New Zealand Parachute Industry Association Ltd

Pilot Drop Rating Course

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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 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

THE REGULATION OF PARACHUTING

Parachuting is regulated in New Zealand by the Civil Aviation Authority (CAA). The CAA has delegated some of its regulatory functions through the Civil Aviation Act to individuals or Certified Organisations through the Rule process. The issue of parachute Drop Ratings although listed under Part 61 is one of those functions. This is why you are contacting a Certified Parachute Organisation for the issue of a Parachute Drop Rating rather than going to an Instructor in the way you would apply for other aircraft type ratings.

The Parachute Organisation will hold a 149 ARO in the same way a training organisation would hold a Part 141 certification to carry out flight training. A 149 Certification however relates to the issue of Parachute Certificates, the setting of Parachute Operating Procedures the same way Part 91 and Part 61 for example set standards and limitations for aircraft, Part 149 also allows the Parachute Organisation any other privilege specified on the 149 Certificate that is allowed by the CAR, hence the issue of Pilot Drop Ratings from Part 61. This privilege must also be listed on the Parachute Organisations Certificate and may not be automatic.

The rules that relate to parachuting in New Zealand for parachutists are generally covered within the Parachuting Rule Part 105 – Operating Rules, and Part 115 – Adventure Aviation Certification and Operations, however as PIC of an aircraft performing parachute operations the rules that you will be directly responsible for are scattered throughout the Rule Parts. Parachute Operators and Parachutists will generally have little or limited knowledge of these requirements and so as PIC of an aircraft performing parachute drops you should ensure that you are fully aware of your responsibilities.

The CAR Parts that relate to either the Parachute Aircraft, the responsibilities of the PIC of the parachute aircraft or the Pilot Drop rating can be found within the following Rule parts;

Part 1	Definitions and Abbreviations
Part 12	Accident, Incident and Statistics
Part 61	Pilot Licences and Ratings
Part 71	Designation of Airspace
Part 91	General Operating and Flight Rules
Part 105	Parachuting – Operating Rules
Part 149	Aviation Recreation Organisations – Certification

It should be stressed that a ARO (Aviation Recreation Organisation or 149 Certificate holder) NZPIA only administers civilian parachuting and parachutes. Emergency parachutes, including those required to be worn by the PIC of the drop aircraft under CAR 91.705, those worn by glider and aerobatic pilots are not covered by the Parachuting Rules.

Pilots who have any difficulty or questions relating to this guide, the exam or assessment process, should at the first instant contact the NZPIA through the web site www.nzpia.co.nz

BECOMING A JUMP PILOT

The task

The task of a jump pilot is simple to explain. His/her 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/she 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.

Qualifications

The qualifications needed to become a jump pilot are laid out in CAR 61.651

61.651 Eligibility requirements

(a) To be eligible for a parachute drop rating, a pilot must—

(1) be the holder of at least a current private pilot licence; and

(2) have at least 200 hours flight time as a pilot, including at least

100 hours as pilot-in-command of the category of aircraft being used for the parachute drop operation; and

(3) have satisfactorily completed a course in dropping parachutists conducted by a parachute organisation if the organisation's Part 149 certificate authorises the holder to conduct the course; and

(4) have demonstrated competence in the dropping of parachutists to an appropriately authorised person within a parachute organisation if the organisation's Part 149 certificate authorises the holder to conduct the assessment.

(b) A pilot who holds a current parachute drop rating issued by an ICAO Contracting State is deemed to have met the requirements of paragraph (a)(3).

THE AIRCRAFT

Types

Many types of aircraft are suitable for parachuting. Some have been designed from the outset specifically for parachuting; others have been modified since manufacture. The defining criterion is compliance with the CAR, in particular 91.705 (b) (1) regarding standard category airworthiness certificate, whether the aircraft flight manual approves the aircraft to be flown with the door open, removed or replaced etc. Careful consideration to 91.705 shows that regardless of the enthusiasm of the parachutists it is the PIC responsibility to ensure these requirements are met.

Aircraft documentation

The documentation required for parachuting aircraft is the same as for any other New Zealand registered aircraft, with the additional specific requirement for the Flight Manual to cover parachuting operations if the normal flight manual does not already do so.

Additional equipment and modifications

Most parachuting aircraft will require some additional equipment or modification in order to be able to fulfil the parachute role. Many of these modifications or additional equipment will be modifications that are required to be listed in the flight manual. A list of the types of additional equipment you might see on parachute aircraft that are likely to be "an approved modification" requiring listing within the aircrafts flight manual might be:

1. In-flight doors
2. Wind deflectors
3. Flap switch isolating plates
4. External camera mounts
5. External Steps
6. External and internal hand rails
7. Wheel steps
8. Oxygen systems
9. Non-standard seating
10. Restraints
11. Jumper exits lights

If you see these types of equipment and modification you should expect to see supplements in the aircraft flight manual regarding the operational limitations of the aircraft. As PIC you should check the flight manual even if you are familiar with the type of aircraft.

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 whether the aircraft is used primarily for parachuting or being used for a display or on a causal basis.

Most Parachute Operators will have their aircraft kept in permanent readiness for parachuting but occasionally they 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. Once again the responsibility lies on the pilot under CAR 91.705. While the Parachute Operator and aircraft owner or Operator will undoubtedly be a useful and hopefully helpful asset in assisting to ensure that the process is carried out safely and in compliance with the Rules, once again the responsibility is actually on the PIC to ensure that the 91.705 is completed. Part 115 however requires the Operator to detail how this requirement will be met within an exposition acceptable to CAA. When operating under this Rule you should check with the operator to check that you are in compliance with the operating procedures set out by the operator of the aircraft you are going to fly. Each aircraft although they may be the same make and model of a previous model you may have flown may have different operating procedures set out by different operators.

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. For some 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.

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.

The Cessna 172/180/182/185 varieties can have an upward opening door modification which does permit use in flight. Aircraft such as the Cressco XL or Cessna Caravan have roller type doors that have specific operational requirements and in some cases have specific instructions and operational requirements that may not be obvious to the inexperienced operator.

Seat / seat belt removal

It is quite common for all of the passenger seats and seat belts in jump aircraft to be removed prior to parachuting use. Accidents have occurred in New Zealand from leaving some seats or seat belts in the aircraft only to have them either entangle with the controls of the aircraft or entangle with the parachutists during the flight.

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.

Restraints

Restraints are not mandatory in New Zealand. However they are optional and in some larger aircraft they are optional by the manufacturer. They are usually of a single point type and are used only for the take of or in the case of an aborted jump landing.

If restraints are fitted to the aircraft however you need to understand that loose restraints in aircraft where the parachutists are unable to stand up can cause considerable risk of premature parachute deployment inside the aircraft. The risk if snagging equipment on exit or prior to exit while the aircraft door is open is extremely dangerous to all and the aircraft. Aircraft have been destroyed and fatalities have resulted from premature deployments of this nature in the past. The correct stowage of all restraints before the in-flight door is opened is extremely important if restraints are used in any aircraft.

