Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR
AC 105-02 v1.0

Parachuting through cloud - Evaluation of applications by parachute operators

File ref: D24/469087

December 2024

Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- approved self-administering aviation organisations (ASAOs) administering parachute descents from aircraft
- parachute operators
- parachutists.

Purpose

Specifications issued under Part 105 of the *Civil Aviation Safety Regulations 1998* (CASR) permit parachutists to enter cloud in the course of a descent in locations (drop zones (DZ)) where this has been approved by a Part 105 ASAO. Approvals will be issued on a case-by-case basis after analysis of the risks and the implementation of the mitigating strategies available.

This AC provides guidance to parachute operators seeking such approvals and outlines the criteria a Part 105 ASAO will use in assessing such applications and the kinds of operational conditions that may be specified in granting approvals.

Compliance with the relevant conditions will not only enhance the safety of other airspace users and of parachutists but will also promote good airmanship and situational awareness of all airspace users in the area.

For further information

For further information, contact CASA's Sport Aviation (telephone 131 757).

Status

This version of the AC is approved by the National Manager, Flight Standards Branch.

Table 1. Status

Version	Date	Details
v1.0	December 2024	This AC supersedes CAAP 152-1(0) - Parachuting Through Cloud: Evaluation of applications by parachuting operator and issue of approvals by CASA, published August 2002.

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Contents

Acknowledgement of Country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to Elders past, present and emerging.

Artwork: James Baban.

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Table 2. Acronyms

Acronym	Description
AC	advisory circular
AA	Airservices Australia
ASAO	approved self-administering aviation organisation
CAR	*Civil Aviation Regulations 1988*
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
GNSS	global navigation satellite system
LSALT	lowest safe altitude
NOTAM	notice to airmen
IMC	instrument meteorological conditions
IFR	instrument flight rules
PIC	pilot in command

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this AC and the civil aviation legislation, the definition in the legislation prevails.

Table 3. Definitions

Term	Definition
chief parachuting instructor	in relation to a parachute descent by a trainee parachutist or tandem parachutist, means the person appointed by the Part 105 ASAO under section 5.44 of the Part 105 MOS as the chief parachuting instructor of the parachuting training organisation that is conducting the parachuting training involving the descent. **Note:** This person is responsible for managing parachute descents by trainee and tandem parachutists at a parachute training organisation.
Cloud descent	a parachute descent in which: a. the parachutist would enter cloud during the descent; or b. the drop zone would not be clearly visible to the parachutist throughout the descent.

Term	Definition
Drop zone (DZ)	means the area, specified by the drop zone safety officer who is performing duties for a parachute descent, intended for the landing of a person undertaking the parachute descent.
Drop zone safety officer (DZSO)	a. in relation to a parachute descent undertaken by a trainee parachutist or tandem parachutist: i means the holder of an endorsement mentioned in paragraph 5.27(2)(a) of the Part 105 MOS who is approved to act as the drop zone safety officer for the descent by the chief parachuting instructor under the procedures mentioned in that paragraph; and ii if the descent is a display descent undertaken by a tandem parachutist—means the endorsement holder mentioned in subparagraph (i) who has been nominated to act as the drop zone safety officer for the display descent by the display organiser of the parachuting display; and b. in relation to a parachute descent other than a descent mentioned in paragraph (a)—means the holder of an authorisation mentioned in paragraph 5.27(2)(b) of the Part 105 MOS that covers that descent. **Note:** The endorsement mentioned in paragraph (a) is granted by a Part 105 ASAO.
Ground control assistant (GCA)	means a person who holds a ground control authorisation that: a. is issued by a Part 105 ASAO that administers a parachute descent; and b. authorises the holder to undertake ground control during the operation of an aircraft to facilitate a parachute descent.
Ground control	means communications, for the purpose of ensuring the safe conduct of a parachute descent, made using visual signals or radiocommunications (or both), between a ground control assistant and the pilot in command of an aircraft being used to facilitate a parachute descent.
loadmaster	means a person who is nominated by the drop zone safety officer who is performing duties for a parachute descent, to have the responsibilities mentioned in section 5.29 of the Part 105 MOS in relation to the descent. For the information of the reader of this AC, the responsibilities from section 5.29 of the Part 105 MOS include: a. conducting a pre-descent briefing of all persons on board the aircraft addressing all aspects necessary to ensure the safe conduct of the descent b. confirm the surrounding airspace and drop zone is clear of conflicting traffic and necessary clearances have been obtained by the pilot in command from the ground control assistant c. confirm the integrity of the exit point. The loadmaster must ensure, prior to commencement of the descent, the DZSO (or the Chief Parachuting Instructor in the case of a trainee or tandem parachute descent) has approved the descent in lower visibility conditions.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Table 4. Legislation references

