CIVIL AVIATION AUTHORITY OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

SAFETY INVESTIGATION REPORT
CAA OCCURRENCE 22/2536
PIPER PA-25-235 PAWNEE
ZK-CIG
TOW UPSET DURING GLIDER AEROTOW
FEILDING AERODROME, FEILDING
07 MAY 2022

Photo credit: http://nzcivair.blogspot.com/2016/02/hurry-up-and-wait.html

Foreword

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

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

> ***72B Functions of Authority***
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> *(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 sets out to determine the circumstances and identify contributory factors of an accident or incident. The purpose of this is to minimise or reduce the risk to an acceptable level of a similar occurrence arising in the future. The safety investigation does not seek to ascribe responsibility to any person but to establish the contributory factors of the accident or incident based on the balance of probability.

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.

Table of Contents

Glossary of abbreviations

agl	above ground level
amsl	above mean sea level
CAA	Civil Aviation Authority
CAR	Civil aviation rule(s)
PPL(A)	Private Pilot Licence (Aeroplane)
E	east
ft	foot or feet
GPS	Global Positioning System
kt	knots
m	metre(s)
mm	millimetre(s)
MHz	megahertz
NNE	north north east
NZST	New Zealand Standard Time
RA	review of airworthiness
S	south
UTC	Coordinated Universal Time
VHF	very high frequency

Data summary

Aircraft type, serial number and registration:	Piper PA25-235 Pawnee, s/n 25-3012 ZK-CIG
Number and type of engines:	One, Lycoming O-540-A1A5
Year of manufacture:	1964
Date and time of accident:	07 May 2022, 1410 hours[1] (approximately)
Location:	Feilding Aerodrome, Feilding Latitude[2]: S 40° 15' 09" Longitude: E 175° 36' 01"
Type of flight:	Glider towing
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Aircraft destroyed
Pilot-in-command's licence	Private Pilot Licence (Aeroplane)
Pilot-in-command's age	74 years
Pilot-in-command's total flying experience:	909 hours (approximately) 416 on type (approximately) 2519 glider tows (approximately)
Investigator-in-Charge:	Mrs SJ Mandich

[1] All times in this report are NZST (UTC + 12 hours) unless otherwise specified.

[2] NZ Geodetic Datum 1949 (or WGS-84) co-ordinates

Executive summary

The Civil Aviation Authority (CAA) was notified of the accident at 1420 hours on Saturday 07 May 2022. The Transport Accident Investigation Commission was in turn notified and chose not to open an inquiry. A CAA safety investigation was commenced the following day.

A tow pilot was conducting a glider aerotow flight from Feilding Aerodrome when the tow plane was observed to roll to the right and descend before impacting trees. The pilot survived the initial impact and was airlifted to hospital, but later succumbed to his injuries.

The accident occurred when the glider became out of position resulting in a combination high lateral tow upset during the aerotow. This caused the tow plane to depart controlled flight. Due to the low altitude at which the tow upset occurred, the pilot was unable to recover the situation prior to the tow plane impacting the trees.

The safety investigation identified that cognitive biases are intrinsic to human nature and cannot be eliminated. The most effective mitigation for the risks these biases pose to aviators is awareness. It is recommended that the CAA review the Human Factors section of their website to ensure awareness of these biases, and the contribution they make to pilot judgement and decision-making errors, are included. It is also recommended that CAA consider producing a Human Factors Good Aviation Practice booklet (GAP).

It is further recommended that Gliding New Zealand (GNZ) ensure that human factors considerations are included as part of the pilot training programme.

The CAA has made four recommendations to address the safety issues identified.

1. Factual information

1.1. History of the flight

1.1.1. On the day of the accident the tow pilot was not originally rostered to fly. He received an email the previous evening advising that the rostered tow pilot was unavailable, and he responded saying he was available to provide cover.

