# Safety Investigation Report

## Fatal parachute accident Tauranga, 20 March 2021

## Summary of occurrence

At approximately 1030 hours New Zealand Daylight Time on 20 March 2021, a recreational solo skydiver exited the aircraft at 15,188ft above Tauranga aerodrome (NZTG[1]). After approximately 70 seconds of uneventful freefall he successfully deployed his parachute. For approximately the next three minutes he manoeuvred above the NZTG parachute landing area (PLA[2]) preparing to land at the southern segment of the PLA. Witnesses on the ground observed the skydiver complete a series of manoeuvring turns. A final left turn was initiated at low altitude, with insufficient height available for the canopy to return to level flight. This resulted in the skydiver striking the ground in a near horizontal attitude with a high rate of descent, resulting in fatal injuries.

## The skydiver's experience

The skydiver had recently completed a 'NZ Diploma in Commercial Skydiving'[3], a New Zealand Qualifications Authority accredited tertiary course of study. The course is designed to give graduates a minimum of 150 skydives and a New Zealand Parachute Industry Association (NZPIA) certificate with a 'B' endorsement[4] within a 32-week period.

The skydiver achieved his 'B' endorsement on 17 October 2020 having completed 76 skydives and passing the required NZPIA theory examination. He completed a further 93 skydives at the skydive school before starting a 12-week internship with a commercial skydive operator at NZTG. This was the final stage of his diploma course.

The internship was completed on 17 March 2021 (three days prior to the accident) and involved parachute rig packing, manifesting of passengers and general duties associated with the commercial operation. As part of the internship, he completed skydives alongside the commercial operations when available. Twenty-four jumps were completed in this fashion. The final entry in his logbook was skydive number 194 on 14 March 2021, six days prior to the accident.

On completion of this internship, he volunteered with the commercial operator, and was given further opportunity to skydive, in return. This was the case on the day of the accident.

[1] NZTG is situated at 13ft above mean sea level.
[2] Parachute landing area (PLA) means an area onto which parachute landings are intended to be made.
[3] The NZ Diploma in Commercial Skydiving aims to provide individuals with the knowledge and skills to work independently as a commercial skydiver. It provides the skydiving sector with commercial skydivers who have a broad understanding of the requirements to work in the commercial skydiving industry.
[4] A 'B' endorsement qualifies a skydiver to jump independently from an instructor.

## Toxicology

A post-mortem toxicology analysis was performed. No evidence of drugs or alcohol that would cause any level of impairment was found.

## Tauranga PLA

The NZTG PLA is divided into northern and southern segments (refer figure 1), the use of which, is based on the local wind conditions and any glider operations taking place. The segment to be used is briefed prior to take-off. The wind conditions on the day were reported by the NZTG AWS[5] as favouring the southern segment with a 7-9 knot wind from 120°-140°[6]. The wind was also reported to have varied between 070° and 190° 30 minutes either side of the accident. The operator placed a windsock within the PLA for skydivers to observe the wind conditions during descent.

The skydiver's logbook did not record which segment was used during previous landings. However, witnesses reported that he had used both segments and was most familiar with the southern segment, which was in operation on the day of the accident.