Document	Title
Part 105 of CASR	Part 105—Parachuting from aircraft
Part 105 MOS	Part 105 (Parachuting from Aircraft) Manual of Standards 2023

2 Introduction

CASR 105.100(2)(c) provides for the Part 105 MOS to prescribe the requirements relating to entering cloud during a parachute descent. Part 105 MOS Section 5.35(1) allows a cloud descent, provided the ASAO that administers the parachute descent has approved the DZ for the descent.

In 1996, the parachuting industry approached CASA to request amending the policy which restricted a parachutist from entering cloud and required a parachutist to ensure the target was clearly visible at all times during a parachute descent. Proposed solutions that would allow parachutists to safely enter cloud during a descent were developed in consultation with the parachute industry. Statistical studies showed that the presence or absence of cloud did not make a marked difference to the probability of collision between parachutists and aircraft or the ability to avoid a collision. The probability of a pilot of an aircraft taking successful avoiding action when a parachutist is under canopy is however improved due to the ability to see a slow-moving parachute and the manoeuvrability of a parachute or parachutist in flight.

There is a heightened risk of parachutists ,who had exited the same aircraft and have opened their parachutes, colliding with each another whilst in cloud. It is therefore beneficial to require parachutists to not make a cloud descent where the base of the cloud is lower than an acceptable and standard height for opening a parachute.

Furthermore, with the advancement in technology and accuracy of global navigation satellite system (GNSS), it is accepted that the correct use of a GNSS is likely to be more accurate than a person determining a correct exit point for a parachute descent visually. To that end, the use of GNSS to determine an exit point is widely used in all conditions, reducing reliance on visually checking the exit point.

To that end, consideration is given to each parachute DZ for cloud descent approval, taking into account the physical characteristics and the airspace management environment. It is not considered reasonable to use a single set of conditions which could apply to all locations. Therefore, each DZ must seek approval from a Part 105 ASAO to conduct cloud descents.

2.1 Background

CASA and an industry risk management consultant have developed two mathematical models to evaluate the probability of a collision or a near-miss occurring between parachutists, whether descending under canopy or in free-fall, and aircraft flying through the airspace surrounding the DZ.

Because the relative movement of parachutists in freefall is perpendicular to that of aircraft, the potential geometry of any collision makes visual manoeuvring of the aircraft, parachutist or both, to avoid an impending collision ineffective and improbable in most cases. Therefore, certain conditions should be met, depending on the particular mix of traffic, airspace, facilities and terrain that exists at each location, to mitigate the possibility of a collision and ensure the safe conduct of a descent. This Advisory Circular seeks to provide guidance for parachute operators and Part 105 ASAO's in order to ensure the process of assessing applications for the issue of an approval are subject to the same levels of rigour and the approvals are issued on a consistent basis.

A parachute operator must make a separate application for each DZ at which it is proposed to seek approval to make parachute jumps that may involve parachutists entering cloud. Applicants may suggest measures that they propose to adopt in order to mitigate risk when making initial or subsequent applications.

The application should be sent to the Part 105 ASAO with which the operator is affiliated. The Part 105 ASAO will make an initial assessment of the proposal and may refer it back to the operator for clarification, further information or amendment.

If the Part 105 ASAO is satisfied that conditions can be applied so as to ensure the proposed operating conditions satisfies acceptable level of safety and is compliant with the ASAO's safe conduct procedures for cloud descents, it may then approve that DZ as a cloud descent DZ.

3 Assessing an application

Part 105 MOS Section 5.25 sets out ASAO exposition requirements for the safe conduct of a parachute descents. This includes kinds of parachute descents permitted by the ASAO and includes a cloud descent.

An ASAO must set out in its exposition a procedure for the approval of a DZ for a cloud descent.

A Part 105 ASAO will review each application including the Collision Hazard Risk Matrix. The parachute operator will provide data which includes the amount of parachuting activity which occurs or is expected to occur, together with a consideration of the airspace, terrain (including physical hazards), traffic mix and aeronautical facilities and services available for risk mitigation.

