately be attending by a powered craft.

When flying over open water the normal requirements for the provision of flotation equipment must be met. It is well to bear in mind that in the past one of the greatest causes of parachuting fatalities was drowning. This is why parachutists do not always welcome flying over open water. Pilots are, therefore, advised not to fly over open areas of water whilst engaged in parachuting operations unless this is unavoidable. Some drop zones near the sea may be far enough in land for parachutists not to be required to wear flotation gear. It is up to the pilot, therefore, not to put them in a position where they might inadvertently need it.

13.6. **Formation flying**

When attempts are made to get large numbers of skydivers joined in large freefall formations it is often necessary to use several aircraft at once, flying in formation to achieve this. In doing so there are several considerations to take into account.

a) Take offs may need to be staggered to take account of the varying climb n performance of different aircraft.

b) This will require rendezvous arrangements for the various aircraft at a predetermined height and location. To join formations in this manner will often require all pilots to be familiar with the principals of lead pursuit curves as a means of interception.

c) Account will have to be taken of which side of the various aircraft the exit door is, as this will affect the ease with which the jumpmasters on each aircraft can see what the other is doing at exit but may be outweighed by a pilot's need to clearly view the lead aircraft he is formating on.

d) The run in speeds and exit procedures for the formation will have to be carefully planned. It will not be possible to have an engine 'cut' on exit because of the difference in aircraft responses. The speed will have to be constant as will the height. For obvious reasons it is inconceivable that a situation should arise where aircraft start to run ahead of the lead or risk dropping behind and low of other aircraft whilst parachutists are exiting. There has been an accident in the UK where an aircraft has run into free fallers who were exiting above and ahead of the aircraft concerned.

e) For all these reasons and more, thorough ground planning and briefing needs to be undertaken, including the nomination of a lead pilot and aircraft and a clear understanding of the communication signals and the words of command and phraseology to be used on the radio.

f) Whilst there are no qualifications required to fly in such formations, it would be wise for pilots who are likely to be engaged in such work to obtain instruction in formation techniques and, initially, only to engage in parachute formations with pilots who have previous experience of this particularly demanding aspect of parachute flying.

14. HUMAN FACTORS

14.1. General

All pilots should be familiar with the general issues regarding human factors which have a bearing on flight safety. It is well known that physiological and psychological problems are often significant issues in the causation of accidents.

These issues are just as relevant to parachute flying as to any other. There are also two issues which parachuting regulations focus on in particular, these are fatigue and ageing.

14.2. Fatigue

Parachute flying can place demands on pilots' stamina which they will not necessarily have encountered in their previous flying career. On a busy day at many parachutes centres pilots may find themselves having to fly in excess of twenty flights spread over a twelve hour day. This can be very tiring given the demands on performance and concentration already required by this kind of flying. It is, therefore essential that pilots come to the job each day in a fit state to carry it out. Hangovers and lack of sleep the previous night are factors which can prove particularly dangerous in these work situations.

The BPAOM requires pilots to have a break from the aircraft of at least 30 minutes after four hours of flying and restricts pilots to a maximum of eight hours flying in any one day. Each Club should have a system in place which enables pilots to easily monitor these limits during the course of their flying. If a pilot is flying under the terms of an AOC then he must adhere to the AOC requirements if these are stricter. Pilots must also adhere to the maximum limits anyway imposed by the ANO (maximum of 100 hours in 28 days and 900 hours in one year).

In the general turmoil of a busy parachuting programme it is easy to inadvertently overshoot these daily limitations and pilots must take care not to.
Club SOPs should contain procedures for monitoring pilot flight times to ensure that the limits are not exceeded. The pilot will also be expected to keep the relevant drop zone organising staff appraised in advance of when a break will be required, so that other tasks (like refuelling) can be organised around it. Remember, if average lift turnaround times are thirty minutes, then a break is going to be required immediately after 3 hours and 35 minutes of flying because it will be impossible to fly another lift without exceeding the limitations.

A pilot will not be popular, however, if he suddenly announces without warning that the jump programme must stop for thirty minutes. It is important, therefore, to anticipate breaks well in advance. At drop zones where two pilots are on hand to fly, none of this is a problem, but for the single duty pilot it often can be.