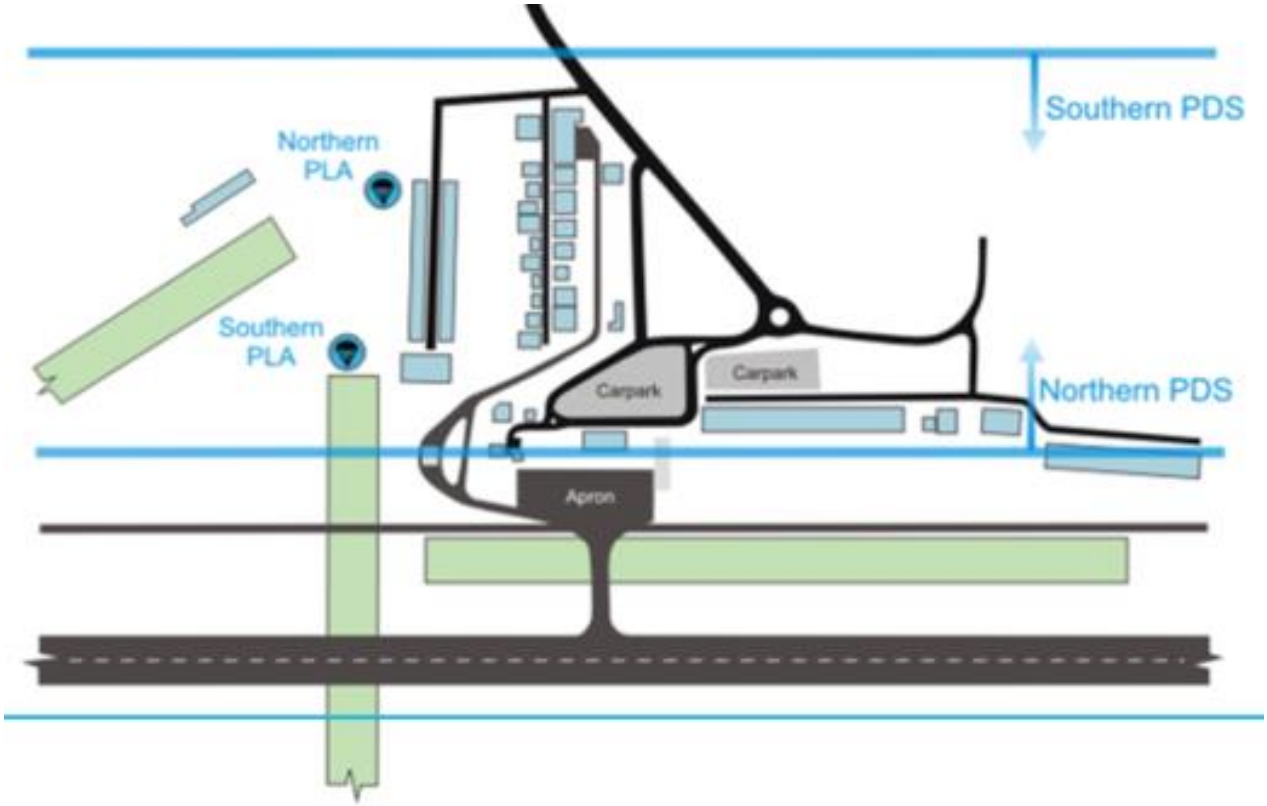



*Figure 1 - Depiction of NZTG PLA.*

[5] Automatic Weather Station providing weather reports every hour.
[6] Wind direction in degrees True.

## Data analysis

The skydiver's electronic altimeter,[7] was sent to the manufacturer to download and conduct analysis of its data. This analysis combined with video footage taken by witnesses and the skydiver's helmet mounted camera, show a normal freefall descent and normal opening of the canopy. Subsequent to the canopy opening he conducted normal control checks and performed a number of turns while manoeuvring above the PLA.

Figures 2 and 3 display the last portion of the canopy descent from overhead and side-on perspectives, with the icons representing the same point in the descent in each figure.


*Figure 2 - Overhead perspective of final portion of descent. Adapted Google™ Earth image with altimeter data. (For illustrative purposes only).*

[7] The skydiver's Dekunu One Smart altimeter was sent to Dekunu where the data was analysed by utilising various methods. Including the automated analysis tools in the Dekunu Cloud Portal, Dekunu database system and backend processing tools. The data is used as an illustrative guide only.