Conditions and requirements appropriate to the location will be imposed on any approval issued.

4 Approval criteria

The Part 105 ASAO that administers a parachute descent through cloud, must take the following into consideration when approving a DZ's application for a cloud descent:

- full details of the DZ for which the approval is being made. This includes the contact details of the parachute operator, the person/s responsible for the cloud descent approval application and maintenance, and the nominated chief pilot (however named)
- the location of the DZ where the cloud descents will occur. This should include the longitude/latitude of the DZ and any significant topographical features within a 5nm radius of the DZ.
- the overlying airspace details surrounding and over the DZ. This should include any nearby aerodromes and the airspace class a parachute descent may originate in or pass through. This should also include any map identifiers or if NOTAMS are in use
- the duties and responsibilities of each personnel required for a cloud descent. This may include DZSO, loadmaster, pilot in command (PIC), ground control assistant, chief parachuting instructor and manifester
- any arrangements made with Airservices Australia (AA) (for example, Letters of Agreement) and outcomes of consultations with local airspace users
- the qualification and authorisation requirements for parachutists who may conduct a descent through cloud. A parachutist must be assessed as competent to conduct a parachute descent. A register of parachutists who have been assessed as competent should be kept by the parachute operator and the parachutist
- any flight planning, assessment of and monitoring meteorological conditions and actions taken should the aircraft operate in instrument meteorological conditions (IMC)
- the flight crew is appropriately qualified, and the aircraft is suitably equipped for this type of operation (this includes the requirement for the aircraft to carry two functioning VHF transceivers. If operating in IMC, the aircraft and PIC must meet the Part 61 requirements for instrument flight rules (IFR) operations
- a procedure to determine the minimum qualifications a parachutist requires to make a cloud descent. This should include factors to be considered in making the determination (for example, extent of cloud coverage, cloud ceiling, types of parachute descents being conducted).
- a pre-flight briefing ensuring all parties involved in a parachute descent are conversant with the meteorological conditions and clear about the procedure for the cloud descent
- a method to determine the parachutist exit point
- a procedure is in place to ensure the airspace is clear and free of conflicting air traffic
- a procedure to account for all parachutists after a parachute descent
- systems in place to ensure communication between DZSO, GCA, and PIC. This should include procedures for loss of communication, changes in meteorological conditions, or unable to determine clear airspace.
- reporting methods to the ASAO should an incident occur during a parachute descent
- maximum period for the approval to considered current (3 years)
- records must be kept showing each parachutist that is authorised to undertake a parachute descent through cloud at each DZ (Master List).

5 Review of approvals

A change of the DZ's personnel (Chief Parachuting Instructor, senior pilot, responsible person) or use of an aircraft of greater capacity than advised in the original approval, must be notified to the ASAO, who may review the approval and vary conditions attached if necessary.

Other grounds for reviewing the approval will be a change in traffic levels (particularly passenger transport services or IFR operations with 10 or more passengers), nearby airspace structure, provision or withdrawal of air traffic facilities and services, or increased levels of parachuting activity, whether on a permanent or temporary basis.

Appendix A
Cloud Descent Procedures Manual - Suggested format

A.1 Organisation

The full name and address of the organisation needs to be stated. This should include the address of the Operational Centre (DZ location). The person who takes overall responsibility (generally the Chief Parachuting Instructor (CI)) is to be identified, by name, as well as how this person can be contacted by the ASAO, ATC and CASA when parachuting operations are in progress.

A.2 Location

A description of the DZ location including the latitude and longitude of the DZ (or DZs). Specify significant topographical features within 5NM radius of the DZ target that determine the applicant's nominated LSALT for the aircraft and parachutists.

A.3 Airspace

The overlying airspace up to the maximum altitude from which parachute descents will be made needs to be described in detail. This should include each Class of airspace through which descents may occur and any identifiers on aeronautical charts.

A.4 Duties and responsibilities

All persons who have a duty in the safe conduct of cloud descents are required to have a knowledge of their duties and responsibilities.. Of particular importance are those of the person responsible for the cloud descent approval, the DZSO, GCA, CI, PIC, Loadmaster and Manifester.