Where parachutists are utilising aircraft seating it would be usual for them to use whatever restraint belts came with the seats however it would be usual for this type of aircraft for the parachutist to be able to stand and walk to the door rather than sit and shuffle as in a smaller type of aircraft.

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 should be carried out by a licensed aircraft engineer and should not be attempted by an unqualified person.

Floor coverings

It is common practice in smaller aircraft to cover the entire floor with a mat or floor covering to protect the aircraft floor covering and provide a smooth surface clear of any snags for parachute equipment. It is very important that this mat or covering is secure to the inside of the aircraft. When the door is open there is a high probability that if this mat is not secure it will lift and be blown out the door after the last parachutist and entangle with the tail plane of the aircraft.

Static Line strong point

If an aircraft is to be used for static line dispatching, you will need to ensure the static line attachment point is suitable. 91.705 (b) (5). A static line is normally a webbing strop, one end is connected to the parachute equipment and will have a flexible pin holding the container of the main parachute closed the other end will have either a specific clip, ring attachment that needs to be attached to a strong point in the aircraft. This is the means static line operated parachutes are attached to the aircraft so that their deployment is initiated immediately the parachutists exit the aircraft. The length of the static line needs to be long enough that the parachute deployment does not begin until the parachutist is clear of the aircraft. Therefore a static line attachment point or static line for one aircraft may not be suitable in all circumstances and discussions with a Parachute Instructor and an aircraft engineer would be advisable.

Some of the issues that must be considered before identifying any strong point and then using this point as for static line dispatching would be;

1. Is the strong point suitable
2. Is the angle of load subjected by the static line on the strong point not going to overload the point?
3. The strong point will generally be in front of the door so as to not "wrap" the static line around the airframe during the parachutist exit.
4. Should the parachutist become hung up, (the parachutist be hanging under the aircraft in flight by the static line) what result would this have on the strong point. Would this result in a structural failure of the aircraft. It was common to connect the static lines to the pilot seats in Cessna aircraft; in this case the seat failure would most likely result in the seat being pulled from the aircraft.
5. What length is the static lines being used?
6. Does the aircraft need an approved modification?
7. If an approved modification is required this will need to be included in the aircraft flight manual?
8. The jumpmaster will usually want to have the strong point close to the door so that the static line attachment can be checked prior to the parachutist exiting.

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. Grab rails and steps have to be installed by engineers to approved designs, included in the flight manual and are not usually quickly or easily detached.

Ancillary cabin equipment

Parachuting operations require various items of ancillary equipment to be carried in the cabin. Among these are carabineer strops, knives, aerial photographs, stowage bags, stopwatches etc. It would normally not be the responsibility of the pilot to ensure that the necessary items were on board, but it should be a safety check to ensure that a hook knife is always carried and accessible to the jumpmaster whenever static line dispatches are being carried out.

Parachutes and Parachute Equipment

A general understanding of parachutes and parachuting equipment will assist the pilot in understanding the potential hazards that they may create.

PILOT CHUTES

These are small, sometimes spring loaded parachutes, designed to spring into the air stream when released from the container. The pilot chute acts as an anchor and draws the parachute from the container as the parachutist falls away from it. The pilot chute is designed to inflate quickly and in almost any air flow.

PARACHUTES

The main parachutes can be divided into two broad classes "round" and "square". The round parachutes are seldom even used as reserve parachutes nowadays. The square class includes all aerofoil shaped parachutes which are often referred to simply as squares or ram-airs and may be main or reserve parachutes.
The square parachutes can achieve airspeeds of up to 50 knots. The airspeed is controlled by changing the angle of attack of the wing. Turns are accomplished by pulling the steering line differentially which has an effect similar to wing-warping. Pulling down the steering lines has the effect of increasing the angle of attack, which results in a slower forward speed and a lower descent rate. Square parachutes are susceptible to turbulence, which can cause them to collapse. This can be very dangerous below 500 feet and can be caused by wake turbulence or prop blast during taxiing.

RESERVE PARACHUTES

On every jump, the parachutist will wear two parachutes, one main and one reserve. The reserve parachute to be used in case of malfunction of the main parachute.
Pilot's rigs contain only one emergency parachute – most are round emergency parachutes. Be sure to get a briefing on its use and aware of the position of the ripcord (both in case you need to use it and to prevent accidental operation).

HARNESS AND CONTAINERS

The parachute harness consists of main lift webs, which start at the shoulder, form an X across the back, are joined across the lower back and connect to two parallel straps to the shoulders. The basic harness has two leg straps and a chest strap.
The containers for the main and reserve parachutes are mounted on the harness. Both containers are attached to the back portion of the harness and the assembly is called a "piggy back" system. The parachute lines terminate at the "risers" and the risers of the main and reserve parachutes are connected to the main lift web at or just below the shoulder. The main parachute risers are attached through a quick release (3-ring) mechanism to allow the parachute to be jettisoned in case of malfunction.
The container is closed by a pin system. The ripcord handles or activation systems for the reserve are on the chest portion of the harness and are therefore quite unlikely to be snagged or pulled accidentally if care is taken. The main activation for most experienced parachutists' rigs can be in several places around the right leg strap or lower corner of the backpack. These have been caught and operated by flap levers, door edges and while perched in the V of the wing strut and do need some attention to ensure they are secure while moving around or turning in the aircraft.

PARACHUTE FLIGHT PROCEDURES

General

The general procedures required for the dropping of parachutists will be much the same at any location throughout New Zealand. Before we go through these general procedures it is important to go through some of the responsibilities of the PIC in relation to the Civil Aviation Rules. There is one particular rule that as PIC is fundamental to your responsibility as a Parachute Drop Pilot.

91.705 (c)

(c) A pilot performing a parachute-drop operation shall not permit a person to make a parachute descent from the aircraft, unless—
(1) the person or persons making the descent have provided the pilot with the details of the proposed descent prior to take-off; and
(2) the pilot is satisfied that each person's descent is—
(i) authorised by the holder of an aviation recreation organisation certificate issued under Part 149; or
(ii) approved by the Director.

91.705 (c) (2) is the rule that provides the most confusion. As a Parachute Organisation or 149 Holder has the ability to set their own procedures and processes, it is most likely that if there is more than one 149 Certificate issued, that there will be more than one way of compliance with this rule. As PIC you need to be satisfied that the parachutists that you are carrying are in fact complying with the procedures of the ARO certificate holder, this is not the Parachute Operator.

Airspace

CAR 105 has specific rules regarding airspace and parachute descents. While you might expect to find airspace rules in Part 71 in this case the rule is in Part 105. The responsibility in these rules lies with the parachutist; it is unlikely the parachutist will have a detailed knowledge of airspace rules. Airways NZ has a MOU with the parachute industry that sets out what is expected from both parties in relation to parachuting in New Zealand.