1.1.2. On the day of the accident, the pilot was described as being in good spirits and feeling well. He had slept well the previous night, woke at about 0700 hours and had breakfast before leaving for Feilding Aerodrome.

1.1.3. After arriving at the aerodrome, the tow pilot prepared the tow aircraft for the day. The tow pilot then conducted four aerotows prior to the accident flight.

1.1.4. The accident flight involved towing a Rolladen-Schneider LS 3, single-seat glider. The glider was equipped with a belly hook[3] only, to which the tow rope was connected for the aerotow.

1.1.5. The purpose of the flight was a private flight. The glider pilot was a qualified glider instructor with the local gliding club, as well as the club's current Chief Flying Instructor. The glider pilot had waited about four hours for the right flying conditions before commencing the accident flight.

1.1.6. Prior to the initial launch, the glider was lined up behind the tow plane and the tow rope connected to the belly hook. A wing runner[4] was used to hold the wings level during the initial phase of the take-off roll.

1.1.7. During the take-off roll, after the wing runner had released the right wing, the left wing of the glider contacted the ground. This caused the nose of the glider to yaw to the left, and the glider to become out of position to the left of the tow plane.

1.1.8. The glider pilot managed to level the glider's wings prior to becoming airborne. Once off the ground the glider was seen to balloon up slightly above the tow plane, while still out of position to the left, but within the wingspan of the tow plane.

1.1.9. At approximately 50 – 100 feet above ground level (agl) the glider was still out towards the left of the tow plane. A witness stated, 'It appeared to go high, then push forward to get back down to the correct vertical position causing a bow in the rope.'

1.1.10. As the slack was taken out of the rope the glider appeared to kite[5] up while out to the left of the tow plane. The tow plane's right wing was seen to drop, and the aircraft rolled to the right before entering a steep nose down dive. The aircraft subsequently disappeared behind a hangar at the northern end of the airfield.

1.1.11. CCTV footage captured the tow plane, with the tow rope attached, impacting a large tree, and coming to rest at the base of the tree near the road.

1.1.12. After the tow plane departed controlled flight, the tow rope failed at the glider end, allowing the glider to continue and complete a close-in circuit and land back on the grass runway. The glider sustained minor damage when it clipped the aerodrome perimeter fence and a subsequent ground loop.

1.1.13. The recorded flight time for the glider was one minute 29 seconds.

1.1.14. The accident occurred in daylight, at approximately 1410 hours, at Feilding Aerodrome (NZFI), at an elevation of 214 feet above mean sea level (amsl). Latitude S 40° 15' 09", longitude E 175° 36' 01".

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[3] A belly hook is positioned on, or near, the glider's centre of gravity.

[4] A wing runner is a ground crew member used to hold the wing and signal the glider pilot's intentions to the tow pilot.

[5] Kiting, also known as slingshot, is when the glider climbs rapidly out of position, above the tow plane.

1.2. Injuries to persons

Injuries	*Crew*	*Passengers*	*Other*
Fatal	1	0	0
Serious	0	0	0
Minor/None	0	0	1

Table 1: Injuries to persons

1.3. Damage to aircraft

1.3.1. The tow plane was destroyed.

1.4. Other damage

1.4.1. The glider sustained minor damage to the undercarriage and wing from contacting the aerodrome perimeter fence and a subsequent ground loop.

1.5. Personnel information (Tow pilot)

Flying hours	All types	Relevant type	Aerotows
Last 24 hours	0.8	0.8	4
Last 7 days	0.8	0.8	0
Last 30 days	0.8	0.8	0
Last 90 days	4.95	4.95	30
Total hours	911	418	2523

Table 2: Personnel information – tow pilot flight hours, powered aircraft

1.5.1. The tow pilot initially gained a Private Pilot Licence (Aeroplane) in May 1977. He gained a glider tow rating in June 1997 after completing a PA 25 Piper Pawnee rating in March 1997.