A.5 Arrangements with the Airspace Manager

If these are described in a Letter of Agreement with AA, it could be appended to the procedures. Any arrangements with local airspace users should also be appended to the procedures. As should any additional consultation with the Aviation State Engagement Forum (AvSEF).

A.6 Authorisation to jump through cloud

The procedures need to explain on what basis a person is permitted to jump through cloud. Specifically: 1) the minimum qualifications and experience to be eligible, 2) the training of, and 3) means by which the permission to jump through cloud will be made.

A.7 Meteorological conditions

Explain how, prior to each day's operations, the likely conditions are determined. This might be a pilot responsibility but involve the DZSO and the Loadmaster(s) in respect of who might be given permission to jump through cloud.

A.8 Flight plan or notification

Describe how aircraft operations for the day are planned and ATC notified. The PIC might activate a standard Flight Plan or lodge one based on the forecast conditions.

A.9 Determination of exit point

The DZSO, in conjunction with the pilot, must calculate the exit point, for example, from the forecast winds, how is this determined in the first instance and how is it subsequently modified in light of changed conditions.

A.10 Manifesting

The procedures should specify how the DZSO, using the Manifester, would ensure only those with the appropriate authorisation are permitted to manifest for a jump.

A.11 Pre-flight briefing

There are two aspects: 1) before take-off the PIC and Loadmaster need to agree on the run-in direction and exit point. 2) The Loadmaster needs to ensure all those about to board the aircraft are conversant with the prevailing meteorological conditions and are clear about the procedures for a descent through cloud. The details of the briefing could be specified here.

A.12 Aircraft operations

The procedures need to describe arrangements with ATC and others in respect to the aircraft used and the type of operation, ie VFR or IFR, frequencies to use, phraseology, climb and descent areas, etc.

A.13 Spotting

The process by which the PIC and Loadmaster determine the correct exit point needs to be specified and what reliance will be made on navigation aids and/or visual observation.

A.14 Determination that the airspace is clear – authorising the exit

How will: 1) the airspace above the cloud be declared clear, 2) the airspace with cloud be declared clear, and 3) that below the cloud declared clear, before the Loadmaster allows the exit to proceed.

A.15 Descent phase

What protective measure will be used to ensure the PJE aircraft descent will not conflict with the parachutists or other airspace users.

A.16 Landing and debriefing

Normal procedures would apply, however, if the presence of cloud introduces other factors that were not predicted, what can be considered (eg the exit point) and how will this information be passed on.

A.17 Reporting of incidents

If the organisation has reporting procedures additional to those normally required then these need to be specified.

A.18 Safety systems

The systems that are in place in the event of a failure of ground-to-air communications, deteriorating weather, or any other contributing factor resulting from the presence of cloud, need to be documented.

Appendix B
Checklist for a Part 105 ASAO to evaluate applications

Organisation	Paragraph/ section number
Organisation:	
• Is full name and address provided?	
• Are contact details specified and correct?	
• Is nominated Responsible Person acceptable to the Part 105 ASAO?	
Location:	
• Is DZ already an ASAO approved DZ?	
• Is Latitude and Longitude correctly stated?	
• Topographical features within 5NM:	
○ Is the highest feature taken into account for opening heights?	
○ Do aircraft procedures reflect appropriate LSALT for aircraft ops?	
• Is DZ adequately identified on aeronautical charts?	
• Have other operators in the area been consulted regarding the proposal?	
Airspace:	
• Is overlying airspace correctly described?	
• Do procedures reflect stated ATC clearance and/or broadcasting requirements?	
• Has the Collision Hazard Risk Matrix been completed and are the results within ALARP range?	
• Accompanying documentation that justifies figures in Collision Hazard Risk Matrix	
Duties and Responsibilities:	
• Do procedures include an organisational chart?	
• Are all necessary DZ personnel with cloud descent responsibility identified?	
• Are their duties and responsibilities adequately stated?	