105.13 Parachute descents

A person must not make a parachute descent unless the descent is—

(1) within controlled airspace classified as C or D airspace under Part 71; or

(2) within an area authorised by a parachute organisation provided that area is depicted on a current aeronautical chart or the details of the parachuting activity have been promulgated by means of an AIP Supplement or NOTAM.

105.19 Controlled airspace

(a) A person must not carry out a parachute operation in controlled airspace except in accordance with an agreement between the local parachute operators and the ATC unit responsible for the airspace.

(b) A person must not make a parachute descent in or into controlled airspace unless —

(1) an ATC clearance has been issued for the parachute descent before the person exits from the parachute-drop aircraft; and

(2) the person descends in accordance with the ATC clearance.

105.25 Clearance from cloud

(a) Except as provided in paragraph (b), a person making a parachute descent must remain clear of cloud.

(b) A person may descend through cloud in airspace designated under Part 71 as controlled airspace, and classified as class C or D, if the person has an ATC clearance to do so.

Within these rules there are requirements for agreements with a number of parties depending on the type of airspace, to avoid unnecessary conflict as PIC it is advised to ensure these agreements are in place prior to carrying out any parachute drops.

Aerodromes, Military and restricted airspace are specifically dealt with;

105.21 Descents onto aerodromes

A person making a parachute descent onto an aerodrome must—

(1) have the prior agreement of the aerodrome operator; and

(2) if ATS is not in attendance, avoid the pattern of traffic formed by aircraft operating within the aerodrome traffic circuit at the aerodrome.

105.23 Descents within military operating areas and restricted areas

A person must not make a parachute descent within a military operating area or a restricted area designated under Part 71 unless they have the approval of the administering authority responsible for the military operating area or the restricted area, as the case may be.

Command of aircraft

Ultimately the pilot is in command of the aircraft and all persons on board. The jumpmaster, however, may be regarded as having a senior role within the command structure, as in some situations he/she 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/she must not hesitate to conduct the flight in whatever manner he/she 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.

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.

Manifesting

There is a requirement that all parachute flights are correctly manifested prior to take off and this is not normally carried in the aircraft. 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.

Much of this information is transferred into the requirements of Part 115.223 for the weight and balance and limitations requirements you are responsible for covered later within this course.

It is usual for this to be covered by a procedure ensuring compliance with CAR 91.705 (c) (1)

Pre-flight briefing

The brief would include an indication of the exit point, 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.

Take off and climb

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). It is also good practice for the pilot to obtain confirmation from the jumpmaster that the load is ready for take-off.

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. 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.

Mixture leaning. Many pilots may not have been taught the importance of correct mixture leaning during their training. This is primarily because most pilot 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 engine 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 engine 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.

Calculation of exit and opening point

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.

Pre-flight calculation. The most widely used wind forecast information source is obtainable over the internet and lists the forecast wind speed and direction for various altitudes from 1000 to 20000 feet at various locations. 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.

USE OF GPS

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.

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.

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 jumper. The advent of GPS has tended to shift the focus of this responsibility towards the pilot. 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.

The GPS however when used correctly can accurately and effectively be used to check the forecast winds at altitude and a responsible pilot will notify the jumpers should any difference show between what was expected and what is actual. The run in and spot can then be changed or even the drop aborted if it is found the upper winds are greater than expected.

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 *o*n the run in the pilot will obtain clearance to drop from ATC if appropriate or provide the appropriate radio calls. 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 status to the jumpers. 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 jumpers 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 in-flight 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 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.

The exit

It should be stressed at this point that the responsibility for exiting the aircraft at the correct exit point is entirely the jumpers. 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 jumper. 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 jumper. At the point of exit the jumper 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 prop-wash 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.

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 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.

The Descent

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 ATC is notified on the radio so that they can anticipate control directions to other aircraft.

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 engine 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.

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 or wing suit flying 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.

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 pre-set 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, the Operator, 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.

There are several types of automatic container activators in use for students and experienced jumpers.
An automatic activation device is designed to open the parachute by using energy stored in a spring or pyrotechnic charge. The spring or the charge are released or fired either by a signal from a timer, an altitude pressure sensor or a rate-of-altitude-change sensor with many units using a combination of these signals to activate the mechanism.
The pilot must be aware when automatic activation devices are on board and how to disarm one should it be necessary for a person wearing one to descend with the aircraft. In practice the jumper or the jumpmaster will take care of this, but the pilot should ensure that it has been done before the aircraft if placed into a high rate of descent.

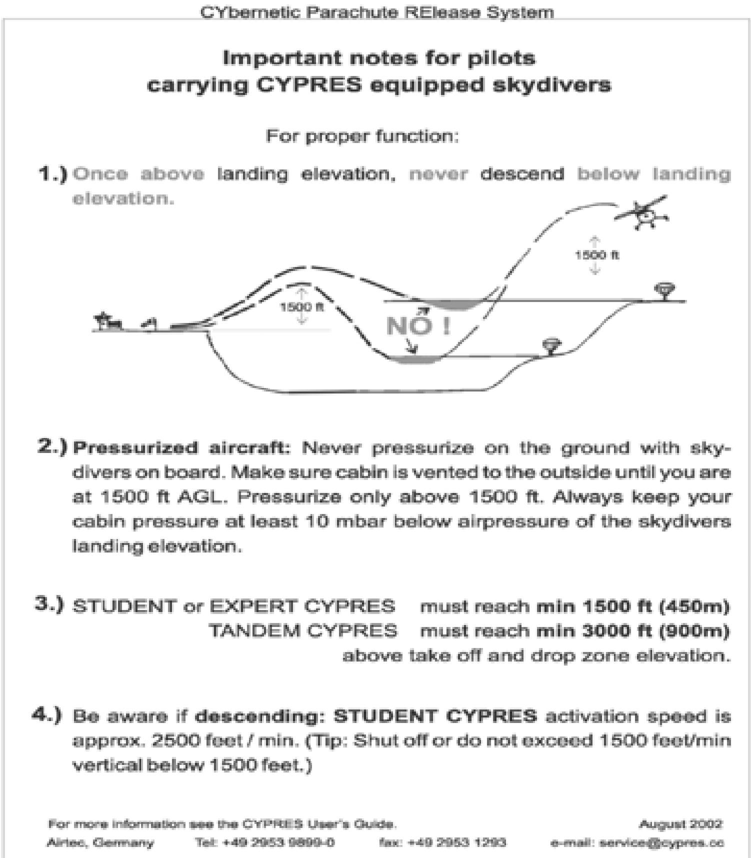
There is an AAD for experienced jumpers in common use called a CYPRES. However there are number of similar types of AADs on the market today.
These units come in various versions and you are unlikely to know or be able to tell them apart without a certain amount of technical knowledge that you simply are not expected to have.

For this reason you should consider to treat all AADs the same and consider the conditions you may encounter as nearly all parachutists will have an AAD fitted to their equipment.