1.5.2. At the time of the accident, the tow pilot's logbook recorded 2519 glider tows. The tow pilot conducted four aerotows on the day of the accident, prior to the accident flight.

1.5.3. The tow pilot was issued a Recreational Pilot Licence (RPL) in November 2016, and held a valid DL9 Class 2, with passenger endorsement issued on 14 October 2020.

1.5.4. The tow pilot held a Glider Tow Pilot Instructor Approval issued on 05 June 2010 by GNZ.

1.5.5. The tow pilot completed a Biennial Flight Review (BFR) in a Cessna 152 on 25 March 2021.

1.5.6. The tow pilot also held a GNZ Lifetime Instructor Rating, issued on 08 October 2011, and a current GNZ Engineer approval with an expiry date of 30 June 2023.

1.5.7. The tow pilot held the appropriate licence, medical certificate, and currency requirements to conduct the flight.

1.5.8. **Personnel information** (Glider pilot)

Flying hours	All types	Relevant type
Last 24 hours	0	0
Last 7 days	0.65	0
Last 30 days	0.65	0
Last 90 days	5.4	4.1
Total hours	1092.5	6.4

Table 3: Personnel information – glider pilot flight hours

1.5.9. The glider pilot commenced gliding in 1979 and held a B-Category Glider Instructor Rating issued on 07 October 1998 by Gliding New Zealand. The pilot had conducted a total of 2030 glider flights prior to the accident flight.

1.5.10. The pilot held a current GNZ Medical Certificate and Declaration issued on 21 May 2021.

1.5.11. The pilot completed a BFR on 10 July 2021. The BFR was completed in a two-seater club glider. This flight also included a Competency Review – Advanced & Senior Instructors for the pilot's B-Category instructor rating.

1.5.12. The pilot was a part owner of the glider and had conducted seven flights in the glider in the preceding three and a half months prior to the accident flight.

1.5.13. As well as having considerable gliding experience the pilot had completed approximately 67 hours fixed wing flying since 2016.

1.5.14. The glider pilot held the appropriate glider certificate, medical declaration, and currency requirements to conduct the flight.

1.6. Aircraft information

1.6.1. Piper PA25-235 (Pawnee), ZK-CIG, serial number 25-3012, was imported into New Zealand from the United States of America in 1964. The aircraft was subsequently registered in March 1965 as ZK-CIG and issued with a standard category airworthiness certificate.

1.6.2. The aircraft was powered by a Lycoming O-540-A1A5, six-cylinder, horizontally opposed engine, driving a McCauley 1A200/FA8452 fixed-pitch propeller.

1.6.3. A modification for the installation of a glider tow hook was approved by the CAA in July 1991.

1.6.4. A biennial review of airworthiness was completed on 28 October 2020 with no defects identified.

1.6.5. At the time of the accident the aircraft had accrued 8329.81 hours total flight time. The last routine maintenance carried out was a 100 hour/ annual inspection on 24 June 2021, with the next inspection due on 24 June 2022.

1.6.6. The engine had accrued 8508.87 hours Total Time Since New (1518.56 hours Total Time Since Overhaul). The propeller, since overhaul in April 2008, had accrued 1111.92 hours at the time of the accident.

1.6.7. The last recorded maintenance carried out on the aircraft was for ‘engine rough running’. The left-hand magneto was removed, repaired, and reinstalled. This was carried out on 29 April 2022. The aircraft was flown with no reported issues on 30 April 2022 for 0.9 hours, prior to the accident.

1.7. Meteorological information

1.7.1. On the day of the accident there was no significant weather forecast in the area. There was scattered cloud in the wider region, with a cloud base of between 2000 - 3500 feet. The wind was approximately 9 knots from the northwest.