Organisation	Paragraph/ section number
• Is the nominated Senior Pilot appropriately qualified for the type of operation envisaged?	
Arrangements with Airspace Manager:	
• Has a Letter of Agreement from AA been included with application?	
• Are Local Instructions promulgated?	
○ Do they reflect what is proposed?	
○ Has ATC agreed to provide traffic information for all airspace above jumper opening height?	
Authorisation to jump through cloud:	
• Are jumper minimum qualifications in accord with Part 105 ASAO requirements?	
• Is training for through-cloud descents adequate and adequately described?	
• Is there an appropriate means of granting authorisations?	
• Do procedures preclude non-approved persons from jumping?	
Meteorological conditions:	
• Does the organisation have an appropriate way of determining forecast meteorological conditions?	
• Is there a system for on-going monitoring of meteorological conditions?	
• Do procedures provide for suspending operations when conditions fall below minima?	
Flight plan or notification:	
• Are flight-planning / flight-notification procedures appropriate?	
• Do these procedures include CASA requirements for flight under VFR or IFR as appropriate?	
Determination of exit point:	
• Is the proposed method of determining exit point appropriate and reliable?	
• Does the system provide for a timely review when conditions change?	
Manifesting:	
• Do the manifesting procedures conform to the Part 105 ASAO requirements?	
• Does the Manifester position have a statement of Duties and Responsibilities	

Organisation	Paragraph/ section number
which:	
○ Ensures only those with the appropriate qualifications are manifested?	
○ Requires an appropriately qualified person is appointed as loadmaster?	
Pre-flight briefing:	
• Is it clearly stated the Loadmaster must conduct a briefing with PIC and jumpers?	
• Procedures ensure Jumpers are made aware of limitations posed by “actual” conditions?	
• Does the system ensure only persons with appropriate qualifications board the aircraft?	
Aircraft operations:	
• Are precise arrangements with ATC specified for climb, descent, etc?	
• Do procedures take account of other traffic likely to be operating in the vicinity?	
Spotting:	
• Is the system of spotting appropriate:	
○ If non-visual spotting is proposed does the system have a way of verifying the exit point?	
○ Is aircraft nav-equipment appropriate for what is proposed?	
Determination that airspace is clear:	
• Procedures ensure that airspace above cloud is clear?	
• Adequate system of communication with ground to declare airspace below cloud is clear?	
• System ensures aircraft in or between cloud layers will not conflict?	
Descent phase:	
• System ensures PJE aircraft descent is away from jumper opening point?	
• Do procedures include a means of accounting for all canopies?	
• Does descent take account of topographical features?	
Landing and debriefing:	
• Do procedures require de-briefing of participants and are these appropriate?	

Organisation	Paragraph/ section number
Reporting of incidents:	
• Is there a documented system for reporting incidents?	
• Does the Part 105 ASAO require additional requirements and are these agreed with the applicant?	
Safety systems:	
• Does the applicant have appropriate ground-to-air communications?	
• Is there a back-up communications system and is it adequate?	
• Are there appropriate mechanisms to call off jump if conditions deteriorate?	

Appendix C
Collision hazard for a mix of aircraft encountering parachutists in a drop zone

C.1 Figure 1 - Collision hazard for a mix of aircraft encountering parachutists in a drop zone

C.1.1 Probability calculations of a collision

Figure 1 calculates the probability of a collision between an aircraft and a parachutist. It accounts for 4 different aircraft of varying sizes and capacity (general aviation, light twin, commuter and RPT (regular public transport)).

The table calculates the probability of a parachutist (the area of a parachutist) and an aircraft (the area of an aircraft) coinciding at the same point in space, dependent on the DZ area (that is, the area in space a parachutist will fall through, and an aircraft may fly through at the same time).

It also calculates the probability that a parachutist and an aircraft may coincide at the same point in time based on the size of the parachutist, the size of an aircraft and the length of time an opportunity may arise that they both may coincide at the same point in time.

Combining these two probabilities, results in the probability of a collision between a parachutist and an aircraft at a single point in time at a single point in space. These are the BLIND DROP RESULTS. This then allows the calculation of the number of these collisions that may occur per year based on how many parachutists and aircraft that may enter the DZ area (the area where a collision may occur).

When risk mitigation strategies are included in the calculations, it then calculates the probability of the number of collisions per year with reference to those included risk mitigation strategies. Risk mitigation factors include; the availability of Air Traffic Control services, the degree of confidence in receiving and providing appropriate responses to radio broadcasts, the effect of the height of the cloud base, the amount of cloud and the visibility below the cloud when making efforts to avoid collisions.

These calculations are transferred to the following tables, to show the probabilities against CASA's hazard assessment criteria.

EXAMPLE

Figure 1 requires data input from the DZ operator. Each of the numbers in red are required to be entered by the operator.

