



## **Erratum to tow upset during glider tow involving Piper PA28-236 Dakota, ZK-FMT**

Springfield Canterbury, 19 January 2014

CAA Safety Investigation Report  
CAA Occurrence No. 14/155  
Erratum date: 17 May 2021

## Introduction

This erratum addresses an inaccurate point in the original report released on 07 August 2015.

Following a review of the witness statement provided by the QGP, paragraph 1.1.2 has been amended to reflect the purpose of the glider flight. The corrections do not affect the safety considerations of the original report.

Paragraph 1.1.2 from the original report:

The third flight (the accident), involved towing a Schempp-Hirth Janus Ce glider with two persons on board. The glider flight was a dual instructional flight with the gliding instructor seated in the rear seat and a Qualified Glider Pilot (QGP) under instruction in the front seat. The purpose of the flight was for the QGP to regain currency on the Janus as they had not flown the glider for some time.

Paragraph 1.1.2 updated:

The third flight (the accident), involved towing a Schempp-Hirth Janus Ce glider with two persons on board. The glider flight was a dual instructional flight with the gliding instructor seated in the rear seat and a Qualified Glider Pilot (QGP) seated in the front seat. Due to the environmental conditions on the day, the QGP stated that he was not confident to fly by himself and so accepted a dual flight which had been offered by the instructor. The QGP was also not current on the Janus glider type, having not flown the glider for some time.

## 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 CAA Act).

Following notification of an accident or incident, TAIC may conduct an investigation. The CAA may also investigate subject to Section 72B(2)(d) of the CAA 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

The purpose of a CAA investigation is to determine the circumstances and identify contributory factors of an accident or incident with the purpose of minimising or reducing the risk to an acceptable level of a similar occurrence arising in the future. The 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.

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**SAFETY INVESTIGATION REPORT  
CAA OCCURRENCE NUMBER 14/155**

**ZK-FMT  
PIPER PA28-236 DAKOTA  
TOW UPSET DURING GLIDER TOW**

**SPRINGFIELD  
CANTERBURY**

**19 JANUARY 2014**



## 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 Civil Aviation Act 1990 (the CAA Act).

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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.

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## Glossary of abbreviations

agl	above ground level
amsl	above mean sea level
CAA	Civil Aviation Authority
E	east
ELT	Emergency Locator Transmitter
GNZ	Gliding New Zealand
GPS	Global Positioning System
kg	kilogram(s)
NZDT	New Zealand Daylight Time
QGP	Qualified Glider Pilot
S	south
UTC	Coordinated Universal Time
VHF	very high frequency

## Data summary

<b>Aircraft type, serial number and registration:</b>	Piper PA28-236 Dakota, S/N 28-7911197, ZK-FMT
<b>Number and type of engines:</b>	One, Lycoming O-540-J3A5D
<b>Year of manufacture:</b>	1979
<b>Date and time of accident:</b>	19 January 2014, 1202 hours <sup>1</sup>
<b>Location:</b>	Springfield, Canterbury Latitude <sup>2</sup> : S 43° 22' 26.71" Longitude: E 171° 54' 29.44"
<b>Type of flight:</b>	Glider towing
<b>Persons on board:</b>	Crew: 1
<b>Injuries:</b>	Crew: 1 fatal
<b>Nature of damage:</b>	Aircraft destroyed
<b>Pilot-in-command's licence:</b>	Private Pilot Licence (Aeroplane)
<b>Pilot-in-command's age:</b>	55 years
<b>Pilot-in-command's total flying experience (approx):</b>	601 hours total 134 hours on type 344 glider tows
<b>Investigator in Charge:</b>	Mr C P Grounsell

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<sup>1</sup> All times in this report are NZDT (UTC + 13 hours) unless otherwise specified.

<sup>2</sup> NZ Geodetic Datum WGS84 co-ordinates.

## **Executive Summary**

The Civil Aviation Authority (CAA) was notified of the accident at 1230 hours on 19 January 2014. The Transport Accident Investigation Commission was in turn notified and chose not to investigate. A CAA Safety Investigation was commenced the following day.

The pilot was conducting a glider tow flight from Springfield Aerodrome when the tow plane was observed by witnesses both on the ground and in the glider to roll to the right, descend and strike trees. An intense fire then ensued which consumed the majority of the aircraft. The first responders to the accident scene attempted to extinguish the fire with hand held extinguishers but they had little effect. The fire was eventually extinguished by the fire and rescue emergency responders who found the pilot deceased within the wreckage.

