CAA Safety Investigation Report
Loss of control on approach
ZK-IMZ Guimbal Cabri G2
Waikawa Beach
24 August 2017

ZK-IMZ (CAA Photo)

CAA Final Report 17/5304
5 June 2018

Executive summary

The Civil Aviation Authority (CAA) was notified on 24 August 2017 that ZK-IMZ, a Guimbal Cabri G2 (Cabri G2) two-seat helicopter, was involved in an accident during a dual training flight. The accident occurred near Waikawa Beach in the L369 Low Flying Area.

The Transport Accident Investigation Commission was notified of the details and elected not to investigate. A CAA Safety Investigation on-site examination was commenced on 25 August 2017.

The CAA safety investigation found that the accident occurred as a result of a loss of directional control on approach to a hover. The instructor pilot failed to anticipate and correct the development of a rapid left yaw. The instructor pilot received serious injuries, and the student pilot received minor injuries in the accident. Both were able to evacuate the helicopter after it came to rest.

Initial notification of the accident was made to the aero club by the student pilot via mobile phone. The aircraft was equipped with an Emergency Locator Transmitter (ELT) but it did not activate in the accident. The investigation found that the ELT was not configured correctly after installation.

The instructor pilot had recently been evaluated and achieved a rating on the Cabri G2 and held authorisations from the aero club for the manoeuvres conducted.

The Cabri G2 has presented challenges for instructors transitioning from conventional anti-torque systems due to the unique characteristics of the Fenestron system. A Fenestron is a protected tail rotor of a helicopteroperating like a ducted fan.

Strong emphasis should be placed on these characteristics during training for instructors and students. The CAA Helicopter Aviation Examiner and Safety Investigation Unit are engaging with aviation professionals to develop requests and recommendations that will then be discussed with the manufacturers of aircraft with Fenestron anti-torque systems.

Factual Information

On the day of the accident the instructor was conducting two training flights to demonstrate the effects of controls.. The accident occurred while conducting the second flight..

The flight departed after 1230 hours, flying to the Reikorangi Valley, to perform straight and level flying, climbs and descents. After experiencing gusty conditions in the valley, the instructor decided to move to L369, a low flying area near Waikawa Beach.

The pilots evaluated the conditions and landing area, conducting two overhead circuits upon arrival. The instructor took control of the aircraft to execute the approach to a hover.

While on approach, the instructor pilot described to the student the control inputs required as the power and aerodynamic changes occurred. As the helicopter neared the airspeed at which translational lift would be lost, the instructor briefed the student that the right pedal should be applied early to keep the nose aligned with the landing direction and that they must anticipate a left yaw during the transition to a hover.

Prior to establishing a hover, the helicopter developed a rapid left yaw rate. The instructor pilot was unable to arrest the yaw rate and regain control of the helicopter, and the aircraft struck the ground.

The accident occurred at approximately 1315 hours, at L369 in Otaki. Latitude 40° 42' 24.20" S, longitude 175° 8' 55.96" E.

Pilot information

The instructor pilot, aged 58 years, holds a Commercial Pilot Licence (Helicopter) and a valid Medical Certificate. His last 'C' Category Instructor renewal was completed on 19 July 2017.

The instructor pilot had accrued 623 hours of total flying time and flown 23.6 hours in the Cabri G2. He holds ratings on five helicopter types, including the NOTAR®-configured Hughes 520N[1]. Prior to beginning training in the Cabri G2 on 21 May 2017, the pilot's last flight was on 30 October 2016 in a Robinson R22.

Description	Logbook record
Total flight hours	623.0
Flight hours in last 7 days (ZK-IMZ)	2.0
Flight hours last 30 days (ZK-IMZ)	4.8
Flight hours last 90 days (ZK-IMZ)	19.8
Total flight hours on Cabri G2 (ZK-IMZ)	23.6

Table 1: Instructor pilot flight hours

The student pilot, aged 59 years, held a Private Pilot Licence (Aeroplane) and a valid Medical Certificate. His total helicopter experience was 1.7 hours.