The same problems also apply to the eight hour limit, of course, but here the problems can be compounded by the pressures on the pilot to keep things moving and not close the day's activities down. This can be a difficult situation for the pilot cope with when persuasive influences encourage pilots to break the rules. Pilots must remember, however, that they are placing themselves and other people in danger when they continue to fly in a fatigued state, however capable they think they feel. They must also remember that after the accident, it will be themselves personally who are called upon to explain why they broke the rules and not anyone else who simply persuaded them to.

The trick is to give plenty of advanced warning so that those who are responsible for organising the jump programme can plan their manifesting well in advance of a shutdown and also to resist pressure to break the rules.

With regard to breaks it is also wise to organise in advance how they will be taken. If a pilot is only to get a thirty minute break in eight hours of flying (as sometimes can be the case) he is better advised to use the time to eat a meal or sit and drink tea rather than refuel the aircraft.

14.3. Age of pilots

The BPAOM now places an upper limit of 70 years of age for a pilot to hold a BPA Pilot Authorisation and an upper limit of 55 years of age to actually gain a new Pilot Authorisation. These age limits were imposed as a result of research into the effects of ageing on psychomotor performance coupled with appropriate medical advice. On average the age of 70 heralds a sharp decline in psychomotor ability and the age of 55 is one where the average human has started to lose his ability to learn and retain new skills.

As these assumptions are based on averages, there will inevitably be individuals who can continue to perform satisfactorily beyond these age limits. Because the BPAOM incorporates the possibility for exemptions to be granted from any of its requirements, given special circumstances, it is therefore possible for individuals to apply for exemptions from these limits. The procedure requires that a CCI applies for an exemption to the BPA Safety and Training Committee (STC) on behalf of the pilot concerned. Following guidelines prepared by a BPA Pilot Working Group STC are likely to require the application to be supported by appropriate medical information supported by input from the BPA Medical Adviser and two BPA Pilot Examiners. The Pilot may be required to attend the meeting.

The way in which such applications will be viewed by the STC will depend upon a number of factors, but chief among them will be the total extent of flying experience, the current extent of flying experience, and the future likelihood of continued flying currency of the individual concerned. Thus an individual with many jump flying hours who is currently employed as a jump pilot would be more likely to get an exemption to continue beyond the age of 70 than someone who was applying having only flown minimal jump hours in the past few years and who was not actively flying for a particular Club or centre at the time.

15. SAFETY IN THE AIRCRAFT

15.1. General

As well as flying the aircraft safely, there are a few points which the pilot needs to pay additional attention to with regard to the general protection of the parachutists on board.

15.2. Headgear

Parachutists are required by the BPAOM to wear their protective headgear during the takeoff phase of flight. They are permitted to remove it during the climb phase but must, obviously, wear it when they jump. There are exceptions for cameramen (BPAOM section 10.1.6) but the rule applies in all other cases. The jumpmaster should be responsible for ensuring that the rule is adhered to but the pilot should also encourage adherence to the rule if he sees it being broken.

15.3. Restraints

Where restraints are required to be used the jumpmaster should, again, enforce the rule. The pilot can also assist with this, however, and should require jumpers to use them if he observes that they have omitted to (See also section 3.9).

15.4. Crash brace positions

The BPA has issued advice to parachutists with regard to crash brace positions. These are detailed in BPA Form 261 which is attached as Appendix D to this manual. Pilots should be familiar with this document. Each Club should display diagrams or instructions which relate to the crash brace positions to be used in any aircraft they are operating.

15.5. Pilot emergency parachutes

The question as to whether a jump pilot should wear a parachute or not is a matter of personal choice in the UK. In some countries it is compulsory for jump pilots to wear parachutes. In the UK common practice seems to indicate that some types of aircraft attract the wearing of parachutes more than others. The majority of jump pilots don't wear parachutes; probably because in many aircraft they are actually difficult to wear in conjunction with the type of pilot's seat available and also because most pilots don't wear them in civil flying generally and are quite used to the idea.

If a jump pilot does choose to wear a parachute, then the most important thing he can do is to learn how to use it. Given the environment in which he is flying, this should not be difficult. There will be plenty of expert advice and training ready to hand.

16. CONTROLLED AIRSPACE

16.1. Pilot qualifications in controlled airspace

Notwithstanding the fact that the CAA permissions issued to BPA Clubs permit PPLs (who are BPA APs) to fly an Aerial Work task which would otherwise require a CPL, there are slightly different requirements when it comes to parachute dropping in controlled airspace.