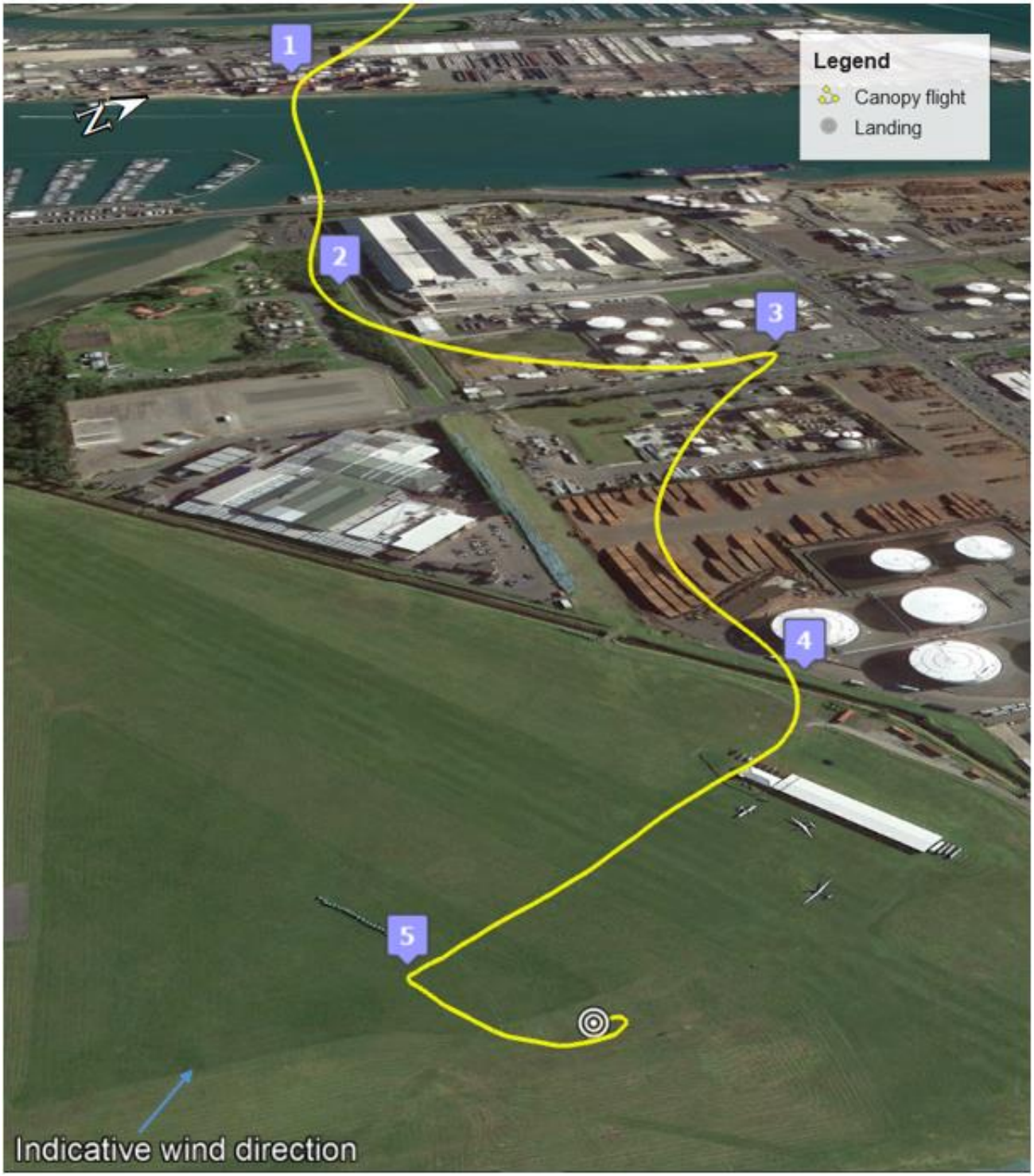



*Figure 3 – Side-on perspective of final portion of descent. Adapted Google™ Earth image with altimeter data. (For illustrative purposes only).*

| | |
|---|---|
| 1 | **1024ft**[8] – established in 25-30° descent gradient, passing slightly south of intended landing spot approximately into wind |
| 2 | **920ft** – initiates an approximately 90° left turn. Wind rear quartering approximately 4-5 o'clock relative position |
| 3 | **760ft** – continues a left turn for approximately 250°, with a descent gradient reaching 70° |
| 4 | **545ft** – initiates an approximately 110° right turn, with a maximum descent gradient of 82°. Wind approximately 9-10 o'clock relative position |
| 5 | **330ft** – initiates a 180° right turn before attempting a second 180° turn to the left at 164ft. This put him directly downwind just prior to contacting the ground in a near horizontal position, with a descent gradient of greater than 80° |

At point 5 it is likely that a safe and long landing could have been carried out had he continued straight ahead. Likewise, after completion of that right turn a safe crosswind landing would also have been possible.

## Focus on accuracy

During his recent jumps, witnesses had reported that the skydiver had been focussing on the accuracy of his landings. This involves landing as close to an identified point within the PLA, usually a windsock, person or ground target. Employees of the skydive operation stated that, during these recent jumps, he was using the ground crew standing in the middle of the PLA as his aiming point, to land as close as possible to them.

## Cognitive or attentional tunnelling

Cognitive or attentional tunnelling is a goal driven mental state when someone's attention is consumed by and fixated on one specific information source. As a result, the brain neglects all other incoming information because in that moment it doesn't consider it relevant.

The skydiver may have become fixated on the intended landing spot while attempting a high level of accuracy, at the cost of assessing the height required for the final manoeuvre or the wind direction.