The CAA safety investigation found that the accident occurred as a result of a lateral tow upset during the aerotow causing the tow pilot to momentarily lose control of the tow plane. Due to the low altitude at which the tow upset occurred, the pilot was unable to recover the situation prior to the aircraft striking trees.

The safety investigation identified that there was minimal GlidingNZ training material available to pilots regarding lateral tow upsets. A safety recommendation was raised with GlidingNZ on this subject, this has now been actioned by them.

### **1. Factual Information**

#### **1.1 History of the flight**

- 1.1.1 On the day of the accident the pilot had been rostered for glider towing duties. He arrived at the aerodrome, pre-flighted and refuelled the aircraft with 32 litres of Avgas and conducted two glider tows of 10 and 8 minutes duration respectively.
- 1.1.2 The third flight (the accident), involved towing a Schempp-Hirth Janus Ce glider with two persons on board. The glider flight was a dual instructional flight with the gliding instructor seated in the rear seat and a Qualified Glider Pilot (QGP) under instruction in the front seat. The purpose of the flight was for the QGP to regain currency on the Janus, having not flown the glider for some time.

- 1.1.3 The glider was equipped with a combination tow hook (belly hook) only, to which the towrope was connected for the aerotow.
- 1.1.4 During the initial launch of the glider, the QGP was in control of the glider, however, during the take-off roll, the left wing of the glider dropped at which point the instructor took control and remained in control of the glider for the remainder of the flight.
- 1.1.5 During the initial climb-out phase and prior to the tow plane and glider turning onto the crosswind leg, the glider's position became high relative to the tow plane. The QGP queried whether they should release from the tow plane. At that time however, the instructor felt that everything was under control and continued with the aerotow whilst manoeuvring the glider in a descent towards the correct position behind the tow plane.
- 1.1.6 The descent increased the glider's airspeed which served to decrease the distance from the tow plane and slacken the towrope. To counter this, the instructor flew the glider out to the left-hand side of the tow plane which placed the glider in the tow plane's approximate 7 o'clock position.
- 1.1.7 At this time both the tow plane and glider were in the right-hand crosswind turn at approximately 300 feet agl. The instructor was about to deploy the glider's airbrakes to assist in correcting the tow position when the tow plane was observed to rapidly roll and descend below the glider.
- 1.1.8 The instructor commanded "release release" for the QGP to release the towrope from the glider, however, this instruction was either not heard or acknowledged by the QGP. Consequently, the tow rope was not released from the glider by either the QGP or the instructor. The instructor however, heard a sound which they took to be the towrope releasing from the glider; this sound most likely coincided with the failure of the safety link in the towrope.
- 1.1.9 The QGP observed the tow plane descending below the glider and noted it beginning to recover from the descent; however, there was insufficient height available to fully do so. They then observed the tow plane strike a stand of trees and begin to break up.

- 1.1.10 From the glider's position in relation to the aerodrome, the instructor was able to fly the glider back for a safe landing on to the duty runway.
- 1.1.11 A number of people on the ground at the aerodrome watched the aerotow as the position of the glider in relation to the tow plane had attracted their attention. It was observed that for the majority of the aerotow, the glider's position was high; one witness described the towrope being at an approximate 45 degree angle between the tow plane and the glider. The witnesses continued to observe the aerotow as the glider began to regain position although offset to the left of the tow plane.
- 1.1.12 The witnesses also commented that the climb profile of the aerotow was shallower than what they had expected. The first turn after take-off was commenced at approximately 250 feet agl, however, the tow plane and glider did not climb appreciably after this. When the tow upset occurred it was estimated that the tow plane and glider had climbed to approximately 300 feet agl.
- 1.1.13 Immediately following the upset, the witnesses observed the tow plane roll rapidly to the right and descend. It was noted that the tow plane was beginning to recover from the descent when it struck a stand of trees at an approximate 20 degree nose down attitude. Shortly thereafter, smoke was observed rising in the vicinity of the accident site. A number of persons at the aerodrome quickly went to the accident site to assist but they found that there was nothing that could be done to save the pilot.
- 1.1.14 The towrope was later located lying across a road approximately 115 metres prior to the accident site. It was found that the safety link in the towrope had broken. The portion of the towrope from the safety link to the glider attachment rings was intact. The other portion of the rope from the safety link to tow plane attachment rings was missing; the missing section of towrope was never located despite an extensive search.
- 1.1.15 The accident occurred in daylight, at 1202 hours NZDT, 0.6 of a nautical mile north-north-west of Springfield Aerodrome, at an elevation of 1200 feet amsl. Latitude S 43° 22' 26.71", longitude E 171° 54' 29.44".