1.7.2. Witness statements confirmed that it was a ‘lovely day’, ‘calm and warm’ and with an approximate ‘5kt wind’.

1.7.3. Weather was not considered a factor in this accident.

1.8. Aids to navigation

1.8.1. Not applicable.

1.9. Communications

1.9.1. Both aircraft were fitted with VHF radios, however, no radio calls were made between the two aircraft.

1.9.2. During the initial take-off roll, communication between the glider and tow plane is done using approved visual signals from the wing runner, as set out in the Gliding NZ Manual of Approved Procedures (MOAP).

1.10. Aerodrome information

1.10.1. The gliding club operates out of Feilding Aerodrome (NZFI), an unattended aerodrome at an elevation of 214 feet amsl.

1.10.2. Glider operations are conducted on the southern grass area, in the direction of the active runway. On the day of the accident, runway 28 was in use.

1.11. Flight recorders

1.11.1. Flight data was retrieved from a recorder on board the glider. This information, although not specifically related to the tow plane, provided information relevant to the accident flight.

1.11.2. Flight data indicated the glider take-off roll began at 15:03:41 hours.

1.11.3. Based on the data, and the final location of the tow plane, it was determined that the approximate time of the upset was between 15:04:05 and 15:04:11 hours, some 24 to 30 seconds after the take-off roll commenced.

1.11.4. The total flight time of the glider was one minute and 29 seconds.

1.12. Wreckage and impact information

1.12.1. The aircraft wreckage was located approximately 100 metres (m) NNE from the end of runway 28, along Taonui Road.

1.12.2. The site examination indicated the aircraft struck a large tree in a steep nose-down attitude and came to rest at the base of the tree, across a deep ditch.

Figure 1: ZK-CIG accident site. Source CAA

1.12.3. All aircraft components were accounted for on site. There was significant damage to the front section and wings of the aircraft.

1.12.4. Pre-accident control integrity was established, with no issues identified. This also included the tow release mechanisms for both aircraft.

1.12.5. Medical and rescue staff cut the aircraft fuselage fabric and the door frame to gain access to the pilot.

1.12.6. Post accident, the tow rope was measured to be 42.8m, ring to ring.

1.13. Medical and pathological information

1.13.1. Post-mortem examination showed that the pilot died of, 'Complications of blunt trauma of [the] head with skull fractures and brain injury'.

1.13.2. An assessment of the pilot's medical records by a CAA senior medical officer concluded that, 'There is nothing to suggest that [the pilot] was not fit to undertake the flight under investigation.' And '…it was unlikely that a medical event would have contributed to the accident'.

1.13.3. The toxicology report stated that, '[The pilot] died in hospital about 12 days after the crash. Therefore, any drugs detected in the blood are likely to have been administered during his time in hospital'.

1.13.4. Based on this information, it is unlikely a medical issue contributed to the accident.

1.14. **Fire**

1.14.1. Not applicable.

1.15. **Survival aspects**

1.15.1. The pilot sustained traumatic head and brain injuries and later succumbed to these injuries.

1.15.2. The aircraft was fitted with a lap and shoulder harness and post-accident examination determined it to be in good working order.

1.15.3. The pilot was not wearing a helmet. However, it could not be conclusively determined if a helmet would have protected the pilot enough to prevent his fatal head injuries.

1.15.4. The aircraft was fitted with an Artex ME406 ELT. Although the ELT did not activate on impact, the accident was witnessed by several people who alerted authorities within minutes.

1.16. **Tests and research**

1.16.1. The engine was dismantled and inspected at a specialist facility under CAA supervision.

1.16.2. The inspection concluded that, 'General engine condition was 'worn' but serviceable with no obvious defects that would have affected performance.'

1.16.3. There was no evidence to suggest that any engine-related issues contributed to this accident.

1.17. **Organisational and management information**

1.17.1. GNZ provides training material to its members explaining lateral and vertical tow upsets. It has also periodically included information in its GNZ monthly newsletter, including a link to a video, *3 Seconds to Crash: Glider Aerotow Gone Wrong*[6], in its August 2022 newsletter.