Notes for Pilots regarding the CYPRES AAD

Expert & Student Cypres are not "armed" if the aircraft is exited before it reaches 1,500 feet above the height at which the jumper intends to land. In the case of the Tandem Cypres, 3000 feet has to be reached. Once the aircraft has climbed through those altitudes and Cypres has become fully operational, it will work for any exit height.
A Student Cypres can activate on descent at a rate of ~2,500 feet per minute, at an altitude of ~1,000ft. Therefore Student Cypres must be switched off when descending in the aircraft.
Expert & Tandem Cypres will activate at a descent rate ~6,500ft per minute at ~1,000ft for Expert & 1,900ft for Tandem therefore should not need to be switched off.

The drop aircraft must not descend to altitudes below the landing elevation



CYbernetic Parachute RElease System

Important notes for pilots carrying CYPRES equipped skydivers

For proper function:

1.) Once above landing elevation, never descend below landing elevation.

2.) **Pressurized aircraft:** Never pressurize on the ground with skydivers on board. Make sure cabin is vented to the outside until you are at 1500 ft AGL. Pressurize only above 1500 ft. Always keep your cabin pressure at least 10 mbar below airpressure of the skydivers landing elevation.

3.) STUDENT or EXPERT CYPRES must reach **min 1500 ft (450m)**
TANDEM CYPRES must reach **min 3000 ft (900m)**
above take off and drop zone elevation.

4.) Be aware if **descending: STUDENT CYPRES** activation speed is approx. 2500 feet / min. (Tip: Shut off or do not exceed 1500 feet/min vertical below 1500 feet.)

For more information see the CYPRES User's Guide. August 2002
Airtec, Germany Tel: +49 2953 9899-0 fax: +49 2953 1293 e-mail: service@cypres.cc

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.

WEIGHT AND BALANCE

WEIGHT & BALANCE

The weight and Balance Sheet is a particularly important document as far as parachute operations are concerned and it is important that pilots understand its use. The Weight and Balance Data is based on the information contained in a Weighing Report which is prepared by the aircraft manufacturer.

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 balance data 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.

Weight and balance calculations

Weight and Balance Procedures. The pilot in command is solely responsible to assure that his/her aircraft is properly loaded and operated so that it stays within gross weight and centre of gravity (CG) limitations. Additional aircraft station position information (loading schedule) should be obtained by the pilot in command for future weight and balance computations. In addition, pilots are solely responsible for reviewing these records and/or the flight manual to become familiar with an aircraft's weight and balance procedures and flight characteristics.
When Computing Weight and Balance. The pilot in command must include the following factors. If this information is not obtained, the pilot would experience considerable difficulty in determining the actual loaded aircraft CG.

a) The maximum allowable gross weight and the CG limitations.
b) The maximum allowable maximum zero fuel weight.
c) The weight of all standard equipment which has been removed (seats and door, etc.)
d) The new empty weight and CG location.
e) The weight and CG location when the aircraft is fully loaded.
f) The aircraft's weight and CG locations for variations in the number of parachutists and fuel carried on each flight.
g) The minimum allowable weight with minimum fuel and CG limitations. (ie. Empty load on decent)

The weight and location of jumpers during each phase of the flight in order to assure that the aircraft stays within CG limits. The pilot in command should keep in mind that the shifting weight distribution of skydivers as they gather at a cabin door in preparation for exit will require a determination of any adverse effects this will have on the aircraft's weight and balance, controllability, and stability.

Suitable placards should be located in the aircraft to help the pilot inform skydivers of the maximum approved loading and weight distribution. These placards should be located where they will be seen by anyone boarding the aircraft and clearly show the maximum approved seating capacity and the load distribution. However, since many parachutists are not familiar with aircraft weight and balance procedures, it becomes the pilot in command's responsibility to ensure that proper weight and balance is maintained throughout all parachute jump operations. 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.

It is advisable, 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.

Weight and balance limitations

When calculating weight and balance the limiting factor will often be the most skydivers with the minimum fuel that it is possible to carry. Often the aircraft manufacturers will make claims regarding the number of parachutists that can be carried in a particular aircraft but the responsibility remains with the pilot in command to remain within the aircraft limitations. This is normally only a factor if the aircraft is going to carry more passengers than the aircraft would be certified to carry in passenger mode.

Each aircraft will is likely to be different depending on a number of factors based on the empty weight of each individual aircraft the STC or modifications made to that aircraft etc. Do not expect that all aircraft of the same type are the same and can carry the same load.

Other limiting factors that can limit the number of parachutists that it may be possible to carry on board an aircraft are:

- Maximum zero fuel weight,
- Maximum landing weight, this could affect how many skydivers it is possible to land with should the jump be aborted.
- CG limits once all parachutist have exited the aircraft, some aircraft will require a minimum fuel quantity to be held when the aircraft is striped of weight and set up specifically for skydiving.
- If CG limits are AFT or FWD limits at MAUW consideration needs to be given to CG limits when fuel is burnt.
- CG limits as parachutists move towards the door on exit, how does this affect the CG if half the load remains in the stations they were for the climb or do they need to move progressively towards the door.
- Floor or station limitations for weight. Aircraft used in cargo configuration can have weight limitations in certain stations.

General

You as pilot are responsible for the safe loading of your airplane and must ensure that it is not overloaded. The performance of an airplane is influenced by its weight and overloading it will cause serious problems. The take-off run necessary to become airborne will be longer. In some cases, the required take-off run may be greater than the available runway. The angle of climb and the rate of climb will be reduced. Maximum ceiling will be lowered and range shortened. Landing speed will be higher and the landing roll longer. In addition, the additional weight may cause structural stresses during manoeuvres and turbulence that could lead to damage.

The total gross weight authorized for any particular type of airplane must therefore never be exceeded. A pilot must be capable of estimating the proper ratio of fuel, oil and payload permissible for a flight of any given duration. The weight limitations of some general aviation airplanes used in skydiving do not allow for maximum loads to be carried, maximum fuel to be carried or all of the cabin space to be utilised. It is necessary, in just about every case, to choose between parachutists’ cabin space and full fuel tanks.

The distribution of weight is also of vital importance since the position of the centre of gravity affects the stability of the airplane. In loading an airplane, the C.G. must be within the permissible range and remain so during the flight to ensure the stability and manoeuvrability of the airplane during flight.

Airplane manufacturers publish weight and balance limits for their airplanes. This information can be found in two sources:

1. The Aircraft Weight and Balance Report.

2. The Airplane Flight Manual.

The information in the Airplane Flight Manual is general for the particular model of airplane.

The information in the Aircraft Weight and Balance Report is particular to a specific airplane. The airplane with all equipment installed is weighed and the C.G. limits calculated and this information is tabulated on the report that accompanies the airplane logbooks. If alterations or modifications are made or additional equipment added to the airplane, the weight and balance must be recalculated and a new report prepared.