Issue 750 of the United States Parachute Association magazine, published in April 2022, provided comment regarding prioritising landing accuracy:

> *"Many new jumpers [skydivers] make landing accuracy a priority at the end of their skydives, which can be a challenge when they are also trying to figure out the descent paths of their parachute. New jumpers also tend to feel a self-induced pressure to land close to the target to complete the landing accuracy requirements for higher licenses. When a jumper ends up in the wrong spot at the wrong altitude, it can lead to confusion and panic. It is always better to continue flying the parachute in a straight line toward a clear area than to make a low turn to try and land closer to the intended landing spot. Landing far away from your intended landing area still serves as a valuable lesson, and you can apply corrections during the next jump to improve accuracy."* Source: USPA Parachutist publication, April 2022. A POSITIVE DIRECTION – THE 2021 FATALITY SUMMARY

[8] Height above ground level.

## The canopy and wing loading

Canopies come in different sizes and behave differently depending on their wing loading[9]. In general terms, a lower wing loading will fly more slowly, not dive as much during a turn and will recover faster coming out of a turn, compared with a canopy with a higher wing loading. For this reason, student and novice skydivers will generally follow a downsizing progression, gradually increasing the wing loading as their experience and competence grows.

The Icarus Safire 2 uses a 9-cell canopy with a lightly elliptical planform shape with a manufacturer recommended wing loading range of 0.5-1.9 lbs/sqft. It is a very popular canopy designed to be versatile enough to suit both inexperienced and veteran skydivers. It is consistently described as a good all-round canopy for novice to intermediate skydivers. The skydiver was familiar with the canopy he was using, having owned it for approximately four and a half months, and using it almost exclusively for the previous 100 jumps.

## Canopy downsizing

As part of the diploma course, students progress through a downsize checklist. Competency assessments are performed and signed off by a suitably qualified instructor, before downsizing to a smaller canopy with a higher wing loading. The skydiver had completed this downsize checklist, although the required signatures from the instructor were missing in most cases. Interviews with the instructor and school indicate this was an administrative oversight and that the student had completed the progression as intended and required.

| Jump number | Canopy size (sqft) | Number of jumps on canopy size | Wing loading* (lbs/sqft) |
|---|---|---|---|
| <36 | 240+ | 35 | <0.79 |
| 36-55 | 220 | 19 | 0.86 |
| 56-72 | 210-190 | 16 | 0.9-0.99 |
| 73-81 | 190-180 | 18 | 0.99-1.05 |
| 82-88 | 169 | 6 | 1.12 |
| 89-93 | 160 | 4 | 1.18 |
| 94-194** | 149 | 100 | 1.27 |

*Table 1 Summary of skydiver's downsizing progression.*

** Wing loading calculated using a constant exit weight of 86kg/189lbs.*
***Jumps on his own canopy, same as accident jump (except jump 138 which was conducted on a borrowed canopy).*

The New Zealand Parachute Federation (NZPF), in co-operation with the NZPIA, has published a Recommended Canopy Size Chart (refer Appendix - figure 4) for use when downsizing. For a skydiver of 86kg with fewer than 200 total jumps, the recommendation indicates a minimum of a 190 sqft canopy and 170 sqft between 200-500 total jumps.

While completing the diploma course, the process of downsizing in practice is generally determined by the frequency of jumps, and an individual's competence, as assessed by an instructor. The high frequency of jumps during the course generally results in a student progressing ahead of the recommended guidelines. This was the case for the skydiver in this accident.

[9] Wing loading is the ratio of how much weight is carried by the size of the canopy. It is calculated by dividing the total exit weight of the skydiver by the size of the canopy. Usually expressed in lbs/sqft.

## Industry safety record

Given the relatively small size of the New Zealand skydiving industry, reliable and meaningful data is difficult to ascertain. For the period from December 2001 to March 2021 there had been 19 accidents reported to the CAA with landing problems attributed to them. At a reported rate of fewer than one per year, it's possible this relatively low rate is reflective of a low rate of accident reporting within the industry. The United States Parachute Association publishes a wealth of industry safety information and data (refer Appendix – figures 5 and 6). Their 20-year (2002-2021) data reported that 34 percent of fatal accidents were caused by landing problems with 8 percent being attributed to unintentional low turns[10].

## Additional considerations

Hypoxia – video footage and witness statements indicate that supplementary oxygen was used and that effects of hypoxia were unlikely. This is corroborated by the normal control checks being carried out after the canopy opening.