1.17.2. GNZ also provides training information on tow upsets to tow pilots in the 'Aerotow Launch' section of the *Pilot Manual Aerotow Launch* Rev 1.3, produced 2018 and revised on 09 August 2022 and again on 05 April 2023.

1.17.3. On the GNZ website, under Safety Information, there are links provided to articles '*Safe Aerotowing*' and '*10 Towing Tips*' produced by the British Gliding Association (BGA).

1.17.4. GNZ Advisory Circular AC3-02 AEROTOW Ropes Section 3.1 *Making up Tow Ropes from Bulk Roll* states:

'The recommended minimum length for an aerotow rope is 50m ring to ring.'

[6] https://www.youtube.com/watch?v=5cpqFzhM9dY

1.18. **Additional information – human factors**

1.18.1. Two CAA human factors subject matter experts (SME) were consulted to provide opinion on the human factors' aspects of this accident.

1.18.2. For the purposes of judgement and decision-making, people often use 'heuristics' or 'rules of thumb'. In simple terms, these are intellectual shortcuts that enable the brain to streamline information processing, particularly when under pressure. While heuristics can simplify the process of decision-making, they can also lead to cognitive biases. These biases can result in errors of decision-making or judgement that, in an aviation environment, can significantly impact safety.

1.18.3. A common cognitive bias is 'confirmation bias'. The following is an explanation of this bias:

"We seek out information that confirms our pre-existing beliefs, while ignoring or dismissing information that contradicts them.'[7]

Confirmation bias exists in various different forms.

1.18.4. One form of confirmation bias is 'continuation bias', also known as 'plan continuation bias'. SKYbrary defines continuation bias as:

"…the unconscious cognitive bias to continue with the original plan in spite of changing conditions."[8]

1.18.5. SKYbrary goes on to state:

"Once a plan is made and committed to, it becomes increasingly difficult for stimuli or conditions in the environment to be recognised as necessitating a change to the plan. Often, as workload increases, the stimuli or conditions will appear obvious to people external to the situation, however, it can be very difficult for a pilot caught up in the plan to recognise the saliency of the cues and the need to alter the plan.

When continuation bias interferes with the pilot's ability to detect important cues, or if the pilot fails to recognise the implications of those cues, breakdowns in situational awareness occur. These breakdowns in situational awareness can result in non-optimal decisions being made, which could compromise safety."

1.18.6. Another form of confirmation bias is 'expectation bias'. This is described by SKYbrary as:

"…a psychological concept associated with perception and decision-making that can allow a mistaken assessment to persist".[9]

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[7] Flight Crew Expectation Bias and Potential Risks - aviationfile

[8] Continuation Bias | SKYbrary Aviation Safety

[9] Flight Crew Expectation Bias | SKYbrary Aviation Safety

Expectation bias tends to occur when a person has a preconceived idea about a situation, ie, expecting a certain condition or outcome. This influences how new information is interpreted and can lead to errors in decision-making.

1.18.7. A well-known human factor that can affect pilots in emergency situations is 'surprise'. SKYbrary provides the American Psychological Association definition of 'surprise':

"An emotion typically resulting from the violation of an expectation or the detection of novelty in the environment."[10]

1.18.8. A similar human factor that can affect pilots in emergency situations is the 'startle effect'. SKYbrary defines startle effect as:

"An uncontrollable, automatic reflex that is elicited by exposure to a sudden, intense event that violates a pilot's expectations."[11]

1.18.9. SKYbrary also highlights the effects and consequences for a pilot who may be experiencing startle effect:

1. Slower information processing
2. Serious impairment, or complete inability to evaluate and take appropriate action due to intense physiological response
3. Basic motor response disruption for up to three seconds
4. Performance of complex motor tasks impacted for up to ten seconds
5. May incur brief period of disorientation and confusion.

1.18.10. SKYbrary lists 'aircraft upset' as one of the potential situations where the startle reflex and response may occur.