Figures 1-3 use the following data as an example

The "Drop Zone - Area" is calculated as:

The drop zone extends 1nm from the centre of the drop zone (a circle around the drop zone with a 1nm radius).

1nm = 1853m

Area of drop zone = 3.14 x 1853 x 1853 = 10,769,898 sq m (Area of a circle = pi x radius squared)

The "Parachutists Dropping Per Year" is entered by the operator as per business records

The "Aircraft in DZ Per Year" is entered by the operator. This data can be calculated by visual observations (taken over two weeks and extrapolated to a year), using technology to observe aircraft over the DZ or via Air Services data sources.

COLLISION HAZARD FOR A MIX OF AIRCRAFT ENCOUNTERING PARACHUTISTS IN A DROP ZONE

NOTES

This model is ready to accept data.

COMMON PARAMETERS

Factor	Value	Units
Feet to Metres	0.3048	Constant
Knots to M/Sec	0.5148	Constant
Drop Zone - Area	10,769,898	Sq Metres

KEY
Input
Calculated Fields
Results

PARACHUTISTS DROPPING

Factor	Value	Units
Span	2	Metres
Length	2	Metres
Height	2	Metres
Length of the Drop Day	8	Hours
Drop Velocity	120	Knots
Parachutists Dropping Per Year	5000	Integer

RISK MITIGATION

Factor	GA	Light Twin	Commuter	RPT	Units
DZ Active Alert Radio Communication Failure	0.1	0.01	0.001	0.0001	Probability
DZ Alert Incorrect Aircrew Reaction	0.3	0.1	0.01	0.001	Probability
Probability of ATC Separation	0	0.3	0.7	0.9	0 = No ATC
Safety Improvement Factor	2.70	13.11	303.31	9,091.74	

AIRCRAFT TRANSITING

Factor	GA	Light Twin	Commuter	RPT	Units
Span	12	15	20	50	Metres
Length	8	10	15	40	Metres
Height	4	5	6	10	Metres
No of People in Aircraft	2	6	40	150	Integer
Aircraft in DZ Per Year	150.00	25.00	50.00	25.00	Fractions OK
Expected Lives at Risk Per Year, **TOTAL**	300	150	2000	3750	**6200**

BLIND DROP RESULTS

Factor	GA	Light Twin	Commuter	RPT	Units
Probability of a Coincidence in Space	3.57E-05	5.57E-05	1.11E-04	7.43E-04	Probability
Probability of a Coincidence in Time	9.23E-09	1.08E-08	1.23E-08	1.85E-08	Probability
Probability of a Collision: Single Aircraft & Parachutist	3.29E-13	6.00E-13	1.37E-12	1.37E-11	Probability
Collisions Per Year: Compound of Aircraft and Dro	**2.47E-07**	**7.50E-08**	**3.43E-07**	**1.71E-06**	Probability

RISK MITIGATED DROP RESULTS

Factor	GA	Light Twin	Commuter	RPT	Units
Probability of a Coincidence in Space	1.32E-05	4.25E-06	3.67E-07	8.17E-08	Probability
Probability of a Coincidence in Time	3.42E-09	8.22E-10	4.06E-11	2.03E-12	Probability
Probability of a Collision: Single Aircraft & Parachutist	1.22E-13	4.58E-14	4.52E-15	1.51E-15	Probability
Collisions Per Year: Compound of Aircraft and Dro	**9.13E-08**	**5.72E-09**	**1.13E-09**	**1.89E-10**	Probability

Figure 1: Collision hazard for a mix of aircraft encountering parachutists in a DZ

C.2 CASA risk envelope

C.2.1 Risk level and frequency of accident occurrence

Using data retrieved from Figure 1, Figure 2 shows the CASA risk envelope which displays the four levels of risk and the frequency of an accident occurring involving 1, 10, 100 or 1000 deaths per annum. For example, the Acceptable Risk of one death per annum should be one in 100,000 (1.00E-05) or for 10 deaths per annum it should be 1 in a million (1.00E-06).