Weather conditions

Weather conditions at the time of the accident were Visual Meteorological Conditions (VMC), with the Levin Automatic Weather Service recording winds at 4-5kts. A local resident, approximately 750 metres from the accident site, recorded the conditions using a Netatmo weather station. The Netatmo station is not an approved aviation weather source but is used for reference due to its proximity to the accident. The winds recorded by this station at the approximate time of the accident were from 353° at 8 knots, with gusts from 343° at 17 knots.

Communications

The aircraft was equipped with a McMurdo Kannad 406 AF-Compact. The ELT did not activate in the accident. Upon removal, the investigator observed that the ELT 3-position switch was in the OFF position. The ELT 3-position switch must be in the ARM position to allow the system to be operated by the Remote Control Panel (Source: *Kannad Aviation Installation Manual Operation Manual*).

[1] The NOTAR® anti-torque system uses a slotted tail boom, fixed aerodynamic surfaces, and a direct jet thruster to provide directional control (source: https://www.mdhelicopters.com/notar.html). The type rating is mentioned here to inform the reader that the instructor is rated to fly other non-conventional anti-torque systems.

Wreckage and impact information

The helicopter was making an approach to the north, but the loss of control resulted in the aircraft changing direction and the direction of impact was to the southwest (see Figure 1). The rear portion of the landing gear dug into the ground on impact and collapsed, with the fuselage sliding to the right along the cross beams. The helicopter came to rest on its right side and received damage to the horizontal stabiliser, rotor head, and fuselage (see Figures 2 & 3). Several Fenestron blades and the three main rotor blades were destroyed in the accident. The instructor's head struck the upper-left portion of the cockpit, fracturing the fuselage above the door.

Flight control continuity was confirmed during the scene investigation.

The engine was operating upon impact.

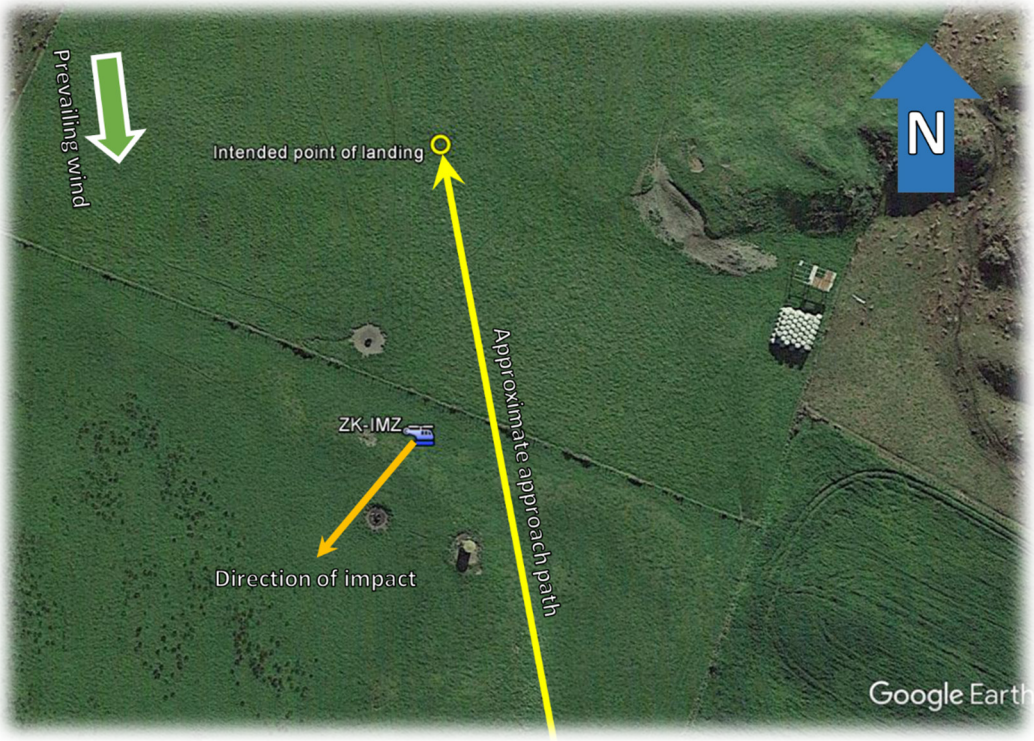

Figure 1: Accident site (Google Earth)

Figure 2: ZK-IMZ Wreckage (NZ Police photo)

Medical and pathological information

The instructor pilot received a laceration to the left side of his scalp, a concussion, and experienced memory loss as a result of the accident. The student pilot received a minor injury to his finger.