Equipment – there was no indication that any of the equipment was faulty or degraded, or that it contributed to the accident.

Incident and behavioural history – witnesses stated that the skydiver was relatively conservative with his canopy control, and that there were no previously recorded incidents or accidents involving the skydiver.

Fatigue and fitness to jump – there were no indications that the skydiver was fatigued or otherwise unfit to jump.

PLA environment – at the time of the accident, operations in the vicinity of the PLA were light, and distraction caused by the environment were considered unlikely.

## Conclusions

- The skydiver attempted to manoeuvre for landing with insufficient height to return to level flight before striking the ground.

- The skydiver may have been focussed on achieving an accurate landing and made an error in judgement with regards to the altitude required for the final manoeuvre.

- Although the skydiver was jumping with a canopy smaller than the recommended guidelines, he had completed 100 jumps with it without incident. He had demonstrated competence and was familiar with its handling and performance characteristics.

- Due to the high rate of descent, the accident was not survivable.

[10] The USPA defines an unintentional low turn as a low altitude turn to face into wind or to avoid another parachute or obstacle on the ground. As opposed to an intentional high-speed landing.

# Actions taken

In response to this accident along with other recent serious incidents in New Zealand and overseas, the NZPIA proactively and independently took measures, which resulted in Safety Notice No. 21-01 (refer Appendix figures 7 and 8) being issued on 26th November 2021.
This safety notice:

- advises instructors and coaches to review their current training material, including a focus on landing priorities and low turn recoveries.

- reminds instructors that trainees under their supervision must maintain up to date documentation regarding their experience.

- advises operators to review their procedures for assessing and authorising skydivers for specific canopies and manoeuvres.

- encourages all participants to engage in community events to promote safety through sharing knowledge and experiences without judgement or blame.

# Safety messages

- The value of reporting incidents and near misses to better investigate, understand and disseminate safety lessons to industry cannot be overstated. Each incident is a learning opportunity. This report serves to encourage participants to proactively report incidents or near misses to assist in improving safety within the skydiving community.

- While not considered a contributory factor in this accident, premature downsizing has been a factor in other accidents. This accident serves as a reminder to the skydiving community of the potential safety benefits of larger canopies and lower wing loading. Industry participants are encouraged to promote a conservative approach to downsizing progression in order to increase safety margins, and to consider 'why' they are downsizing prior to doing so. As part of any downsize progression or canopy handling assessment, emphasis should be placed on landing priorities, safe execution of out of wind landings and strategies for low turn recovery.

# Administrative information

| | | |
|---|---|---|
| Canopy manufacturer and model | | Icarus Safire 2 - 149 |
| Helmet | | Cookie G3 – full face |
| Location of incident | | NZTG – Tauranga, New Zealand |
| Date and time of incident | | 20 March 2021, 1035 NZDT |
| Civil aviation rules applying | | Part 105 *Parachuting Operating Rules* |
| Occurrence number | | 21/1494 |
| Injuries | Crew | 1 fatal |
| | Passengers | N/A |
| | Others | N/A |