1.18.11. The terms startle and surprise are often used synonymously. However, they elicit different responses with different causes and effects. The startle response is a fast and brief autonomic nervous system response to a sudden and unexpected auditory, visual or tactile stimulus[12]. Surprise is an emotional and cognitive response to an unexpected event and results in a change in the understanding of a situation.

1.18.12. As with startle, surprise elicits similar physiological and psychological responses. However, the surprise response is less defensive or incapacitating.[13]

[10] Surprise | SKYbrary Aviation Safety

[11] Startle Effect | SKYbrary Aviation Safety

[12] Davis, M. (1984). The mammalian startle response *Neural mechanisms of startle behaviour* (pp. 287-351): Springer, Boston, MA.

[13] Bradley, M. M., Miccoli, L., Escrig, M. A., & Lang, P. J. (2008). The pupil as a measure of emotional arousal and autonomic activation. *Psychophysiology*, 45(4), 602-607.

1.18.13. Situational awareness is our accurate awareness and understanding of a situation or system and 'what is going on' around us.[14]

1.18.14. When situational awareness is compromised, changes in the environment are likely to go unnoticed and can have serious consequences. Multiple and complex tasks can quickly exceed the brain's limited attention capacity and impede situational awareness development resulting in decision making errors and degraded performance.

1.19. **Useful or effective investigation techniques**

1.19.1. Not applicable.

2. Analysis

2.1. During the take-off roll, the glider's wing contacted the ground causing it to yaw to the left. This resulted in the glider being out of position to the left of the tow plane on take-off.

2.2. At about 50 – 100 feet agl, the glider, while still out to the left, but within the wingspan of the tow plane, appeared to go high and then push forward to get back to the correct vertical height, causing a bow in the tow rope.

2.3. As the tow rope re-tensioned, the glider appeared to kite up while still out to the left of the tow plane causing a lateral high upset of the tow plane. The result of a lateral high upset is an uncommanded yaw, roll and nose pitch down of the tow plane. This would have developed rapidly and probably startled the tow pilot.

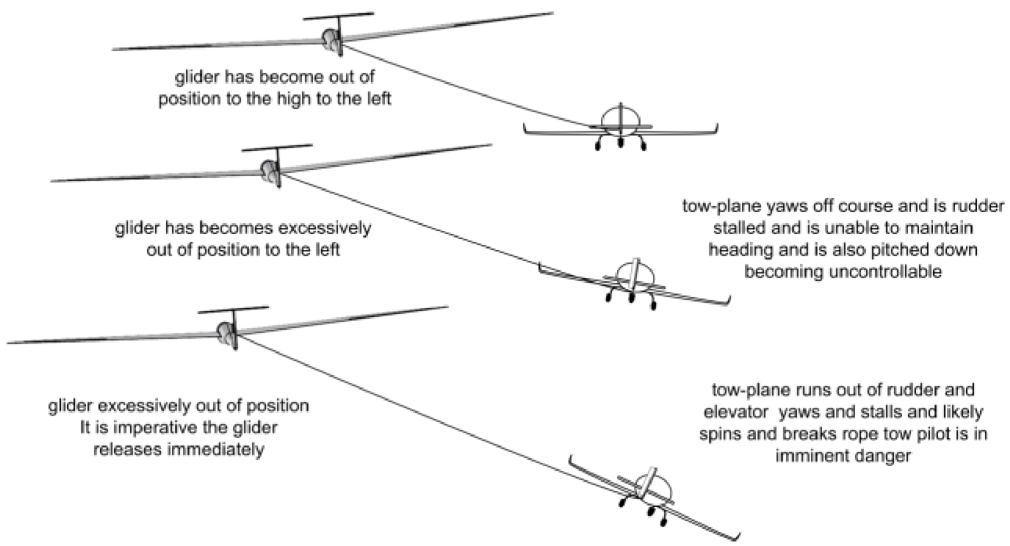

Figure 2: Lateral High Upset Diagram

(Source: https://gliding.co.nz/wp-content/uploads/2018/01/Instructor%20Manual%20Part%202-Jan18%20amdt.pdf)

[14] Endsley, M.R. (2000). Theoretical underpinnings of situation awareness: A critical review. In M.R Endsley & D.J. Garland (Eds.), *Situation awareness analysis and measurement*. Mahwah, NJ: LEA.

