CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

AIRCRAFT ACCIDENT REPORT

CAA OCCURRENCE NUMBER 14/151

SCHLEICHER ASW 20-L

ZK-GDF

IMPACT WITH TERRAIN

DRURY, AUCKLAND

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).

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

> **72B Functions of Authority**
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> (2) The Authority has the following functions:
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> > (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.

A CAA Safety investigation seeks to provide the Director of CAA 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:

amsl	above mean seal level
BFR	Biennial Flight Review
CAA	Civil Aviation Authority
C of G	centre of gravity
GPS	Global Positioning System
hPa	hectopascals
kg	kilogram(s)
kts	knots
MAUW	maximum all up weight
NZDT	New Zealand Daylight Time
PDA	Personal Digital Assistant
QGP	Qualified Glider Pilot Certificate
UTC	Coordinated Universal Time

Data summary

Aircraft type, serial number and registration:	Schleicher ASW 20-L, 20315, ZK-GDF
Number and type of engines:	N/A
Year of manufacture:	1980
Date and time of accident:	19 January 2014, 1629:51 hours[1]
Location:	Drury, Auckland Latitude[2]: S 37° 06' 34.8" Longitude: E 174° 58' 57.0"
Type of flight:	Private
Persons on board:	Crew: 1
Injuries:	Crew: 1 (Fatal)
Nature of damage:	Aircraft destroyed
Pilot-in-command's licence	Gliding New Zealand Qualified Glider Pilot Certificate
Pilot-in-command's age	36 years
Pilot-in-command's total flying experience:	212 hours, 86 on type (approximately)
Investigator in Charge:	Mr A M Moselen

[1] All times in this report are NZDT (UTC + 13 hours) unless otherwise specified.

[2] WGS-84 co-ordinates.

Synopsis

On Sunday 19 January 2014, at approximately 1644 hours, The Civil Aviation Authority (CAA) was notified that an aircraft identified as ZK-GDF, a Schleicher ASW 20-L glider, had crashed onto a farm property three quarters of a nautical mile south east of Drury Aerodrome. Witnesses who were first on the scene found that the pilot had not survived the accident. A CAA field investigation was commenced the next day.

1. Factual Information

1.1 History of the flight

1.1.1 ZK-GDF was owned and operated by a number of pilots in a syndicate. Earlier on Sunday 19 January, the glider had been rigged, inspected and flown by another syndicate member. The flight was described as uneventful except for some bumpy conditions, sinking air and unpredictable lift in the Drury Hills area. On return to Drury Aerodrome, one of the owners handed over ZK-GDF to the pilot involved in the accident.

1.1.2 After a normal pre-flight, the glider was launched at 1628 hours by winch[3] from Drury Aerodrome, Runway 19. Approximately 30 seconds later, the pilot released the tow line after climbing to an altitude of approximately 1300 feet amsl[4].

1.1.3 The launch was observed by a number of Auckland Gliding Club members whom described it as unusual, "climbing much too steeply and with considerable yaw to the right". They further commented that after tow release the glider "appeared to be fine". A Personal Digital Assistance (PDA) recovered from the wreckage contained flight data which confirmed their observations.

1.1.4 Analysis of the flight data showed that shortly after tow release, the pilot had manoeuvred the glider left toward the Drury hills. The glider continued in that direction at an altitude of approximately 1300 feet and a ground speed of 60 kts. At 1629:10 the glider turned right through 35 degrees toward the south-east. At that time the glider was being subjected to a light tailwind and whilst the altitude remained the same the recorded ground speed had decreased to 45 kts. Over the next ten seconds and whilst maintaining a south-easterly track, the glider lost approximately 100 feet of altitude.

1.1.5 At 1629:30 the glider entered a thermal that provided lift for a brief period of approximately four to five seconds. At 1629:36 the pilot manoeuvred the glider into a steep right-hand reversal turn that continued through approximately 190 degrees. It was estimated that to achieve the radius of the turn the manoeuvre required an average bank angle of approximately 55 degrees.

1.1.6 At 1629:38 the ground speed steadily reduced from 47 kts to 38 kts. Over the next two seconds the glider stalled. At 1629:41 the glider then entered a rapid, fully

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[3] Gliders are often launched using a stationary ground-based winch mounted on a heavy vehicle.

[4] All heights are in feet above mean seal level unless otherwise specified.

developed clockwise spin. Whilst evidence from the scene examination indicated that the spin was recovered the pilot did not recover the glider from the ensuing dive.

1.1.7 The accident occurred in daylight, at 1629:51 hours, one nautical mile south-east of Drury Aerodrome, at an elevation of 250 feet, latitude S 37° 06' 34.8", longitude E 174° 58' 57.0".