## 1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>
Fatal	1	0	0

Table 1: Injuries to Persons

## 1.3 Damage to aircraft

1.3.1 The aircraft (ZK-FMT) was destroyed.

## 1.4 Other damage

1.4.1 Nil.

## 1.5 Personnel information (Tow Pilot)

Flying hours	All types	PA28-236
Last 24 hours		0.3
Last 7 days		0.3
Last 30 days		0.3
Last 90 days	2.05	1.0
Total hours	Approximately 601.0	Approximately 8.1

Table 2: Tow Pilot flight hours

1.5.1 The tow pilot had gained his Private Pilot Licence in January 1984. From that date he flew a number of different aircraft types and gained various ratings such as a night rating and aerobatics rating. He gained his glider tow rating with the gliding club in June 2007. Up until the time of the accident, his logbook showed he had completed 344 glider tows.

1.5.2 The pilot completed his type rating on the Piper PA28-236 in October 2011. He had flown a number of Piper PA28 aircraft variants since gaining his Private Pilot License. He had accumulated approximately 134 hours on the Piper PA28 aircraft type.

1.5.3 The pilot held a current Class 2 Medical Certificate which is appropriate for this type of flight.

#### 1.5.4 Personal Information (Gliding Instructor)

Flying hours	Glider (all types)	Powered aircraft (all types)
Last 24 hours	Nil	
Last 7 days	3.75	
Last 30 days	14.25	1.10
Last 90 days	28.0	14.75
Total hours	1874	1844.6

Table 3: Gliding Instructor flight hours

1.5.5 The gliding instructor commenced gliding in 1975 and at the time of the accident held a current C-Category Instructor Rating issued by Gliding New Zealand. A current class 2 Medical certificate was also held which is appropriate for this type of activity.

1.5.6 As well as having considerable gliding experience, the gliding instructor held a Private Pilots Licence (Aeroplane) which was issued in June 1974 with a glider tow rating gained in July 1976. At the time of the accident, the gliding instructor was a rostered tow pilot for the gliding club and was current and familiar with using ZK-FMT for towing gliders.

#### 1.6 Aircraft information

1.6.1 Piper PA28-236, ZK-FMT, had been imported into New Zealand from Malaysia in July 1986. The aircraft was subsequently registered as ZK-FMT and a Standard Certificate of Airworthiness was issued by the CAA in October 1986. The aircraft had been fitted with an approved tow release system in 2001 to enable towing operations to be conducted.

1.6.2 At the time of the accident the aircraft had accrued 3295 hours total flight time. The last maintenance carried out on the aircraft was for a reported engine stoppage when the throttle was advanced for take-off in September 2013. The maintenance provider noted that the 'Engine was test run and no fault found but [the] electric fuel pump [was] racing'. A serviceable electric fuel pump from another aircraft was fitted to ZK-FMT and the aircraft was released to service. The aircraft had flown a further 19.0 hours since that maintenance was performed.

1.6.3 The aircraft was powered by a Lycoming O-540-J3A5D, 235 horsepower engine driving a Hartzell HC-F2YR-1F constant speed propeller. The engine had accrued 123.0 hours flight time since overhaul and the propeller 660.0 hours since overhaul.

1.6.4 It was determined by calculation that the aircraft was approximately 412 kilograms below the maximum allowable all up weight of 1364 kilograms. The centre of gravity was also calculated to be within the specified limits for the aircraft.

## **1.7 Meteorological information**

1.7.1 Weather conditions at the time were reported by witnesses to be generally fine with few clouds and a south-westerly breeze of approximately 8 to 10 knots.

1.7.2 Comments from glider pilots who had flown prior to the accident flight indicated that there was some mild turbulence after take-off. This turbulence was most likely due to the disturbed airflow encountered on the lee side of the hills to the west of the aerodrome.