2.4. The tow plane departed controlled flight and the tow pilot was unable to regain control in the height available.

2.5. The forces created by the increasing divergence between the glider and tow plane caused the tow rope to fail at the glider-end splice.

2.6. The failing of the rope allowed the glider to complete a close-in circuit and land, sustaining minor damage when it contacted the boundary fence and subsequent ground loop.

2.7. Post-accident, the tow rope was measured and found to be 42.8m. 7.2m shorter than the GNZ AC 3-02 AEROTOW Ropes[15] minimum recommended 50m length.

2.8. The shorter rope was likely a contributing factor in the accident as it would have increased the rate at which the upset occurred. Thus, reducing the time available for either of the pilots to react to the upset situation.

2.9. Information available in the *Gliding Federation of Australia Aerotowing Manual* states, 'The chances of a tow plane upset occurring are considerably reduced if the minimum rope length is adhered to. The shorter the rope, the less TIME the tow pilot has to get rid of the glider in an upset situation. It does not take much shortening of the rope for this time-compression to become critical.'[16] It also states, 'The recommended minimum length for an aerotow rope is 55 metres plus or minus 5 metres.'

2.10. The time from take-off to the accident was estimated, from the glider flight data, to be about 24 to 30 seconds.

2.11. The glider was fitted with a combination tow hook, often referred to as a belly hook. The belly hook is positioned on, or near, the glider's centre of gravity. The position of the belly hook is designed for winch-launching but is also used in aerotowing.

2.12. According to BGA Safe Aerotowing guidance[17], gliders fitted with only a combination hook and the use of a short rope are two of several factors that could contribute to a hazardous situation. It is important for pilots to be aware of these factors.

2.13. Human factors SMEs provided the investigation with an analysis of the contributory factors that likely influenced the glider pilot's decision-making.

2.14. It is likely that the glider pilot's decision to continue with the take-off was influenced by the following human factors:

1. Confirmation bias:

   There were two forms of confirmation bias that likely contributed to the pilot's decision to continue with the take-off, even when there were cues suggesting that the situation was becoming unsafe:

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[15] https://gliding.co.nz/wp-content/uploads/currentdoc/AC3-02.pdf

[16] https://www.doc.glidingaustralia.org/index.php?option=com_docman&view=download&alias=2275-aerotowing-manual-ops-0008&category_slug=manuals&Itemid=101

[17] https://members.gliding.co.uk/bga-safety-management/safe-aerotowing/

a) Expectation bias:

When the glider wing contacted the ground during the take-off roll, the pilot did not abort the take-off. The glider pilot stated that the wing contacting the ground is not uncommon and he had experienced several wing-drop situations. The glider pilot felt confident he could correct the situation and did so.

However, once airborne, and as a consequence of the wing contacting the ground, the glider became out of position behind the tow plane. While being out of position was unexpected, the glider pilot had been trained and had trained others for this type of scenario. It is likely therefore, he expected to be able to correct it, contributing to his decision to continue with the take-off.

b) Plan continuation bias:

The glider pilot stated he had waited for about four hours on the day for the conditions to be right for the flight. It is likely that by the time the flight occurred, he was keen to complete the flight and achieve his aims.

The glider pilot also stated that once airborne, he assessed that there were limited 'out-landing' options to use in the case of release from the tow plane.

Both of these factors likely contributed to the glider pilot's decision-making being biased towards continuing the flight.