Fuel and 0il: The Airplane Flight Manuals for airplanes of U.S. manufacture give fuel and oil quantities in U.S. gallons. Canadian manufactured airplanes of older vintage may have manuals that give fuel and oil quantities in Imperial gallons. Some recently printed manuals may give fuel and oil quantities in litres. At all airports in New Zealand, fuel is now dispensed in litres. It is therefore necessary to convert from litres to U.S. or Imperial gallons as required for your particular airplane. To convert litres to U.S. gallons, multiply by .264178. To convert litres to Imperial gallons, multiply by.219975.

The following weights are for average density at the standard air temperature of 15° C. At colder temperatures, the weights increase slightly. For example, at -40° C, one litre of aviation gasoline weighs 1.69 lbs.

	Litre	U.S. Gallon	Imp. Gallon
Aviation Gas	1.58 lb.	6.0 lb.	7.20 lb.
JP-4	1.76 lb.	6.6 lb.	8.01 lb.
Kerosene	1.85 lb.	7.0 lb.	8.39 lb.
Oil	1.95 lb.	7.5 lb.	8.5 lb.

Maximum Landing Weight: The maximum weight approved for landing touchdown. Most multi-engine airplanes which operate over long stage lengths consume considerable weights of fuel. As a result, their weight is appreciably less on landing than at take-off. Designers take advantage of this condition to stress the airplane for the lighter landing loads, thus saving structural weight. If the flight has been of short duration, fuel or payload may have to be jettisoned reduce the gross weight maximum or maximum landing weight. It is not acceptable to simply allow for the ability to jettison parachutists in the case of an emergency to reduce the aircraft weight down to maximum landing weight. If sufficient height cannot be achieved or the environmental conditions do not allow the parachutist to exit the aircraft, then t will be impossible to reduce the aircraft to the maximum landing weight allowable by the manufacturer. In most cases of aborted parachute drops the situation or condition usually occurs when it is also too dangerous to carry out a safe parachute descent.

Maximum Weight - Zero Fuel: Some planes carry fuel in their wings, the weight of which relieves; the bending moments imposed on the wings by the lift. The maximum weight - zero fuel limits the load which may be carried in the fuselage. Any increase in weight in the form of load carried fuselage must be counterbalanced by adding weight in the form of fuel in the wings.

Balance limits

The position of the centre of gravity along its longitudinal axis affects the stability of the airplane. There are forward and aft limits established by the aircraft design engineers beyond which the C.G. should not be located for flight. These limits are set to assure that sufficient elevator deflection is available for all phases of flight. If the C.G. is too far forward, the airplane will be nose heavy, if too far aft, tail heavy. An airplane whose centre of gravity is too far aft may be dangerously unstable and will possess abnormal stall and spin characteristics. Recovery may be difficult if not impossible because the pilot is running out of elevator control. It is, therefore, the pilot's responsibility when loading an airplane to see that the C.G. lies within the recommended limits.

Usually the Airplane Owner's Manual lists a separate weight limitation for the baggage compartment or specific sections in addition to the gross weight limitation of the whole airplane. This is a factor to which the pilot must pay close attention, for overloading these sections or stations (even if the plane itself is not overloaded) may move the C.G. too far aft and affect longitudinal control or exceed the limitations of the flight manual.

There is no relief provided in the rules for an aircraft to operate over weight or outside the limitations of the aircraft flight manual. Rules also require the PIC to adhere to the limitations set by the aircraft manufacturer. The Aircraft flight manual may also specify such things as which fuel tank is to be emptied first. Such instructions should be carefully complied with.

As the flight of the airplane progresses and fuel is consumed, the weight of the airplane decreases. Its distribution of weight also changes and hence the C.G. changes. The pilot must take into account this situation and calculate the weight and balance not only for the beginning of the flight but also for the end of it after the parachutists have exited.

Weight and balance and flight performance

The flight characteristics of an airplane at gross weight with the C.G. very near its most aft limits are very different from those of the same airplane lightly loaded.

For lift and weight to be in equilibrium in order to maintain any desired attitude of flight, more lift must be produced to balance the heavy weight. To achieve this, the airplane must be flown at an increased angle of attack. As a result, the wing will stall sooner (i.e. at a higher airspeed) when the airplane is fully loaded than when it is light. Stalling speed in turns (that is, at increased load factors) will also be higher. In fact, everything connected with lift will be affected. Take-off runs will be longer, angle of climb and rate of climb will be reduced and, because of the increased drag generated by the higher angle of attack, fuel consumption will be higher than normal for any given airspeed. Severe g-forces are more likely to cause stress to the airframe supporting a heavy payload.

An aft C.G. makes the airplane less stable, making recovery from manoeuvres more difficult. The airplane is more easily upset gusts. However, with an aft C.G., the airplane stalls at a slightly lower airspeed. To counteract the tail heaviness of the aft C.G., the elevator must be trimmed for an up load. The horizontal stabilizer, as a result, produces extra lift and the wings, correspondingly, hold a slightly lower angle of attack.

An airplane with a forward centre of gravity, being nose heavy, is more stable but more pressure on the elevator controls will be necessary to raise the nose - a fact to remember on the landing flare. The forward C.G. means a somewhat higher stalling speed another fact to remember during take-offs and landings.

Every pilot should be aware of these general characteristics, shared by most airplanes, when they are loaded to their weight and balance limits. The important thing to remember is that these characteristics are more pronounced as the limits are approached and may become dangerous if they are exceeded. Overloading, as well as the immediate degradation of performance, subjects the airplane to unseen stresses and precipitates component fatigue.

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 placard 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 88kg) 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 seat 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.

STALLS

A stall occurs when the smooth airflow over the airplane's wing is disrupted, and the lift degenerates rapidly. This is caused when the wing exceeds its critical angle of attack. This can occur at any airspeed, in any attitude, with any power setting.

It is important to understand this as during parachute flying some aircraft allow for operations with aft CG at higher airspeeds than is listed in the AFM while parachutists are exiting. This may make aircraft stall warnings and Vmc speeds different to AFM limitations. Aircraft that do not have STC modifications or have been approved for parachuting in their respective fight manuals need specific attention during exit of parachutists.
Stall recovery, recognition and review you received during your aircraft type rating may not necessarily prepare you for the conditions you may encounter during parachuting when the likelihood of aircraft stalling is most possible.

The longer it takes to recognize the approaching stall, the more complete the stall is likely to become, the greater the risk to the parachutists, the aircraft and the greater the loss of altitude to be expected.

RECOGNITION OF STALLS

Pilots must recognize the flight conditions that are conducive to stalls and know how to apply the necessary corrective action. They should learn to recognize an approaching stall by sight, sound, and feel. The following cues may be useful in recognizing the approaching stall.