1.2 Injuries to persons

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

Table 1: Injuries to persons

1.3 Damage to aircraft

1.3.1 The glider was destroyed.

1.4 Other damage

1.4.1 Damage to trees and farm fencing.

1.5 Personnel information

Flying hours	*All types*	*Relevant type*
Last 24 hours		2 minutes
Last 7 days		2 minutes
Last 30 days		4 hour 35 minutes
Last 90 days	30 minutes	8 hours 10 minutes
Total hours	Approximately 212	Approximately 86

Table 2: Pilot flight hours

1.5.1 The pilot, aged 36 years, held a Gliding New Zealand Qualified Pilot Certificate (QGP) and a valid Gliding New Zealand Medical Declaration and Certificate.

1.5.2 The pilot had commenced glider flying in 2006 and had accrued approximately 212 hours on all types with 86 of those hours on the single seat Schleicher ASW 20-L, ZK-GDF. During the early stages of flying he experienced eight different instructors for a total of 8 hours flying. The pilot's first solo occurred after 29 hours of instruction.

1.5.3 His introduction to ZK-GDF occurred in August 2009 and he flew the glider regularly until early May 2010. The pilot then took long breaks from flying. Specifically, eight months in 2010, ten months in 2011, nine months in 2012, and nine months in 2013.

1.5.4 The pilot's current Biennial Flight Review (BFR) was conducted in a PW6 glider on 19 October 2013. At that time the pilot had not flown a PW6 for two years. Furthermore, the pilot had not flown at all for nine months before taking the check. The instructor commented that the pilot was capable but "rusty" and needed additional instruction prior to carrying out any further winch launching. The pilot completed the requirement the following day with an instructor. In addition, and until he considered himself to be current, the pilot, when flying ZK-GDF, was required to conduct only aero-tows[5]. In this regard, the pilot completed three cross country flights by aero-tow launch during November and December totalling eight flying hours. They were the last flights the pilot conducted prior to the accident flight.

1.5.5 On the day of the accident the pilot was described as relaxed and in good spirits.

1.6 Aircraft information

1.6.1 Schleicher ASW 20-L, serial number 20315, was manufactured in Germany during 1980. In October 2005, the glider was imported into New Zealand from the United Kingdom in a damaged condition following a landing accident there. The glider was repaired and registered as ZK-GDF in 2006. The last annual maintenance inspection and Annual Review of Airworthiness of the aircraft and documents was completed on 13 October 2013: at this time the aircraft had logged 2429 hours since manufacture.

1.6.2 The Schleicher ASW 20-L is a high performance single-seat competition glider of all-composite construction with a mid-wing layout and T-tail. The L version indicates optional extended wing tips from 15 to 16.59 metres. On the day of the accident, ZK- GDF was flown in the standard 15 metre configuration.

1.6.3 The glider's flight controls consist of a cable operated rudder and push-pull rods for the elevator, ailerons, flaps and the upper wing surface airbrakes. The flap system incorporates a mechanical mixing unit that provides partial flap movement to augment aileron control when the control stick is moved laterally. In addition, the flaps have five selectable positions that are designed to maximise laminar flow over a variety of speed ranges. The flap positions that provide the low drag performance are position one to four. Flap five is a high drag configuration and used for landing.

1.6.4 The range of speeds to fly, at particular flap positions and various wing loadings are provided in the Flight Manual. For example, flap position four is recommended when thermalling[6]. At a wing loading of 1.3g, (40 degrees angle of bank), the best low drag speeds are between 49 and 55 kts.

1.6.5 The Flight Manual also provides minimum speeds to fly for the various flap configurations. At 454 kg MAUW, in a wings level attitude at flap position four, the recommended minimum speed is 43 kts. Research indicates a stall speed for ZK-GDF of approximately 35 kts. At 55 degrees angle of bank the wing loading increases to 1.7g and the stall speed also increases by a factor of 1.3 to 46 kts.

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[5] In an aero-tow, the glider is attached to a powered aircraft with a tow rope. The tow-aircraft takes the glider to the height and location requested by the pilot where the glider pilot releases the tow-rope.

[6] A term that refers to circling within an upward current of warm air in order to gain height.

1.6.6 A weight and balance calculation for the accident flight found that the weight of the pilot plus parachute placed the centre of gravity (C of G) towards the aft limit.

1.6.7 The Schleicher ASW 20 Flight Manual for ZK-GDF provides information on its spin characteristics. It is claimed the glider spins easier and flatter in the Flap 4 and 5 configurations than with negative (up) flap settings. The explanation goes on further to point out that negative flap should be used to prevent wing drops and spins but recognises that this is impossible when thermalling at low level. In that regard, the Flight Manual recommends the use of safety speeds in excess of the minimum recommended.