Survival aspects

The occupiable space was not reduced in the accident, and both pilots remained in their seats and harnesses.

The rate of left rotation is unknown, but markings on the ground indicate that there was a single impact and that the helicopter struck and rolled in place, with the rear portion of the landing gear embedded in the ground. The linear and angular momentum was absorbed by the landing gear, spreading the skids, with additional energy absorbed by the fuselage sliding across the skid tubes.

There was no first aid kit on board, and the ELT did not activate in the accident.

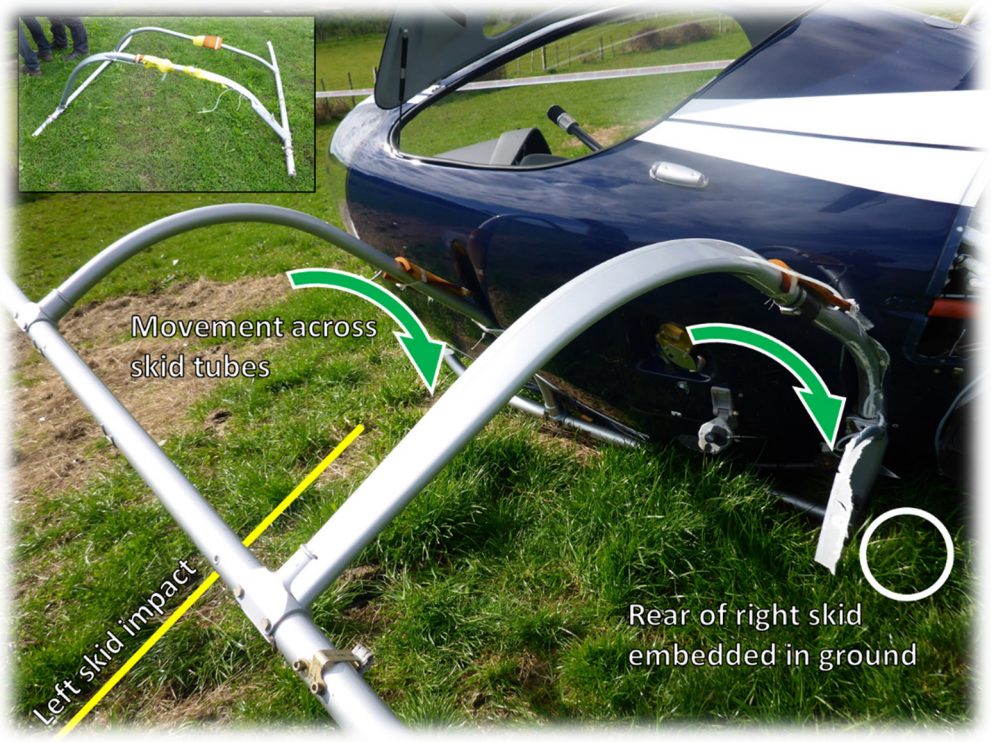

Figure 3: ZK-IMZ Landing gear (CAA photo)

Additional information

Guimbal Helicopters released Service Letter 12-001 A, *Yaw control in approach*, which describes the characteristics and performance of Fenestron anti-torque systems and conditions that may lead to a rapid left yaw. These characteristics are also described in Eurocopter Service Letter 1673-67-04.