- Vision is useful in detecting a stall condition by noting the attitude of the airplane. This sense can only be relied on when the stall is the result of an unusual attitude of the airplane. Since the airplane can also be stalled from a normal attitude, vision in this instance would be of little help in detecting the approaching stall.
- Hearing is also helpful in sensing a stall condition. In the case of fixed-pitch propeller airplanes in a power-on condition, a change in sound due to loss of revolutions per minute (r.p.m.) is particularly noticeable. The lessening of the noise made by the air flowing along the airplane structure as airspeed decreases is also quite noticeable, and when the stall is almost complete, vibration and incident noises often increase greatly.
- Kinaesthesia, or the sensing of changes in direction or speed of motion, is probably the most important and the best indicator to the trained and experienced pilot. If this sensitivity is properly developed, it will warn of a decrease in speed or the beginning of a settling or mushing of the airplane.
- Feel is an important sense in recognizing the onset of a stall. The feeling of control pressures is very important. As speed is reduced, the resistance to pressures on the controls becomes progressively less. Pressures exerted on the controls tend to become movements of the control surfaces. The lag between these movements and the response of the airplane becomes greater, until in a complete stall all controls can be moved with almost no resistance, and with little immediate effect on the airplane. Just before the stall occurs, buffeting, uncontrollable pitching, or vibrations may begin.

FUEL MAGANEMENT

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, and 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.

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.
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. 'ZK ABC– '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.

Errors can also occur when dipping on uneven surfaces. Fuel tanks can be connected together and you should have a good understanding of the fuel system of the aircraft in all cases.

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/her 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 pilots must never hesitate to shut down and recheck fuel levels if they are unsure.

HEIGHT LIMITS

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.

Height limits

Except in emergency situations, or specially exempted circumstances, parachute drops will normally take place from a minimum of 2500 feet and a maximum of 20,000 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.

USE OF OXYGEN

The requirements regarding height limits and the use of oxygen are slightly different for parachutists than for pilots.

Pilot requirements are covered under CAR 91.209

91.209 Use of oxygen equipment
(a) A pilot-in-command of an unpressurised aircraft must, during any time that the aircraft is being operated above 13 000 feet AMSL and during any period of more than 30 minutes that the aircraft is being operated between 10 000 feet and up to and including 13 000 feet AMSL, require—
(1) each crew member and each passenger to use supplemental oxygen; and
(2) each crew member to use portable oxygen equipment, including a regulator and attached oxygen mask, for any duty requiring movement from their usual station.

Parachutist's requirements are covered under CAR 105.27

105.27 Descents from higher altitudes
(a) Each person making a parachute descent from an unpressurised aircraft shall—
(1) when between altitudes of 10 000 and 13 000 feet for longer than 30 minutes, use supplementary oxygen until immediately prior to exiting the aircraft; and

(2) when between altitudes of 13 000 and 20 000 feet, use supplementary oxygen until immediately prior to exiting the aircraft.
(b) Each person making a parachute descent from a pressurised aircraft shall, when between altitudes of 13 000 and 20 000 feet, use supplementary oxygen during the period from immediately prior to depressurisation to immediately prior to exiting the aircraft.
(c) Each person making a parachute descent from altitudes above 13 000 feet shall have satisfactorily completed a training course, for high altitude descents, conducted by a parachute organisation.
(d) Each person making a parachute descent from altitudes above 20 000 feet shall use individual supplementary oxygen from immediately prior to depressurisation, or from immediately after disconnection from any aircraft mounted supplementary oxygen system, until descent below an altitude of 13 000 feet.

Oxygen requirements are also covered under CAR 115.571

(3) each person participating in the tandem parachute descent operation is equipped with, and uses, supplementary oxygen above 10000 feet AMSL when a tandem parachute descent is planned to take place above FL130

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 cloud base 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.

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. 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.

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.

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.

COMMUNICATION PROCEDURES

Radio Communication

It is important to demonstrate professionalism in all airborne transmissions, whether on an unattended frequency, local ATC or Control. Refrain from chitchat and keep transmissions to the correct terminology.

START

Start clearance is required by some ATC. Check your local conditions requirements. Traffic checks are also a good idea prior to starting if the operation is in a high traffic density area.

TAXI

A local frequency call for taxi is required giving sortie details including:

- Number of persons on board
- Type of POB – student, experienced or tandem *[all have different activation altitudes and rates of descent]*
- Altitudes required
- Run ins required
- Any additional information like canopies opening higher than normal
- Observers remaining with the aircraft
- Plus QNH etc

This may be modified if operating from an unattended airfield.

CLIMB

Standard airborne clearances when entering different airspace need to be observed as well as the additional clearance for the drop.

JUMP RUN

A clearance should be requested at least 2 minutes prior to the intended drop. Parachutists must not exit the aircraft until this clearance is given by the appropriate ATC. If you are requested to operate on a Control frequency, clearance for the drop is still required from the local ATC. Alternatively, if operating from an unattended airfield, transmission of intention to drop is required to inform local traffic of impending parachuting hazard.

It is a common requirement to operate/monitor two frequencies – it is helpful to have two functional VHF radios in the aircraft.

DESCENT

Immediately following the parachutists' exit, the pilot is required to transmit "Jumpers away" and advises descent or requests descent clearance. Observe all clearances/requests when vacating different airspace.

DISPLAY PARACHUTING

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 air shows 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 Rules covered in parts 91, 115 and 105 regarding airspace, approvals, agreements and aircraft need to be considered before you carry out any parachuting outside "normal' locations.

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.

Note:

Smoke canisters while they may well be wanted by the parachutists, fall under the definition of "dangerous goods" and CAR Part 92 needs to be complied with before you should allow them to be carried on the aircraft.

EMERGENCIES

General

Pilots should be familiar with the emergency procedures which relate to the specific aircraft they are flying and 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.

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.

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

b) Use of restraints
c) Adoption of brace positions
d) AADs

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.

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 NZPIA 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).

Premature parachute deployment

This situation can occur 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.

Parachutists 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.

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 ATC and the Operator 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.

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 or if the speed is too high for a Canopy Formation exercise.

SPECIAL PROCEDURES

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.

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 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.

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

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 tail plane or elevator and cause structural damage. A correctly configured assembly will be a few inches short of the tail plane 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.

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 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.

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’.

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.

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 the pilot should advise the ATC that parachute canopies are opening high

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.

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.

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 and 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 where an aircraft has run into free fallers who were exiting above and ahead of the aircraft concerned.

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.

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.

HUMAN FACTORS

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.

The most common response to flight safety and accidents when fatigue is suspected is the introduction of flight and duty times. Most flight and duty times however are not, or were not set up for parachuting flying and as such seldom take into account many factors of this activity that do not exist in the commercial aviation sector.

The high dependency on weather, with long waiting period and then often period of high pressure sometimes long hours with little fixed routine do not lend themselves well to a fixed flight and duty time structure. The chances of fatigue becoming a factor in an accident remain even with the strictest duty time still exist and as a parachute drop pilot you may need to be more aware of this than perhaps many other types of flying.

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 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.

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 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.

Sleep Deprivation

Sleep deprivation will affect your levels of energy. What has been shown is that in accidents where fatigue been highlighted as a possible cause; there has often been an acute or chronic sleep loss somewhere in the last 72 hours, sometimes longer.