1.6.8 For spin recovery, the Flight Manual includes a recommended recovery technique and some additional remarks:

'(1) Apply opposite rudder, i.e. against the direction of rotation of the spin.
(2) Short pause.
(3) Ease the control column forward, until the rotation ceases and sound airflow is established again.
(4) Centralise rudder and allow sailplane to dive out.

Recovery from spin can be easier achieved if the flaps are set in negative position. Extending the airbrakes slows down rotational speed but needs more height for recovery and therefor is less recommended.

If the Schleicher ASW 20 recovers itself from a spin, it starts a spiral like side-slip with high increase in speed. Recovery from this flight attitude is done by usual control inputs.

At forward C. of G. positions the ASW 20 -L spins very steeply and starts a spiral dive in less than one turn, whereas at rear C. of G. positions the gliders pitch becomes steeper and steeper after an initial flat and slow turn (approximately 30 degrees negative pitch) until the transition into a spiral-dive develops after five to seven turns.'

1.7 Meteorological information

1.7.1 Fine weather prevailed over the area at the time of the accident. Specifically, light and variable west to south-westerly winds with clear skies. One witness who had flown in the Drury area on the same day stated that despite the fine weather, visibility was hazy creating an indistinct horizon.

1.8 Aids to navigation

1.8.1 Not applicable.

1.9 Communications

1.9.1 Not applicable.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 A PDA containing flight data was retrieved and this provided a detailed history of the flight. The recorded information included time (at one second intervals); GPS position, height, ground speed, plan and vertical profiles.

1.12 Wreckage and impact information

1.12.1 The accident occurred on private property adjacent to Drury Hills road, one nautical mile south-east of Drury Aerodrome.

1.12.2 The glider initially struck the crowns of two trees in a wings level, 70 degree nose down attitude. The left and right wing assemblies had then torn away from their wing to fuselage attachment pins and remained in the trees.

1.12.3 Free of the wings, the fuselage and tail assembly had sufficient energy remaining to continue at a high vertical descent rate albeit at a largely reduced nose down attitude. The glider then struck two large boulders at the lower right side of the cockpit area and bounced forward 10 metres before coming to rest.

1.12.4 All parts of the glider were accounted for at the accident site. Pre-impact control integrity was established and whilst considerable disruption to control surfaces, push rod mechanisms and rudder cables had occurred, all damage was attributed to impact overload failure.

1.12.5 The left wing airbrake was found in the fully extended position but the right wing airbrake was retracted. It was determined that the condition was likely to have occurred during the impact sequence.

1.12.6 Aside from the PDA recording device, other instruments from the cockpit area were destroyed. The only useful information gained was the flap selector trapped in the flap four detent, and an altimeter setting of 1017 hPa.

1.13 Medical and pathological information

1.13.1 Post-mortem examination showed that the pilot died of injuries consistent with a high-energy impact.

1.13.2 Toxicology tests detected trace levels of alcohol in the blood and urine. Trace levels of alcohol less than five milligrams per 100 millilitres may be due to means other than deliberate ingestion.

1.14 Fire

1.14.1 Fire did not occur.

1.15 Survival aspects

1.15.1 Although the pilot was wearing a parachute, there was insufficient height and time available for him to use the device.

1.15.2 The pilot was also restrained by a combined lap and shoulder harness. However, the impact forces were not survivable.

1.16 Tests and research

1.16.1 In terms of the glider's spin characteristics, a highly experienced pilot of another Schleicher ASW 20-L glider provided a video recording of a stall spin entry and recovery to assist the investigation. Whilst flying at a low airspeed, in the flap four configuration, the pilot conducted two left and right turns. When the glider stalled in the turns there was an accompanying rapid and pronounced wing drop. This was immediately followed by a transition to a steep nose down attitude and spin entry. Recovery action was taken immediately on recognition, including retracting the flap to position one. Return to controlled flight occurred after a rotation of less than half a turn. The pilot commented that height loss during both demonstrations was 300 to 400 feet.

1.17 Organisational and management information

1.17.1 Nil.

1.18 Additional information

1.18.1 Nil.

1.19 Useful or effective investigation techniques

1.19.1 Nil.

2. Analysis

2.1 Evidence gathered during the safety investigation indicates that the accident occurred when the glider, having stalled and spun during a turn was not sufficiently recovered within the height available to avoid impact with terrain.

2.2 Examination of the glider at the accident site and subsequent off site location eliminated all possibility of an aircraft defect, control malfunction, a weight and balance anomaly or factors relating to the environment.