CASA RISK ENVELOPE				
Casualties	Intolerable	Scrutiny	ALARP	Acceptable
1	1.000E-01	1.000E-02	1.000E-04	1.000E-05
10	1.000E-02	1.000E-03	1.000E-05	1.000E-06
100	1.000E-03	1.000E-04	1.000E-06	1.000E-07
1000	1.000E-04	1.000E-05	1.000E-07	1.000E-08
RESULTS	People At Risk	EXPECTED FATALITIES		
GA	2	GA Blind	GA Risk Mitigated	
		2.47E-07	9.13E-08	
Light Twin	6	Light Twin Blind	Light Twin Risk Mitigated	
		7.50E-08	5.72E-09	
Commuter	40	Commuter Blind	Commuter Risk Mitigated	
		3.43E-07	1.13E-09	
RPT	150	RPT Blind	RPT Risk Mitigated	
		1.71E-06	1.89E-10	

Figure 2: CASA risk envelope

C.3 Parachute collision risk mapped on CASA's hazard assessment criteria

C.3.1 Parachute collision risk mapped

Figure 3 shows the four levels of risk depicted on a chart (Incident probability Per Year vs People at Risk Per Incident), indicated by the four level of risk indicators (coloured lines).

Combining all factors (number of parachutists, number of expected fatalities, number of aircraft movements, probabilities and risk levels), the chart can display where the expected levels of risk are for the types of aircraft and if the risk is above or below certain risk levels.

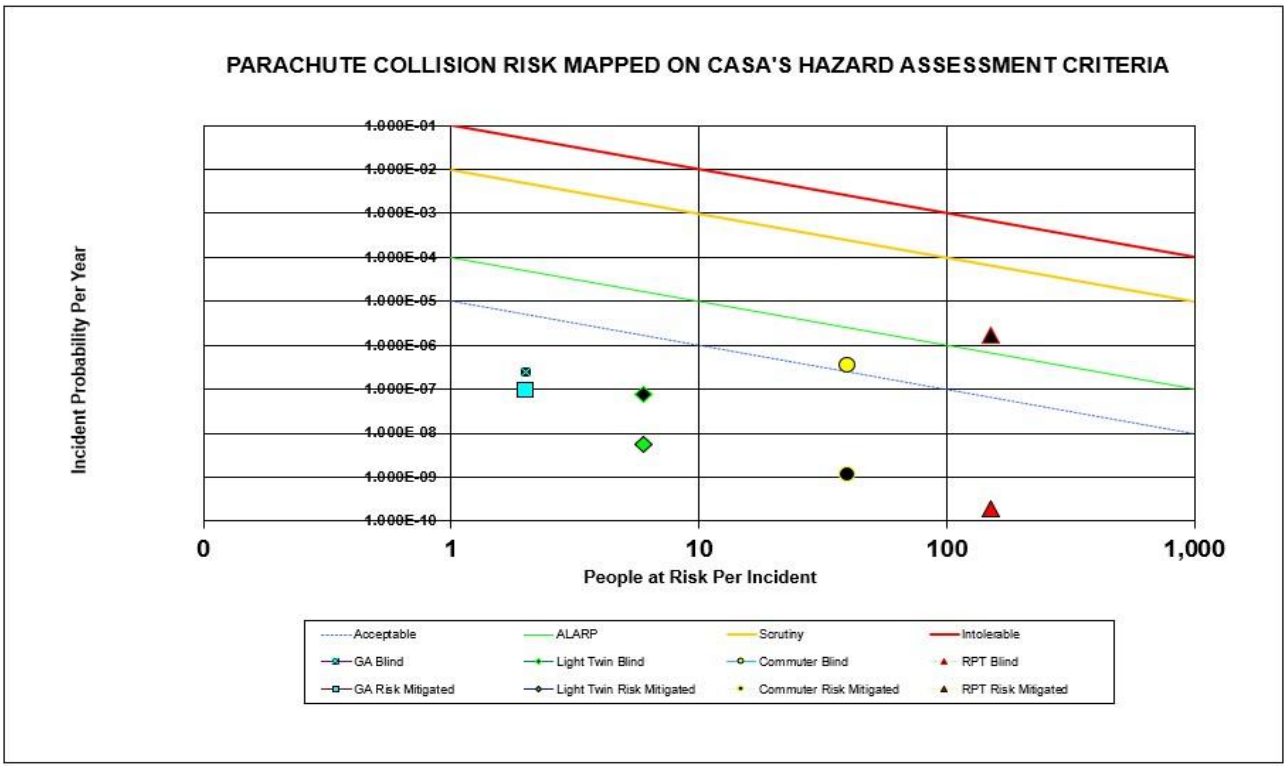

Figure 3: Parachute collision risk mapped on CASA's hazard assessment criteria