## **1.8 Communications**

1.8.1 Both the tow-plane and glider pilots were in radio communication with each other. All radio calls made between the tow plane and glider were of an expected nature, no radio transmissions were heard from the tow pilot immediately preceding the accident.

## **1.9 Aerodrome information**

1.9.1 The Gliding Club operates from Springfield Aerodrome which has an elevation of 1216 feet amsl. The aerodrome has two grass runways. On the day of the accident, runway 28 was in use. Runway 28 requires a right-hand circuit to be flown.

## **1.10 Flight recorders**

1.10.1 Data was retrieved from the two recorders fitted to the glider. Although the data was not directly associated with the flight of the tow plane, it did provide good indications of airspeed, height and the flight path during the aerotow. This data proved useful during the safety investigation.

## **1.11 Wreckage and impact information**

- 1.11.1 The aircraft had entered a stand of willow trees at an approximate 20 degree nose down attitude and slightly right wing low. The majority of the aircraft had come to rest in a small ditch at the base of the trees. The left wing had detached and was found on the right side of the aircraft.
- 1.11.2 The continuity of all flying control system cables was established however the complete integrity of the flight control systems could not be confirmed because of fire damage. The tow hook assembly was located and it was determined by operation that the tow release mechanism was operational at the hook mechanism.



Figure 1: Accident site

- 1.11.3 The engine and propeller had separated from the airframe on impact with the trees and came to rest approximately seven metres forward of the main wreckage. The QGP commented that when the aircraft entered the trees, branches were observed being flung into the air by the propeller. Although this observation may indicate normal operation of the engine, it was removed from the site for testing.

## **1.12 Medical and pathological information**

- 1.12.1 Post-mortem examination revealed that the pilot died of high energy impact injuries to chest, spine and limbs with minimal compounding effects of smoke and fume inhalation.

- 1.12.2 There was coronary and hypertensive heart disease but no pathological evidence of a pre-existing impairment. There was no evidence of old or new myocardial infarction.
- 1.12.3 Results of toxicological testing showed no alcohol or drugs present in the blood.
- 1.12.4 Carbon Monoxide saturation was less than 5%. (Blood carbon monoxide saturations of less than 10% are consistent with normal levels observed in the general population).
- 1.12.5 The QGP and gliding instructor were not tested for the presence of alcohol or drugs following the accident. The CAA currently has no mandate for this to be carried out.

### **1.13 Fire**

- 1.13.1 Following the impact with the trees, an intense post-crash fire consumed the majority of the aircraft. The likely ignition source was from impact related damage to the aircraft electrical components. The fire was then fed by fuel from the disrupted main fuel tanks.

### **1.14 Survival aspects**

- 1.14.1 Although the pilot was restrained by a combined lap and shoulder harness, the impact forces involved were not survivable.
- 1.14.2 The aircraft was fitted with an Artex ME-406 ELT operating on 121.5 and 406 MHz. No transmissions were recorded from the ELT and due to the intense fire, it was not possible to determine if the ELT had activated during the accident.

### **1.15 Tests and research**

- 1.15.1 The engine was dismantled and inspected at an engine overhaul facility under CAA supervision. No evidence was found of any engine defect which could have caused a loss of power.

## **1.16 Organisational and management information**

- 1.16.1 Gliding New Zealand (GNZ) has well established training procedures and information available to both glider and tow pilots. During training, pilots are taught to recognise and take action in the event of an out of position glider during an aerotow to prevent a possible tow upset from occurring.
- 1.16.2 At the time of the accident there was significant training information available to pilots regarding vertical tow upsets sometimes referred to as ‘kiting’. However, little information was available regarding a lateral tow upset such as that which occurred to ZK-FMT.
- 1.16.3 Following the accident, CAA safety recommendation 15A952 was raised with GNZ to amend GNZ AC2-09 *Manual of Tow Pilot Training and Tow Procedures* to provide information and guidance on lateral tow upsets. This recommendation was accepted by GNZ, the amended manual can be accessed on the GNZ web site using the link: <http://gliding.co.nz/wp-content/uploads/2015/03/AC-2-09-v5.pdf>
- 1.16.4 In February 2014 following the accident, GNZ published an article titled ‘Tow Upsets’ in the SoaringNZ gliding magazine highlighting the dangers of vertical and lateral tow upsets. A copy of this article is provided in Appendix 1 for reference.