2.3 Human factors dominated the causal factors in this accident. These include the pilot's possible lack of familiarity with the Schleicher ASW 20-L in an inadvertent stall/spin situation with the glider configured for flap 4, startle factor[7] and a breakdown of situational awareness.

2.4 The importance of familiarity becomes clear when a pilot of a Schleicher ASW 20-L encounters an inadvertent stall/spin at a relatively low height. The pilot had 10 to 12 seconds to fully recover control of the glider, but success required his immediate recognition and counter-response in accordance with the recommended procedure. With the centre of gravity rearwards, the spin fully developed, and initial recovery delayed, his situation would have rapidly deteriorated. When the rotations eventually

[7] **The effects of startle on pilots during critical events: A case study** (W Martin, P.S.Murray, & P.Bates) Research has shown adverse effects in a proportion of volunteers during startle experiments. Tests by Vlasek (1969), Woodhead (1959, 1969) and others have shown cognitive impairment for up to 30 seconds following startle and this has been shown in some accidents to be a period where underperformance has been critical to recovery.

stopped the pilot was still faced with a glider in a steep dive with little height remaining in which to recover the situation.

2.5 It could not be determined whether the pilot recovered the spin from recommended control inputs or the glider self-recovered as explained in the Flight Manual. However, the fact that the flaps remained in position four does suggest his lack of familiarity by non-adherence to the recommended techniques for recovery. This aspect combined with the likelihood of "startle factor", may have combined to impede a timely recognition and response.

2.6 The effects of startle are common to all humans. The pilot that provided information from tests (1.18.1) commented that although he was fully prepared for a spin and that recovery was immediate, he was nevertheless surprised at the steep nose down entry and subsequent height loss.

2.7 The pilot's general lack of flying activity was an aspect noted by his BFR instructor and probably explains the observations of witnesses at the winch launch. Prior to the reversal turn the gliders ground speed had reduced to that which approximately aligned to the minimum airspeed recommended for wings level flight. To maintain height and to provide a stall margin a turn requires an increase in airspeed to counter the effects of an increase in wing loading. The Schleicher ASW 20 Flight Manual goes further in recommending safety speeds higher than the minimum when manoeuvring at low altitudes.

2.8 The reversal turn decision appears to have been made on the spur of the moment and was probably based on the thermal the glider passed through a second or two earlier. However, there was a significant lack of airspeed at the commencement of the turn including an allowance for any gusts that may have been encountered. Whilst an indistinct horizon may have hindered the pilot during the flight, the circumstances that led to the inadvertent stall and spin are more aligned to a degradation of situational awareness. When this occurs, the pilot when faced with a problem simply doesn't realise a problem exists.

2.9 In terms of the pilots training and experience, the pilot had a variety of different instructors particularly at the commencement of his basic training. Whilst not ideal, his flying was however regular and this aspect would have provided sufficient continuity for the pilot in maintaining currency and for building experience. However, from 2010 onwards his long breaks from flying were not conducive for maintaining currency and experience.

2.10 The accident provides lessons for all glider pilots where a lack of regular flying can have a detrimental effect on situational awareness and handling skills. Pilots should also be thoroughly familiar and current with the type of glider they fly, particularly when operating at low altitudes at or near the limits of the gliders performance envelope.

2.11 The investigation also observes Gliding New Zealand's website where glider pilots can access the excellent articles on threat and error management and points to remember when encountering an inadvertent stall/spin situation.

3. Conclusions

3.1 the pilot was appropriately qualified for the flight;

3.2 the aircraft had a valid airworthiness certificate and had been maintained in accordance with relevant requirements;

3.3 no pre accident aircraft defect, or weight and balance anomaly were found;

3.4 the pilot's Medical Declaration and Certificate did not disclose any medical history that would be likely to affect his ability to fly a glider safely;

3.5 during a reversal turn the glider stalled with an accompanying rapid wing drop and spin entry,

3.6 there was a delay in counter-response to recover the spin;

3.7 the delay was likely to have been influenced by the pilots lack of familiarity with the situation, startle effect and degraded situational awareness; and,

3.8 the glider's subsequent impact with the ground was not survivable.

4. Safety Actions

4.1 Following the accident, The Auckland Gliding Club's Chief Flying Instructor provided an article in their weekly newsletter concerning pilot currency:

> *'As a key underlying factor, currency was promulgated as an issue to club members. It was designed to remind members that currency consideration is an obligation on all club pilots and has facets involving the pilot, the aircraft, the launch method, the type of flight and general conditions. Pilots were reminded to consider these factors and that instructors were available to help them with any aspect they were concerned with.*

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Date 15 July 2014

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