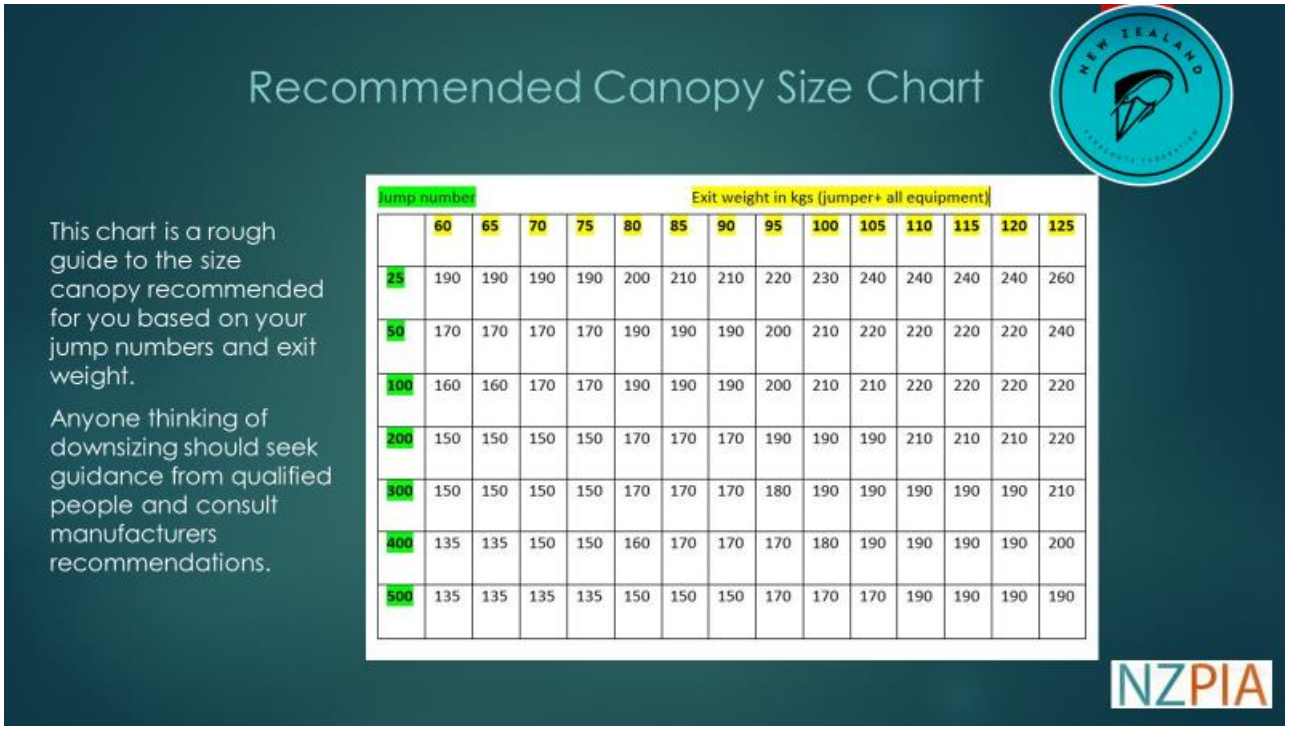
# Pilot information

| | | |
|---|---|---|
| Age and gender | | 21 male |
| Licences | | NZPIA B Certificate |
| Ratings | | NZPIA High Altitude (20,000') Course |
| Wing loading (lbs/sqft) | | 1.27 |
| Skydiving experience (number of jumps) | Total | 194 |
| | Total on canopy size (149) | 101 |
| | In prior 7 days | 3 |
| | In prior 90 days | 29 |
| | In prior 12 months | 194 |
| | Time in sport | 7 months, 26 days |

# Meteorological information

| | | |
|---|---|---|
| Conditions at accident site (NZTG AWS average of 1000 & 1100 NZDT) | Wind | 130°T, 7-9 knots, max gust 16 knots |
| | Visibility | 45km |
| | Cloud | Few 047 (4700 ft) |
| | Pressure | 1028.6 hPa |
| | Temperature | 19.2 °C |
| Departure point | | NZTG |
| Destination | | NZTG |

# Appendix




| Jump number | Exit weight in kgs (jumper+ all equipment) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 |
| 25 | 190 | 190 | 190 | 190 | 200 | 210 | 210 | 220 | 230 | 240 | 240 | 240 | 240 | 260 |
| 50 | 170 | 170 | 170 | 170 | 190 | 190 | 190 | 200 | 210 | 220 | 220 | 220 | 220 | 240 |
| 100 | 160 | 160 | 170 | 170 | 190 | 190 | 190 | 200 | 210 | 210 | 220 | 220 | 220 | 220 |
| 200 | 150 | 150 | 150 | 150 | 170 | 170 | 170 | 190 | 190 | 190 | 210 | 210 | 210 | 220 |
| 300 | 150 | 150 | 150 | 150 | 170 | 170 | 170 | 180 | 190 | 190 | 190 | 190 | 190 | 210 |
| 400 | 135 | 135 | 150 | 150 | 160 | 170 | 170 | 170 | 180 | 190 | 190 | 190 | 190 | 200 |
| 500 | 135 | 135 | 135 | 135 | 150 | 150 | 150 | 170 | 170 | 170 | 190 | 190 | 190 | 190 |

*Figure 4 - Recommended canopy downsizing chart (extracted from NZPF 'Canopies - Essential Skills & Downsizing' resource).*