16.2. Parachuting at notified drop zones

Where parachute flights penetrate class A airspace there is a requirement for the pilot to hold an Instrument Rating, as there is for all other types of flight in the same category of airspace. In the case of notified drop zones, however, it is not necessary for the pilot to hold an IR provided that he holds at least an IMC rating and that the parachute flight arrangements are the subject of a letter of agreement between the drop zone operators and the relevant ATSU.

Pilots who fly at such drop zones will need anyway to be thoroughly familiar with (and abide by) the terms of such agreements in order to maintain the privileges they accord.

16.3. Display parachuting in controlled airspace

If a display drop is taking place from within class A airspace at a location which is only notified for the purpose of the display (i.e. other than at a notified drop zone) then the pilot will require an IR regardless of the type of licence that he holds. This is because the temporary nature of display zones means that they are unlikely to be the subject of letters of agreement with ATSUs.

17. WEATHER CONSIDERATIONS

17.1. Limitations

Sport parachuting is a very weather constrained operation. The detailed limitations are listed in Section 8 of the BPAOM but, broadly speaking, parachuting is only be able to take place in a maximum ground wind speed of 20 knots and with a flight visibility of at least 5km. Thus normal parachuting weather conditions are not, on the face of it, likely to be very demanding of pilots.

This does not mean, however, that jump pilots will not encounter difficult weather conditions. Whatever weather conditions are forecast, parachuting is generally conducted on the suitability of actual weather conditions prevailing at the time within the drop zone. This means that pilots will often be faced with flying in acceptable conditions but with the expectation of deteriorating weather.

17.2. TAWS exemption requirements

At the present time most turbine aircraft used within parachuting are required to be fitted with a Terrain Awareness and Warning System. Some turbine aircraft are, however, formally exempted from this requirement by the CAA. Such exemptions do carry various provisos.
One of these states that the aircraft may only be used "for any other purpose in connection with the business of the Club only when the cloud ceiling and visibility forecast for the estimated time of landing at the aerodrome at which it is intended to land and at any alternate aerodrome are greater than 1000 feet or 1nautical mile respectively". These limitations are intended primarily for aircraft ferrying and do not override the limitations which apply when engaged in actual parachute dropping.

17.3. Weather judgement

When faced with an expectation of deteriorating weather the pilot and the parachute drop zone control are faced with differing types of decision. The drop zone control is faced with deciding when conditions are safe to parachute and when they are not. This is not a decision which is the pilot's responsibility. He will, to a point, keep flying until someone tells him to stop.

What the pilot is responsible for, however, is judging weather the conditions are safe for the aircraft he is flying and the limitations of his skill, experience and licence. It is possible, for instance, for a pilot to be flying in safe parachuting conditions but with an imminent approaching snow storm. For the time being the parachutists may be happy with this situation if they feel they are going to be on the ground before it strikes. The pilot may not be in the same happy position.

Under these circumstances it is incumbent upon the pilot to make his own decision about whether or not he should continue flying. His decision should be made solely with regard to the safety of the aircraft and anybody on board (including himself)**.** This decision most definitely overrides that of the parachutists who may wish to jump. The pilot must realise that whatever pressure is put on him by parachutists on board to continue, they may not have the experience or knowledge to make an informed decision. He must also remember that if the aircraft is involved in some difficult weather incident, it will be the pilot who carries the blame for it and not the parachutists.

18. SAFETY MANAGEMENT

18.1. **General**

As well as the practical issues dealt with in this manual it is important for pilots to be aware of the safety framework within which they perform the job of jump flying and as far as possible take a proactive role within that framework. If a pilot ever feels that particular safety issues are neglected, or need addressing in some way, then he must not hesitate to involve the CCI and the Club management and voice his concerns. In addition to the BPAOM there are several other safety management vehicles which may involve pilots and place further responsibilities upon them. They are outlined briefly below.

18.2. **Standard Operating Procedures**

BPA Clubs are required to have Standard Operating Procedures (SOPs). These are rules or procedures which are specific to each individual Club and are determined by local requirements. The BPA has published guidelines for producing SOPs. These are contained within BPA Form 172 and are attached as Appendix F to this manual.

It must be noted that SOPs contain instructions to pilots which cover all local flying procedures and safety requirements, including fuelling and non confliction procedures. They are, therefore, essential reading for any pilot who is new to a particular BPA Club.

18.3. **Club Risk Assessments**

BPA Clubs are also expected to produce formal risk assessments to cover all aspects of their operation including flying. The BPA publishes Club Risk Assessment Guidelines as BPA Form 244a. This is attached as Appendix G to this manual.