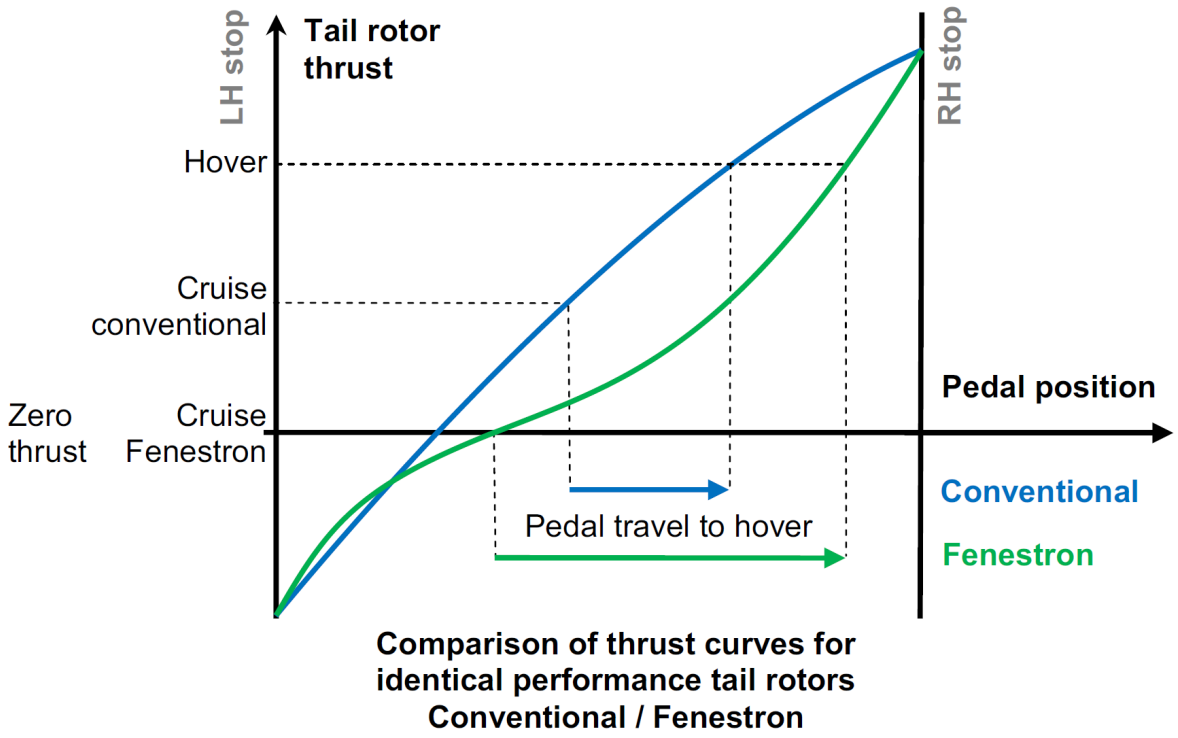

Figure 3: Comparison chart (Guimbal SL 12-001 A)