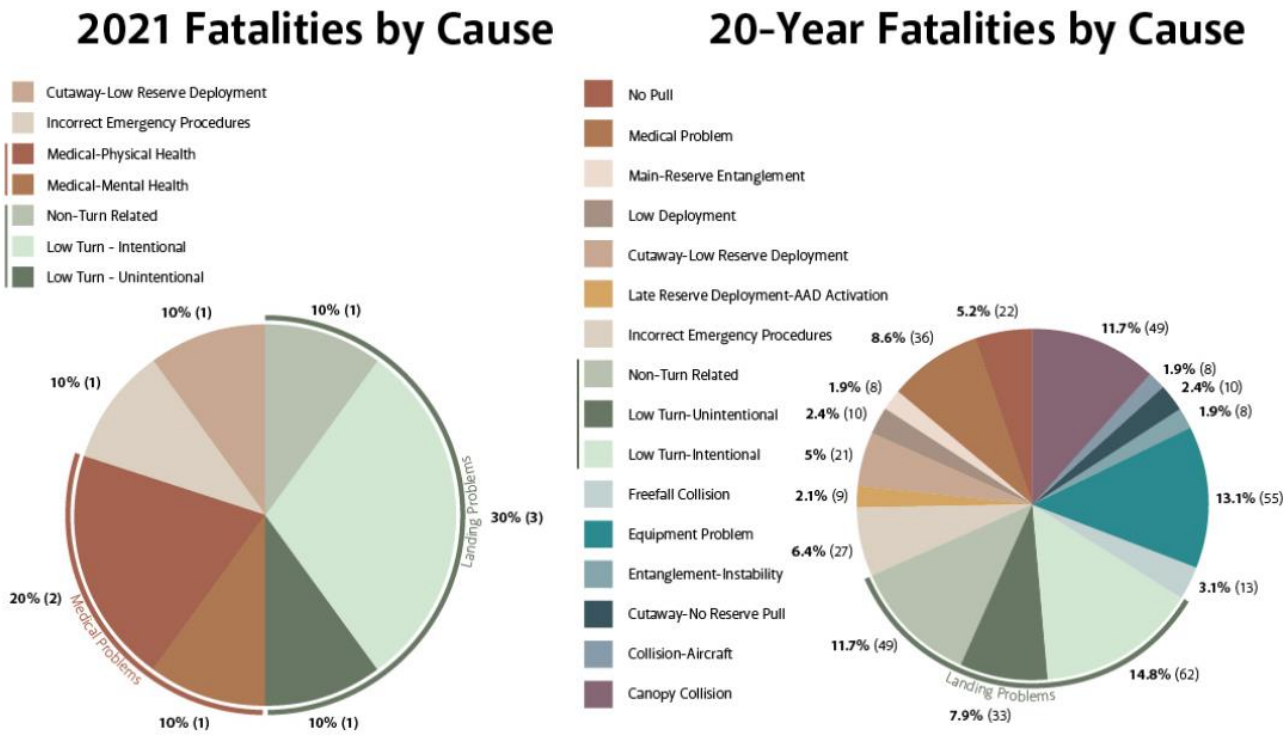



*Figure 5 - USPA fatal accident statistic.*

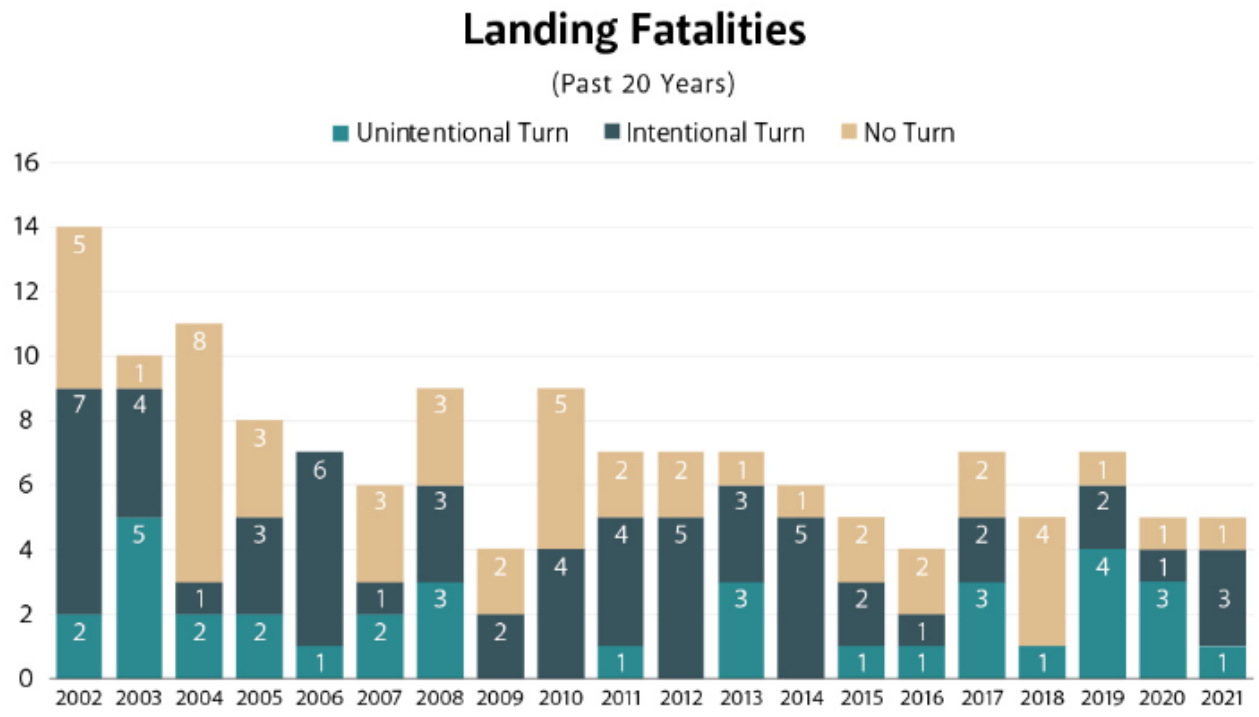



*Figure 6 - USPA landing fatality statistics.*

Instructors and canopy coaches

Instructors and canopy coaches at all levels are advised to review their current training material with a focus on the basics, including landing priorities; traffic / right-of-way rules; crosswind, downwind and no-wind landings; obstacle landings; off-PLA landings; and low turn recovery.

Instructors and coaches are also reminded that trainees under their supervision must maintain accurate and up-to-date logbooks to document the skills they've learned and their experience on different equipment.

It is recommended that instructors and coaches in all disciplines regularly engage in comprehensive refresher training or peer proficiency checking, covering all of the above areas at a minimum, in addition to the required biennial proficiency checks.

*Figure 7 - Excerpt from NZPIA SN No.21-01.*

Operators / safety officers

Operators are advised to review their procedures for assessing and authorising parachutists for specific canopies and landing manoeuvres. There are no "safe" or "unsafe" canopies—all can be landed safely or unsafely depending on the skill of the canopy pilot—so it's important for all parachutists, from students to experts, to have skills and training that are appropriate to the type of canopies they are flying.

It is recommended that operators, if they haven't already, include consequential risks of Covid-19 protection measures to their SMS, e.g. the effects of lockdowns and reduced workloads on personnel currency/ongoing competency and proficiency with the operation's safety systems and risk management procedures.

ALL PARTICIPANTS