## **1.17 Additional information**

- 1.17.1 Nil

## **2. Analysis**

- 2.1 Evidence gathered during the safety investigation indicates that the accident occurred as a result of a lateral tow upset during the aerotow causing the tow pilot to momentarily lose control of the tow plane. Due to the low altitude at which the tow upset occurred, the pilot was unable to recover the situation prior to the aircraft striking trees.
- 2.2 The lateral tow upset occurred when the glider flew out of position to the left of the tow plane while both aircraft were in a right-hand turn. During the turn, tension was applied to the towrope which applied an increased force to the left on the tail of the tow plane. This force caused a yawing motion to the tow plane which then, as a

secondary effect of the yaw, caused the tow plane to roll. A vertical tow upset then followed with the tow plane descending towards the ground.

- 2.3 The effect of lateral tension on the towrope may result in either a vertical stabiliser (fin) stall or a dynamic lateral upset of the tow plane. Both situations will result in an uncommanded yaw, roll and nose pitch down of the tow plane. In either case, events would develop rapidly with the tow pilot probably taken by surprise.
- 2.4 For a fin stall to occur, the glider via the towrope would need to be applying a constant lateral force to the tail of the tow plane. This would require the tow pilot to apply a constant rudder input to counteract that force. If rudder input by the tow pilot was nearing maximum and further lateral force was applied causing the tow plane to yaw further, it is possible for the critical angle of attack of the fin to be exceeded resulting in the fin stalling. This would result in a rapid loss of yaw control of the tow plane. With the lateral towrope force still being applied, the tow plane would roll and descend before the tow pilot could react.
- 2.5 For the dynamic lateral upset, divergence between the glider and the tow plane can induce an abrupt large yaw of the towplane when the rope comes tight. The tow plane pilot won't have applied rudder to correct the yaw before it happens, and once the yaw and roll turns the towplane onto a further diverging flight path, the upset increases in magnitude. Further information on lateral tow upsets can be found in an article titled *Aerotowing Guidance Notes* by Author John Marriott at: <http://old.glidering.co.uk/bgainfo/clubmanagement/documents/aerotownotes.pdf>
- 2.6 The instructor had observed that the towrope was slack moments prior to the tow upset, it is probable that the lateral upset was of a dynamic nature occurring when the towrope became taut as the tow plane continued to turn to the right. The sudden tensioning of the towrope would have been unexpected resulting in the tow pilot momentarily losing control of the tow plane as it rolled and descended.
- 2.7 The glider was equipped with a combination tow hook, often referred to as a belly hook, located on the glider's belly. The position of the combination hook made it more suited for winch launching, however, it is also utilised for aerotowing. Due to the combination hook being positioned on or near the glider's centre of gravity, this makes the glider less directionally stable during an aerotow in both the lateral and

vertical planes. In the event of any flightpath that diverges from the correct stable position immediately behind the towplane, a divergent flightpath and possible tow upset is likely to occur.

- 2.8 When the towrope was re-tensioned moments before the tow upset, the effect was to cause an excessive yawing moment to the tow plane rather than affect the glider's flight path. This is due to the towrope applying a force to the tail of the tow plane and the long moment arm from the tail to the tow plane's centre of gravity. Whereas with the glider, the towrope is attached very close to the glider's centre of gravity therefore the yawing moment and the effect on the glider, is far less than the effect on the tow plane.
- 2.9 The instructor's command to the QGP to release the towrope was made because the instructor was fully occupied controlling the glider, with one hand on the control stick and the other on the airbrake lever. The QGP was not occupied in flying the glider and it was reasonable to expect that they should have been able to react to the instructor's command.
- 2.10 The reason why the QGP did not react on the instructor's command to release the towrope could not be positively established. When questioned during the safety investigation, they could not recall hearing the command from the instructor. However, their lack of response may have been due to having been relieved of flying the glider, and he was now sufficiently 'out of the loop' in terms of situational awareness<sup>3</sup>. With degraded situational awareness and on observing the events developing rapidly, they may have been sufficiently overloaded and unable to react.
- 2.11 Consideration was given as to why the tow pilot did not activate the tow release prior to the lateral tow upset occurring. The following were considered:
- a. Up until the time that the tow upset occurred, there was no evidence to indicate that the tow pilot was concerned with the conduct or performance of the aerotow,

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<sup>3</sup> Situational Awareness(SA) put simply, means being aware of what is happening in ones environment in order that a decision can be made on what to do.