Pilots will need to be familiar with the risk assessments that apply to the Club they fly for and the measures it takes to manage risks. Pilots will often be involved in reviewing risk assessments and should be prepared to initiate a risk assessment review if they feel that circumstances have arisen that warrant it.

18.4. **Pilots' Voluntary Reporting Scheme**

The BPA also runs a Pilot Reporting Scheme which is similar to the CHIRP system sponsored by the CAA. This enables pilots to report incidents or occurrences to the BPA so that the lessons learned from them can be passed on to other Clubs and pilots. The system is designed to respect confidentiality and contributors' identities are not revealed if this is requested. The BPA Pilot Voluntary Reporting form is published as BPA Form 176 and is attached as Appendix H to this manual.

19. FURTHER QUALIFICATIONS

19.1. What next

After the Approved Pilot Certificate there are two further pilot qualifications within the BPA system of approval. These are the Club Chief Pilot and Pilot Examiner certificates. These are both qualifications which jump pilots may wish to aspire to once they have gained experience as Approved Pilots. These qualifications are important within the BPA system and the posts that they represent are vital in maintaining good safety standards among the existing pool of Approved Pilots and in preserving the body of knowledge and expertise within jump flying and passing this on to new pilots as they enter the system.

19.2. Club Chief Pilot

The BPAOM requires that every Club Chief Instructor (CCI) appoints a Chief Pilot who is responsible to them for the Club's flying operations. The qualifications to become a Chief Pilot are listed in the BPAOM. They are relatively simple and depend largely upon a degree of additional experience of parachute dropping as well as a further written examination

The BPAOM does not, however, specify the duties of a Chief Pilot as it recognises that the responsibilities of the job will vary greatly depending upon the size and location of the particular Club or Centre. There are, however, published guidelines which suggest the various areas of responsibility that a Chief Pilot might be called upon to fulfil. These are published as BPA form 236 and are attached as Appendix E to this manual.

This list is very comprehensive but is not intended to necessarily represent the mandatory duties of every Chief Pilot. Each Club will require their Chief Pilot to perform some of these tasks and it is usual for the nominated tasks to be included in the Club's Standard Operating Procedures (SOPs) and for the Chief Pilot to have signed that accepts responsibility for them. The acceptance of responsibility for certain tasks in this manner does then attach certain legal and mandatory obligations by virtue of the chain of requirements which extend back via the BPAOM and into the Air Navigation Orders. For this reason the job must be taken seriously.

19.3. Pilot Examiner

Pilot Examiners play the principal role in ensuring the continuity of the BPA pilot qualification system. The requirements for becoming a Pilot Examiner are listed in the BPAOM and include further parachute dropping experience and the completion of a written exam.

The duties of a Pilot Examiner will extend to supervising and conducting the training and testing requirements for Approved Pilots as laid out in section 9 of the BPAOM. It should be noted, with regard to the conduct of tests, that Pilot Examiners do not necessarily need to hold type or class ratings for the aircraft that they are conducting the tests on. The candidates they are testing are already properly licensed to fly the aircraft concerned and examiners are only, in effect, testing to ensure that the candidate handles the aircraft and conducts the parachuting dropping aspects of the flight to an acceptable standard

When a Pilot Examiner is not familiar with the type of aircraft that he is conducting a test on, it is incumbent upon him to at least familiarise himself with the relevant aspects of its performance (critical speeds, flap settings etc.) and the correct configuration that is required when dropping actually takes place. Some Pilot Examiners who have qualified on small relatively simple aircraft, on which they may have vast experience, may nevertheless feel daunted at the prospect of examining on much larger, complex aircraft of which they have little knowledge or experience. When these circumstances present themselves it would be prudent for the Pilot Examiner to decline to conduct such a test unless he is able to access and familiarise himself with the necessary information.

Examiners must also realise that they carry a great responsibility when they clear a pilot as being proficient to conduct parachute dropping flights. The fact remains that not all pilots can handle the demands of parachute flying and examiners must not hesitate to reject those pilots that they feel are not up to the job. To pass someone out because of a misplaced kindness aimed at sparing them expense or disappointment, or simply to avoid being unpopular, is a grave weakness and anyone who feels that are likely to be overridden by these feelings should not advance themselves towards this position.