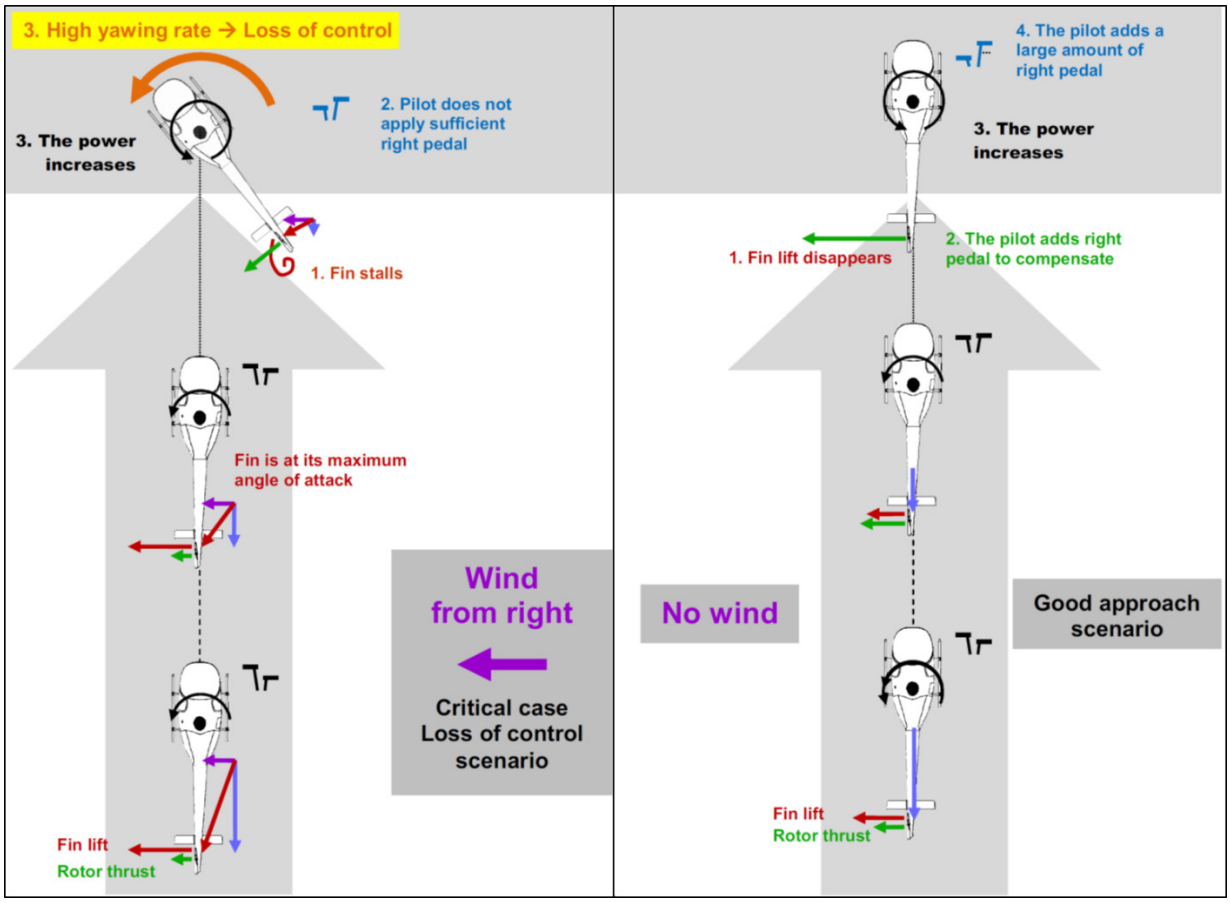

Figure 5: Approach scenarios 1 and 2 (Guimbal SL 12-001 A)