- b. If the tow pilot had been aware that 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 the tow pilot is aware that releasing the glider may put the glider pilot in an extreme situation and so the tow pilot is reluctant to release. It is likely that 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 delays releasing the glider and then cannot recover from the ensuing tow upset,
- c. Although unlikely, due to a possible loss of situational awareness with regard to the glider's position, the tow pilot may not have been aware that the glider was displaced laterally out to the left of the tow plane. The tow pilot continued to turn further to the right which applied tension on the tow rope resulting in the lateral tow upset.

2.12 As a consequence of a tow release not being made by the pilots of either the glider or the tow plane, the safety link in the towrope failed. It did this once it had reached its pre-determined breaking strain of 750 kg +/- 75 kg.

2.13 Possible factors as to why the observed climb performance of the tow plane appeared less than expected are:

- The glider's high tow position in relation to the tow plane resulting in the tow pilot having to use excessive elevator input to control the tow plane's pitch attitude and thereby increasing drag and reducing performance.
- The tow plane and glider had been in a continuous right turn from when the first turn was commenced until the tow upset occurred. Banking (turning) an aircraft will result in a reduction in climb performance.
- Due to the prevailing wind conditions, it is possible that downdraught conditions and turbulence would have been encountered reducing the climb performance of the tow plane.

- 2.14 The last maintenance performed on the aircraft was for the replacement of the electric fuel pump in response to an occurrence where the engine stopped on the ground when the throttle was advanced. It is considered extremely unlikely that if this same defect re-occurred, that it would affect engine operation in flight. The mechanical fuel pump fitted to the engine is capable of supplying sufficient fuel to the engine at all times. Based on the inspection and testing of the engine and its components during the safety investigation, it is considered unlikely that an engine malfunction occurred during the flight.
- 2.15 Although flight control integrity could not be established due to the extensive damage to the aircraft, there was no evidence to indicate that the pilot had experienced a flight control problem. The fact that he appeared to be regaining control of the tow plane prior to it striking the trees would indicate normal functioning of the flight controls. Had the tow pilot been faced with a problem of any nature during the glider tow, his natural trained reaction would be to communicate with the glider by either radio or recognised signals, and/or immediately release the glider and land.
- 2.16 The pathologist's findings were referred to the CAA medical team for review and comment. Whilst a medical condition leading to an episode of pilot incapacitation or distraction could not be fully ruled out, there was no evidence of an acute coronary event.

### **3. Conclusions**

- 3.1 The tow pilot held a valid Private Pilot Licence (Aeroplane) with glider towing and applicable aircraft type ratings.
- 3.2 The gliding instructor held a Gliding New Zealand C-Category Gliding Instructor Rating and was experienced and current on the glider type.
- 3.3 The gliding instructor took control of the glider during the take-off roll and remained in control for the remainder of the flight.
- 3.4 During the aerotow, the glider became out of position high in relation to the tow plane.

- 3.5 During an attempted repositioning of the glider to the correct tow position, the glider began to over-run the tow plane with the towrope becoming slack.
- 3.6 The glider was manoeuvred to the left of the tow plane in an attempt to counter the problem.
- 3.7 While in the right-hand turn, tension was re-applied to the towrope resulting in a lateral force being applied to the tail of the tow plane.
- 3.8 The lateral force caused a destabilising yawing moment to the tow plane resulting in a lateral tow upset.
- 3.9 The lateral tow upset was probably dynamic in nature, rather than as a result of a fin stall.
- 3.10 The reason that neither aircraft effected a tow release could not be determined.
- 3.11 It is evident from witness accounts, that the pilot was regaining control of the tow plane.
- 3.12 There was insufficient height available for the pilot to effect a recovery from the tow upset.
- 3.13 The use of the combination hook fitted to the glider for aerotowing purposes made the aerotow more susceptible to a tow upset.
- 3.14 No evidence was found to indicate that the pilot was experiencing a problem with the operation of the tow plane.
- 3.15 At the time of the accident, there was little information available to GNZ members regarding lateral tow upsets.
- 3.16 Due to the forces involved, the accident was not survivable.

#### **4. Safety Actions**

- 4.1 Following the accident, GNZ published an article titled 'Tow Upsets' in the February 2014 issue of the SoaringNZ magazine. The article provides information and advice regarding tow upsets, the contributing factors and how best to avoid them.