1. Has your sleep been interrupted or disturbed in the last 72 hours?
2. Has your normal sleep pattern changed in the last 72 hours?
3. Have you had the same number of sleep hours each night for the last 7 days?
4. Are there factors in your environment that interfere with your sleep? (noise, light, phone calls etc)
5. Have you been working a combined total of more than 12 hours per day for more than 3 consecutive days?

It is important that your sleep patterns are regular. When you have differing sleep lengths you are more likely to suffer from fatigue related mistakes.

Circadian Factors

The primary circadian trough is approximately midnight to 0600, especially 0300 to 0500. However there is a secondary "lull" at approximately 1500 to 1700.
Careful consideration needs to be given around circadian factors when periods of operational delays are likely to run into this area during the afternoon.

Sleep Disorders, Health and Drug Issues

Your own individual performance will normally be affected before you ask for medical advice. The fear of losing your aviation medical and affecting your future in the aviation industry has in the past resulted in some pilots flying and putting passengers at risk. The use of non-prescription drugs is not an acceptable method of managing fatigue.

If you are on prescribed medication, does your medication have any warnings regarding sleepiness, insomnia, or any other sleep related issues that may affect your sleep patterns?

Time Awake, Energy Levels

When did you last sleep and for how long? When did you last eat or drink? Managing your own energy levels is very important to ensuring that you do not make fatigue related mistakes.

In turbine aircraft at large operations, many of the usual activities other pilots in GA may usually complete may be completed for you. You may find yourself in the cockpit for many hours without a break and in most aircraft no co-pilot to talk to.

It is important that you manage your fatigue levels not only while you are flying but also during breaks, down time and time off. Parachute drop flying can be very challenging and physically draining, when you are drained of energy, fatigued or dehydrated mistakes are more likely to happen.

SAFETY IN THE AIRCRAFT

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.

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 whether 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 front. 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.

COMPLETION OF THE PILOT DROP RATING COURSE.

This course represents the material you require to provide you with much of the knowledge required to pass the Pilot Drop Rating Exam.

You may feel you have enough knowledge to sit the exam know or you may feel that you require further assistance and guidance before completing the exam. You should contact a NZPIA Parachute Drop Rating Assessor or the NZPIA for a list of available assessors in your areas to sit the exam. You may sit this exam multiple times; there is no additional cost for repeating the exam or future competency checks.

Once this process is completed you may apply to sit the competency assessment with a NZPIA Drop Pilot Assessor and at that time you will be assessed on your technical knowledge and the competency demonstration will take the following path.

1. Confirmation that you have sat and passed the NZPIA online exam in the past 90 days.
2. A knowledge and technical competency assessment with the assessor
3. A weight and balance calculation in the aircraft you are using for the competency demonstration
4. A practical pre-flight briefing
5. At least one actual parachute load

PRACTICAL FORMS USED FOR YOUR ASSESSMENT

Once completed satisfactorily your information can be entered online and your rating can be issued into your log book.

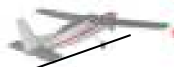
The forms and check lists that will be used during the practical demonstrations and competency assessments are shown here:

Take off and Climb to Jump run

2000ft
Power settings ________
Speed Kts ___________Vy

1000ft
Power Target rate of climb
Speed __________ Vy

Jump Run ___________
Within 2nm from Exit piont ______
Speed ___________ Vy
ATC Comunication _____



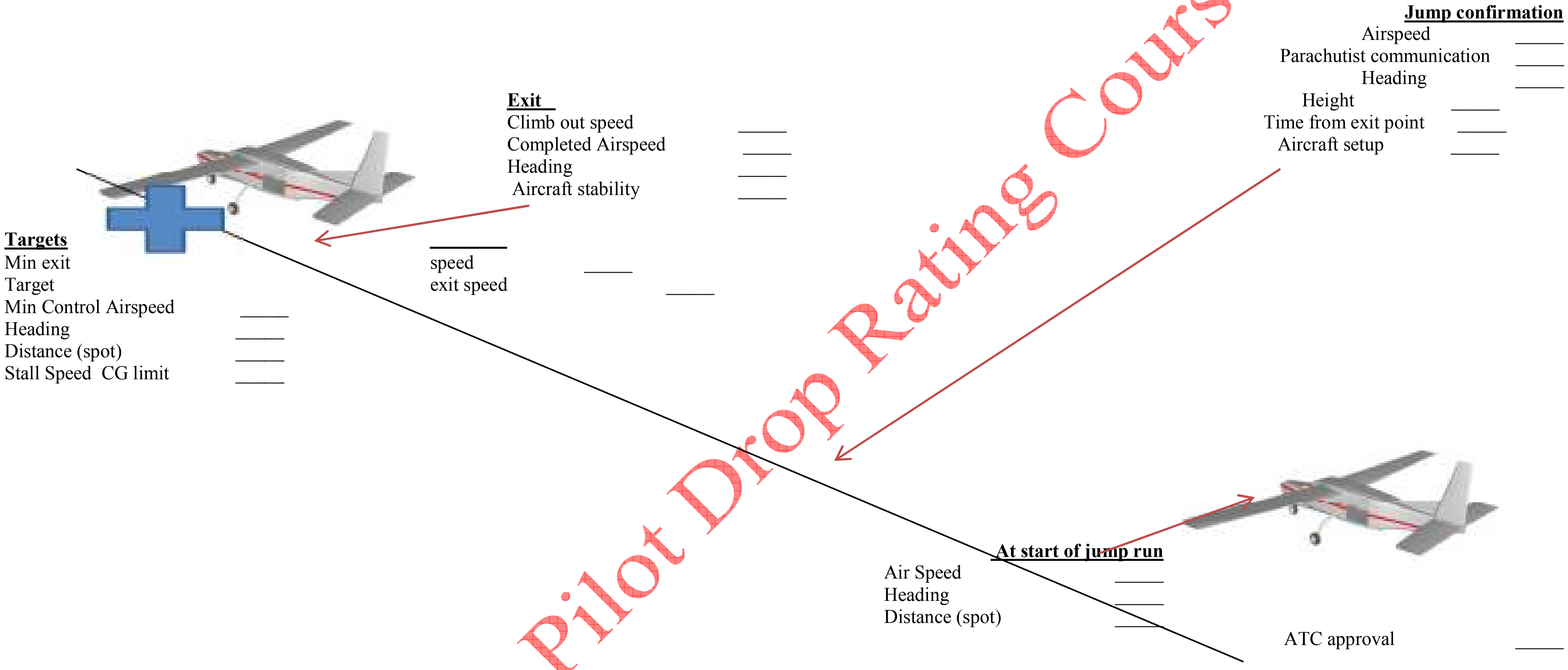
Take-off roll
Power Settings __________
Rotate Speed Kts_________ V1
Angle of attack __________ Vx