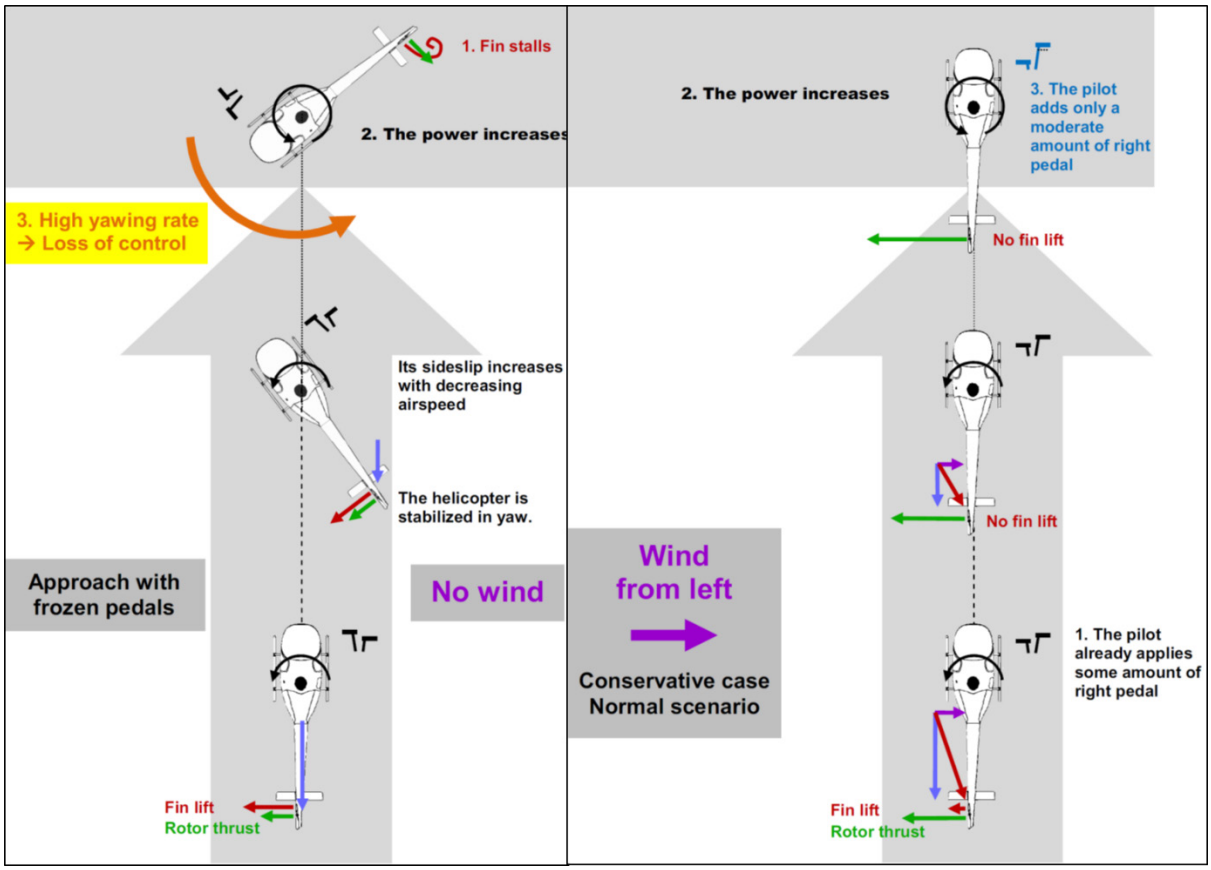

Figure 5: Approach scenarios 3 and 4 (Guimbal SL 12-001 A)

The loss of tail fin lift and increase in collective pitch require the pilot to apply a 'quick and large right pedal input' to prevent the left yaw rate from accelerating.

There have been nine accidents involving Guimbal Cabri G2 Helicopters in New Zealand. Six accidents occurred during training, and three involved yaw excursions. All three yaw excursions occurred during training flights (source: *ISRA report*).

Analysis

As the yaw rate developed, the instructor pilot likely increased collective pitch to abort the approach and initiate a climb. The increase in main rotor pitch created a higher demand for anti-torque thrust, resulting in an increased left yaw rate. As the instructor pilot attempted to stabilise the helicopter the cyclic inputs caused the aircraft to accelerate to the left-rear in relation to the intended approach track.

Conclusions

The instructor pilot did not make the appropriate control inputs to effectively prevent or arrest the left yaw rate as the aircraft transitioned from cruise to hovering flight, resulting in a loss of control and impact with terrain.

The characteristics of Fenestron-equipped aircraft are significantly different from that of a conventional tail rotor. The thrust created by the Fenestron is adequate, and the amount of pedal input required by the pilot is much larger and must be applied more rapidly than what is required for a conventional anti-torque system.

The ELT was not configured correctly. This prevented the remote switch from arming the ELT and prevented the ELT from activating in the accident.

The accident occurred on a VMC approach to a clear, unimproved landing area in favourable conditions.

Safety Action

The CAA Helicopter Aviation Examiner is consulting industry to identify effective training strategies that are already in use. Information is being gathered to be presented to Hélicoptères Guimbal and Airbus Helicopters with a view to additional training materials and guidance.

Safety Messages

Pilots: remain aware of the characteristics of Fenestron equipped helicopters

Pilots, especially those with experience flying with conventional anti-torque systems, must familiarise themselves with the techniques required in flying Fenestron-equipped aircraft. Anticipate the helicopter's reaction to aerodynamic and environmental changes and be prepared to apply the large and rapid pedal inputs required. Pedal travel is significantly more than that which is required for conventional tail rotor systems. Refer to Guimbal Service Letter 12-001 A and Eurocopter Service Letter 1673-67-04 for further information.

Instructor pilots: provide thorough Fenestron-specific training to students

Current information shows that loss of directional control on approach results in the highest number of Cabri G2 accidents from any single cause in New Zealand (source: *ISRA report*). The manufacturer recommends that instructors focus on the Fenestron characteristics during training and that the pilot's knowledge is checked periodically (source: *Guimbal Service Letter 12-001 A*).

Confirm ELT configuration

The ELT switch configuration should not be changed after being released to service. Changing the position of the switch may prevent the remote switch from arming or activating the ELT, preventing notification of an incident to rescue services.

About the CAA

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

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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