4.2 CAA Safety Recommendation 15A952 was raised with GNZ to amend the Manual of Tow Pilot Training and Tow Procedures include information on lateral tow upsets to aid in the training of glider and tow pilots. This recommendation has been accepted and the revised manual has now been published on the Gliding NZ web site.

4.3 The following safety actions were initiated by the gliding club:

1. The Club's Instructor's Panel to provide additional briefing material to members regarding the use of the belly hook and the tendency for this to make the aerotow more susceptible to mishandling and getting out of position, and
2. Glider ZK GPB to be modified by the addition of a nose hook for aerotowing, this will make the glider less susceptible to an out of position condition or mishandling during an aerotow. This modification is due for completion by October 2015.

Report written by:

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## Appendix 1



## TOW UPSETS

BY MAX STEVENS  
& THE BRITISH GLIDING ASSOCIATION

Seven tug pilots have been killed in the UK since 1974 while aerotowing. Two accidents stemmed from engine failure, one from a lack of fuel, and four from tug upsets. The New Zealand experience over a similar period is four tug pilots killed; one where a broken hinge allowed the cockpit door to strike the pilot in the head (Auckland), one from an upset shortly after take-off (Masterton), one where the take-off was made while the tug's rear control stick was tied by the seat straps (Tauranga), and a recent one where the cause is not yet known (Springfield).

The four fatal upsets in the UK took place in the 1970s-80s and the British Gliding Association made considerable efforts to educate pilots and instructors on how to avoid such accidents. The tug upset incident rate then decreased, and the fatal accidents stopped. But the tug upset incident rate is now 7 times higher than 10 years ago. In 2012 alone, six tug upset incidents were reported. In one of these incidents the tug pilot recovered 100ft above trees. In yet another incident, in 2013, the tug pilot recovered 40ft from the ground. New Zealand is not immune – there have been some upset incidents at Omarama very recently.

Tug pilots must remain aware of the possibility of tug upsets. If you are losing control of the tug do not hesitate to dump the glider – act now, ask questions later!

Some excellent video simulations are available on the BGA website at [www.gliding.co.uk/bgainfo/safety/safeaerotowing.htm](http://www.gliding.co.uk/bgainfo/safety/safeaerotowing.htm)

### Aerotowing Accidents

#### 1. Tug Upsets

In a vertical tug upset the glider gets high behind the tug and pulls the tug tail up. The slingshot vertical upset is

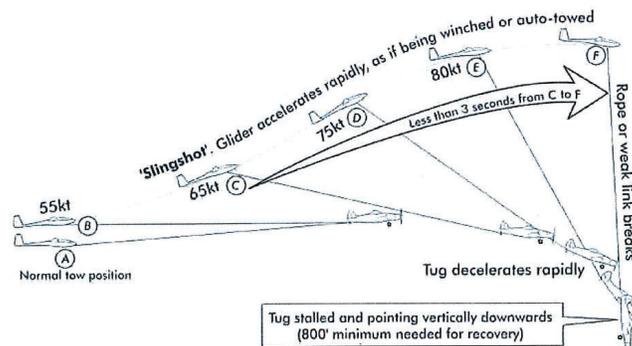
particularly dangerous. If the glider pilot is low in relation to the tug and the pilot moves back into position too quickly the glider in effect does a winch launch behind the tug which tips the tug into a vertical dive. In a lateral upset the glider is too far to one side and it can be just as dangerous particularly if a slack rope suddenly tightens. It can be all over for the tug pilot in as little as three seconds.

The circumstances which make tug upsets more likely are:

- » belly hook intended for winch launching
- » short rope
- » pilot with little aerotow experience
- » near aft C of G
- » turbulent conditions
- » all flying tailplane, or light elevator forces

Vertical upsets are more likely with a belly hook but can also occur with a nose hook.

A vertical upset can also arise when



the glider releases if the glider turns before the pilot has confirmed that the rope has separated. Similarly, the tug pilot must not rely on the usual feel of a release – release must be visually confirmed before turning away.

### 2. Wing Drop Accidents

About 25% of aerotow accidents to gliders in the UK involved a wing drop on take-off. The necessary energy for a cartwheel was not usually present, but the glider was substantially damaged in half of the instances.

As with winch launches, if you cannot keep the wings level, release before the wing touches the ground.