2.15. It is likely that the glider pilot's response to the evolving situation was influenced by the following human factors:

2. Surprise/situational awareness:

The glider pilot likely experienced surprise and a consequent workload increase as the glider became out of position. The need to focus his attention on the more complex situation likely contributed to the pilot experiencing reduced situational awareness, meaning he would be less likely to respond effectively to the developing emergency.

3. Startle:

As the glider appeared to rapidly and unexpectedly kite, the pilot likely experienced a degree of startle. Startle would have had a significant effect on the glider pilot's capacity to interpret the rapidly changing situation and release from the tow plane.

2.16. The following considerations were given as to why the tow pilot may not have released the glider prior to the upset occurring:

1. Up until the time the upset occurred, there was no evidence to indicate that the tow pilot was concerned with the conduct or performance of the aerotow.

2. If the tow pilot was aware the glider was out of position, he may have delayed releasing the glider as there would be a reluctance to do so unless it was

absolutely necessary. At low level a tow pilot is aware that releasing the glider may put the glider in a safety-critical situation and so the tow pilot may have been reluctant to release.

3. It is likely the tow pilot would give the glider pilot the opportunity to return to the correct tow position. In most cases the glider pilot recovers. However, on occasion, the tow pilot's delay in releasing the glider can result in an unrecoverable upset situation.

3. Conclusions

3.1. Due to a combination high lateral tow upset during the aerotow, the tow plane departed controlled flight and the tow pilot was unable to regain control in the height available.

3.2. The investigation identified several likely contributory factors. Each individual factor may not result in an unrecoverable upset situation. This accident was likely the result of the combination of these factors.

3.3. During the take-off roll the glider's wing contacted the grass resulting in the glider becoming out of position to the left of the tow plane.

3.4. At approximately 50 – 100 feet agl, the glider, while still out of position to the left of the tow plane, became out of position high relative to the tow plane.

3.5. During an attempt to reposition the glider into to the correct tow position, the tow rope became slack.

3.6. As the tow rope re-tensioned, the glider appeared to kite up while still out to the left of the tow plane, causing the tow plane to yaw excessively to the right, followed by an uncommanded roll and then pitch nose down.

3.7. The shorter rope resulted in an increased rate at which the upset occurred.

3.8. The rate at which the upset developed reduced the reaction time for either pilot to effect a release.

3.9. It is likely that the glider pilot continued with the plan rather than release from the tow plane due to his expectation that he could safely recover the situation and continue on to achieve the intended aims of his flight.

3.10. When the situation became safety-critical the glider pilot's actions were likely affected by startle, preventing an effective response to the emergency.

3.11. The reason the tow pilot did not release the glider could not conclusively be determined.

3.12. The low altitude at which the upset occurred meant the tow pilot could not effectively respond and recover from the upset.

4. Safety actions/recommendations

4.1. Cognitive biases are intrinsic to human nature and cannot be eliminated. The most effective mitigation for the risks these biases pose to aviators is awareness. It is recommended that the CAA review the human factors section of their website to ensure awareness of these biases, and the contribution they make to pilot judgement and decision-making errors. It is also recommended that CAA consider producing a human factors Good Aviation Practice booklet (GAP).

4.2 Gliding NZ's Human Factors Study Guide provides information on multiple aspects of human factors. However, a review by the CAA identified that there are some areas where information could be further enhanced to provide pilots with a comprehensive understanding of this important field of knowledge. It is recommended that GNZ include additional information in their study guide focusing on non-technical skills. Reference to the CAA human factors website information would support the implementation of this recommendation.

4.3 It is recommended that GNZ ensure gliding clubs are reminded of the importance of ensuring tow ropes meet the recommended minimum length as set out in GNZ Advisory Circular AC3-02 AEROTOW Ropes. It is also recommended that an assessment of tow ropes be included in routine club audits and that clubs provide an easy means of measurement.

4.4 It is recommended that GNZ remind pilots of the factors that can contribute to an increased risk of an upset during an aerotow, as outlined in the GNZ Pilot Training Programme and BGA guidance for safe aerotowing.

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