LIST OF APPENDICES

A **BPA OPERATIONS MANUAL – SECTION 9 (FLYING)**

B **BPA FORM 246 - AIRCRAFT DOCUMENT CHECKLIST**

C **BPA FORM 193 - ATSU NOTIFICATION MONITORING SHEET**

D **BPA FORM 261 - AIRCRAFT CRASH LANDING PROCEDURES**

E **BPA FORM 236 - SUGGESTED GUIDELINES FOR THE RESPONSIBILITIES OF A CLUB CHIEF PILOT**

F **BPA FORM 172 - GUIDELINES FOR PRODUCING STANDARD OPERATING PROCEDURES (SOPs)**

G **BPA FORM 244a - CLUB RISK ASSESSMENT GUIDELINES**

H **BPA FORM 176 - PILOTS VOLUNTARY REPORTING**

GLOSSARY OF TERMS

AAD This stands for Automatic Activation Device. It is a device that is now worn by most sport parachutists and is intended to activate the reserve parachute in circumstances where the parachutist has failed or has been unable to activate it himself. It is usually triggered by sensing when the rate of descent is too fast at a low height.

AFF Accelerated Free Fall. This is a method of training and progression for student parachutists which enables them to free fall from high altitude on their first jump. Early jumps are performed with two instructors helping to stabilise the fall and ensure that the free fall phase is performed safely. It is seen as a way of enabling student parachutists to quickly progress their skills and experience.

CANOPY FORMATION Is a particular aspect of parachuting which involves manoeuvring parachute canopies so that they join together to make linked formations. In its competitive format the speed with which formations are achieved is the determining factor.

DROP ZONE Often referred to as the DZ. This is the airspace above a parachute landing area (PLA – see below). It is designated on 1:500,000 charts as a 1.5nm radius circle with a parachute symbol contained within it. There is no designated upper limit though sport parachuting is not permitted to take place above 15,000 feet AGL unless special arrangements have been made via the CAA. It is a requirement that all parachuting takes place within a designated drop zone. This requirement does not, however, prevent a parachute aircraft from flying outside of the zone whilst gaining altitude for the drop. The establishment of a drop zone does not confer any rights of exclusivity to a pilot or drop zone operator. Other aircraft therefore have the right to fly into a drop zone, though this may not always be very wise.

The term DZ has also historically been used to refer to the parachute landing area and general ground facilities for parachuting. A parachute club or centre will often be referred to as a DZ.

EXIT POINT The point above the ground which has been calculated as the optimum location for parachutists to exit the aircraft and achieve a landing on their target. It will take account of wind speed and direction, free fall time, free fall drift, and where necessary, the effects of throwforward.

HANG UP An emergency situation where a parachutist is unintentionally suspended outside an aircraft, but still attached to it.

JUMPMASTER A parachutist who has been appointed to take charge of parachutists on board an aircraft and who is responsible for the safe exit of parachutists from the aircraft. He is normally the most experienced parachutist on board and where student parachutists are on board he will always be a qualified parachute instructor.

OPENING

POINT The point above the ground which has been calculated as the optimum point at which a parachutist should deploy his canopy in order to achieve a landing on his target. It will take account of wind speed and direction, opening height and parachute canopy performance.

PLA Parachute Landing Area. This is an area of ground that has been specifically designated for parachutists to land on. PLA dimensions are subject to regulations (see BPAOM).

RUN IN Sometimes referred to as the 'jump run'. This is the final phase of a parachute flight prior to actually dropping. It is the point at which the pilot has assumed the required heading towards the exit point and has achieved, or is just about to achieve, the height and airspeed that will be required at exit.

SPOTTING This is the process of calculating the exit point and guiding the aircraft towards it and then giving the exit command at the correct point. The task is normally performed by the jumpmaster.

TANDEM JUMPING Tandem jumping is the process of utilising one large parachute to carry two people. It is very popular as a means of performing a first jump. The parachute is worn and controlled by a Tandem Instructor. The student wears his own harness which is then attached to the instructor's harness so that they both face the same direction with the instructor behind the student.

WIND DRIFT INDICATOR WDI –Wind Drift Indicator often referred to as a 'widdy'. This is a brightly coloured strip of paper (crepe paper is usually favoured) which is weighted at one end in order that it descends at approx. 1000 feet per minute which is the average descent rate of most sport parachutes. It is thrown from an aircraft and its descent observed in order to assess wind drift.

WIND LINE Is an imaginary line which represents the mean wind direction from the opening point to the parachutists' target.