### 3. Launch Failure Accidents

There has been one glider pilot fatality in the UK from a spin after a return to the airfield following a rope break. After an aerotow launch failure in the air, the glider will probably be at its approach speed, in roughly level flight, so the pilot has a good view of the options, the airspeed is not reducing rapidly, and it should be straightforward to avoid a stall/spin accident.

### Aerotowing Technique

The currently recommended aerotowing technique is:

- » While waiting for the tug to leave the ground, fly at a height of 6-10ft. The top of the tug fin is a good marker.
- » Control the vertical positioning of the glider by reference to the vertical position of the whole tug in the canopy. Techniques involving positioning the tug in relation to the horizon, or aligning fore and aft parts of the tug structure, are less reliable, and less stable in turbulence.
- » The vertical position of the tug in the canopy at the beginning of the ground run will probably be roughly the correct position in flight. If you are unsure of the correct position, gently descend until you encounter the slipstream and then move up about 10ft.
- » If you are displaced to one side of the tug, adopt the same bank angle as the tug, wait for the rope to pull the glider astern of the tug, and then gently dip one wing to stop the lateral movement of the glider. It is not necessary to bank towards the tug to recover from a lateral displacement.
- » To release, check it is clear,

pull the release, visually ensure the rope has separated from the glider, and raise the nose slightly before making a turn.

### Aerotowing Essentials

#### Should you be flying?

If you are inexperienced, do not aerotow on a belly hook and do not aerotow in turbulent conditions.

Avoid distractions on the ground and in the air. Rushed checks may leave the airbrakes unlocked. During the tow, leave any instrumentation, ventilation, or similar problems until after release. Leave the undercarriage down.

#### Pre-Flight Preparation:

- » Are you within the CG limits? If you are inexperienced, ensure the cockpit load is at least 10kg more than the placarded minimum weight
- » Precisely align the fuselage with the take-off direction
- » Use the aerotow hook, if one is available
- » Note the vertical position of the tug in the canopy; this will probably be roughly the correct position for the tug once the combination is airborne.

#### Ground Run:

- » Left hand on the tow release.
- » For flapped gliders, keep your hand on the release until positive lateral control is assured before changing flap setting, if required.
- » Use the elevator, ailerons, and rudder independently.
- » If you cannot keep the wings level, release before the wing touches the ground or the glider may groundloop and the tug may yaw uncontrollably.
- » Balance the glider on its main wheel.
- » Keep the glider running straight behind the tug.
- » Wait for the glider to take off.

#### Glider Airborne, Tug on the Ground:

- » Use the controls in a coordinated way
- » Allow the glider to climb to 6-10ft; the top of the tug fin is a good marker
- » In a cross-wind, keep the glider directly behind the tug
- » Wait for the tug to take off

#### Tug and Glider Airborne:

- » Be ready for the tug to climb, and climb with it
- » Continually update your launch failure options
- » Maintain the correct vertical position of the tug in the canopy. Do not allow the glider to get too high.
- » If you are too low behind the tug shortly after the tug take-off, or at any other time, move back into position SLOWLY. Being lower than the tug is not dangerous. An upset can follow if you pull up quickly.
- » Release immediately if the glider is going high and the tendency cannot be controlled or you lose sight of the tug.
- » If you are unsure of the correct position for the tug in the canopy, gently descend until you encounter the slipstream and then move up about 10ft.
- » If the glider is to the left or right of the tug maintain the same bank angle as the tug and allow the rope to pull the glider back into position.
- » Fly the glider! Leave any instrumentation, ventilation, or similar problems until after release. Leave the undercarriage down.

#### Release:

- » Is it clear? Pull the release, visually ensure the rope has separated from the glider, and raise the nose slightly before making a turn.

Any tug upset incident has the potential to be fatal for the tug pilot. We must strive to reduce these upsets. This article is based on a British Gliding Association leaflet recently published, and offers advice to the glider pilot on safe aerotowing and in particular the avoidance of tug upsets.

#### Club CFIs – are your trainees and low experience pilots really aware of this hazard?

Does the glider only have a belly hook?  
Does the glider have an all-flying tailplane?

Is the tow rope short?

Is there rough ground in the take-off area?

Are conditions turbulent?

Inexperienced tug or glider pilot?

**THEN THE RISK IS HEIGHTENED!**