Limitations and Target Speeds

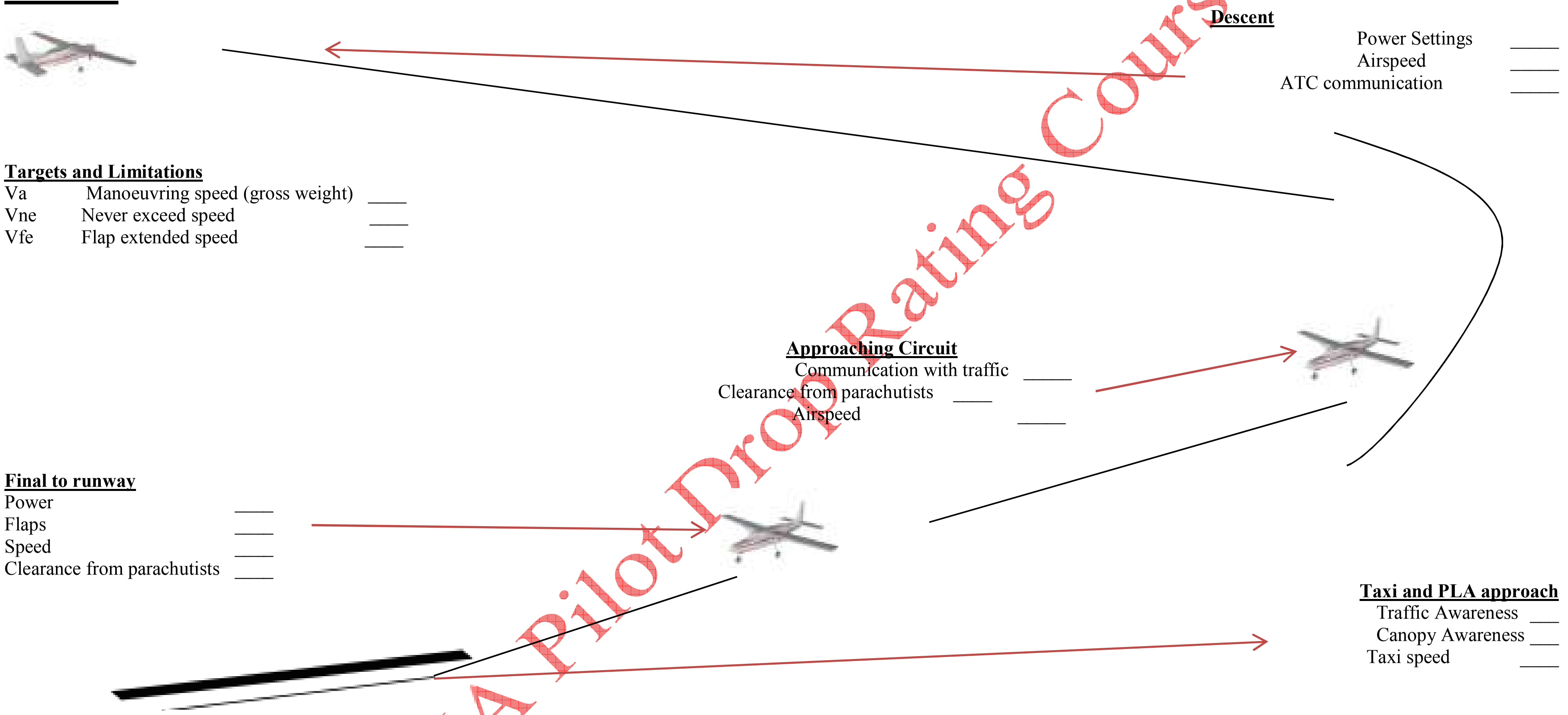
Vx	Best angle of climb speed	____
Vy	Best Rate of Climb	____
Vmc	Minimum control Airspeed	____
V1	Rotate speed	____

Before taking to runway
Before take-off Checklist _____________
Departure Briefing:
Altitude ________________
Spot ________________
Engine Failure Plan ________

Jump Run


Targets
Min exit
Target
Min Control Airspeed
Heading
Distance (spot)
Stall Speed CG limit
Exit
Climb out speed
Completed Airspeed
Heading
Aircraft stability
speed
exit speed
Jump confirmation
Airspeed
Parachutist communication
Heading
Height
Time from exit point
Aircraft setup
At start of jump run
Air Speed
Heading
Distance (spot)
ATC approval

Descent


Descent
Power Settings _____
Airspeed _____
ATC communication _____
Targets and Limitations
Va Manoeuvring speed (gross weight) ____
Vne Never exceed speed ____
Vfe Flap extended speed ____
Approaching Circuit
Communication with traffic _____
Clearance from parachutists ____
Airspeed _____
Final to runway
Power ____
Flaps ____
Speed ____
Clearance from parachutists ____
Taxi and PLA approach
Traffic Awareness ___
Canopy Awareness ___
Taxi speed ____

Competency assessment Matrix	Unacceptable Level of knowledge						Acceptable Level of knowledge					
NZPIA Parachute Drop Rating	Knowledge of the Applicant Is unacceptable given the aircraft being used for the assessment						Knowledge of the Applicant Is acceptable given the aircraft being used for the assessment					
Aircraft type ________	Judgement based on the following areas						Judgement based on the following areas					
	Traffic Awareness	Run In and Exit	Weight and balance	Navigation	AFM Limitations	ATC Clearances	Traffic Awareness	Run In and Exit	Weight and balance	Navigation	AFM Limitations	ATC Clearances
Technical Subject Areas												
Pre-flight Preparation												
Emergency Operations												
Refuelling												
CAA Rules, Operational Procedures												

Note:
Mark each subject you have assessed at either satisfactory or unsatisfactory in the appropriate box before the candidate carries out the practical competency assessment. You must assess all items in the technical subject areas and at least one other area in each of the other items.
The questions and or subject information you can use are covered within your Assessor Manual and also within the NZPIA Drop Rating course. You should find specific data related to the aircraft within the AFM. You will be required to confirm this information when you enter the details online.

	OK	Comment	Comments
Pre-flight Action			
WX Briefing			
Weight and Balance			
Fuel Required			
Rwy Lengths			
Flight requirements			
Emergency procedures, engine failure at take-off, stall during exit etc.			
checklists available			
Departure			
Pre-flight Inspection			
Use of Checklist			
Nav/GPS Com set up			
Taxi and take off			
Initial Climb			
Climb			
indcated airspeed Vy			
Enroute Climb			
Navigation			
Inflight decisions			
Fuel management			
Engine management			
ATC Communication			

	OK	Comment	Comments
Jump run			
Aircraft set up			
Arrival at height			
Airspeed			
ATC Communication			
Communication with parachutists			
Aircraft airspeed during exit			
Aircraft attitude during exit			
Aircraft heading and height during exit			
Engine management			
Aircraft configuration for exit			

	OK	Comment	Comments
Descent			
ATC Communication			
Engine management			
Airspace management			
Scanning for traffic			
Approach			
landing and Taxi			
Use of checklist			

Aircraft configuration for exit

Overall			
ATC Communication			
Cockpit organisation			
Cabin organisation			
Climb and jump run efficiency			
Descent and approach efficiency			
taxi and ground movement awareness around canopies			