NZPIA strongly recommends that everyone participating in parachuting activities—regardless of area of specialty, total experience or currency—regularly participate in training courses, skills camps and community events, either as a host or an attendee. These events help community members stay in touch with their peers and promote safety through sharing knowledge and experiences.

NZPIA also strongly encourages all participants to openly discuss and share information about accidents and incidents, without judgement or blame, to promote safety through shared learning at all levels of the community.

*Figure 8 - Excerpt from NZPIA SN No.21-01.*

# About the CAA

New Zealand's legislative mandate to investigate an accident or incident is prescribed in the Transport Accident Investigation Commission Act 1990 (the TAIC Act) and Civil Aviation Act 1990 (the Act).

Following notification of an accident or incident, TAIC may open an inquiry. CAA may also investigate subject to Section 72B(2)(d) of the Act which prescribes the following:

**72B Functions of Authority**

(2) The Authority has the following functions:

(d) To investigate and review civil aviation accidents and incidents in its capacity as the responsible safety and security authority, subject to the limitations set out in section 14(3) of the Transport Accident Investigation Commission Act 1990

A CAA safety investigation seeks to provide the Director of Civil Aviation with the information required to assess which, if any, risk-based regulatory intervention tools may be required to attain CAA safety objectives.

# About this safety investigation report

The purpose of this brief is to identify to the aviation community:

- what happened
- factors contributing to the accident, and
- any relevant safety messages.

Civil Aviation Authority of New Zealand Level 15, Asteron Centre
55 Featherston Street
Wellington 6011 OR

PO Box 3555, Wellington 6140, NEW ZEALAND

Tel: +64-4-560 9400 Fax: +64-4-569 2024
www.aviation.govt.nz