New Zealand Helicopter Association

Safety Bulletin

CFIT and object collisions in transport operations

This bulletin is the product of a collaborative effort between the NZHA and CAA to establish and analyse an extensive dataset of all New Zealand helicopter accidents between 2000 and 2012. Its purpose is to distribute the results so that we may all learn as much as possible from the accidents of the past, and adapt our operations and procedures accordingly.

CFIT and object collisions

CFIT is defined by the FAA as *'when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain (or water or obstacles) with inadequate awareness on the part of the pilot of the impending collision'*[1]. Within this definition 'terrain' is extended beyond 'land surface' to include water and objects (wires, trees, fences, etc). The reason for this is that the factors underlying terrain collisions are generally the same as those underlying *all* collisions; we will get a better understanding of the causes of the issue by looking at a wider pool of accidents.

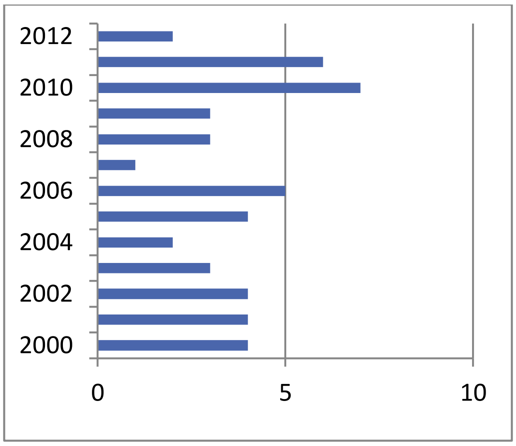
International research and findings

In their 2003 Advisory Circular on CFIT accidents in General Aviation the FAA stated that 17% of all GA accidents were CFIT, and that half of these occurred in IMC. In a 2005 study the ATSB found that 60% of Australia's CFIT accidents were fatal[2]. The IHST has identified that while CFIT accidents are the 13th most common accident type for helicopters, these accidents have a high fatality rate: Like the ATSB report, the IHST has stated that 60% of helicopter CFIT accidents have been fatal[3]. Their analysis of CFIT accidents yielded these common causal factors:

- Disregarding cues that should have led to termination of flight or manoeuvre
- Inadequate consideration of weather/wind during flight planning
- Unsafe flight profile - Altitude

Helicopter CFIT accidents in NZ

There have been a total of 48 helicopter accidents involving CFIT or object collision between 2000 and 2012 with 15 fatalities and 5 serious injuries:

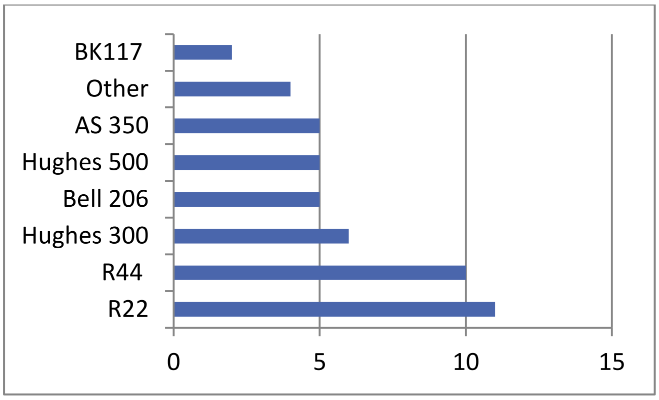


[1] FAA Advisory Circular No: 61 – 134 'General Aviation Controlled Flight Into Terrain Awareness, 2003.

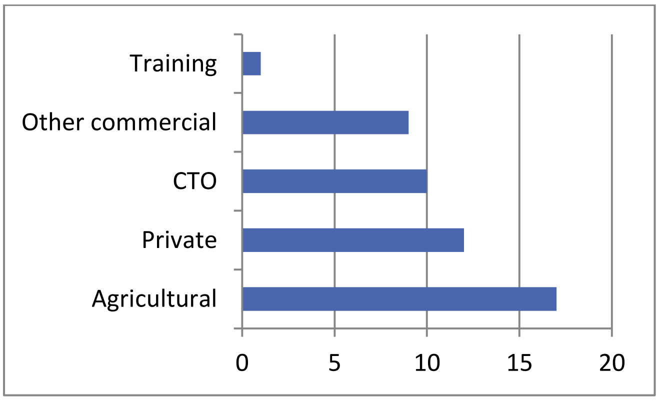
[2] ATSB Safety Research Report. CFIT: Australia in Context, 1995-2005.

[3] IHST Training Factsheet – CFIT. Note that IHST analyses are based predominantly on USA data.

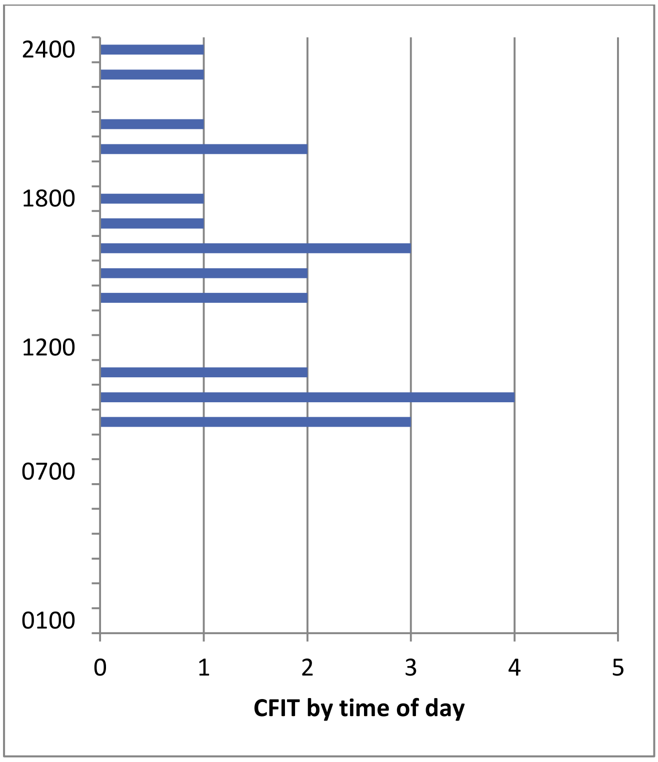
This accident type is more common among light utility **models:**



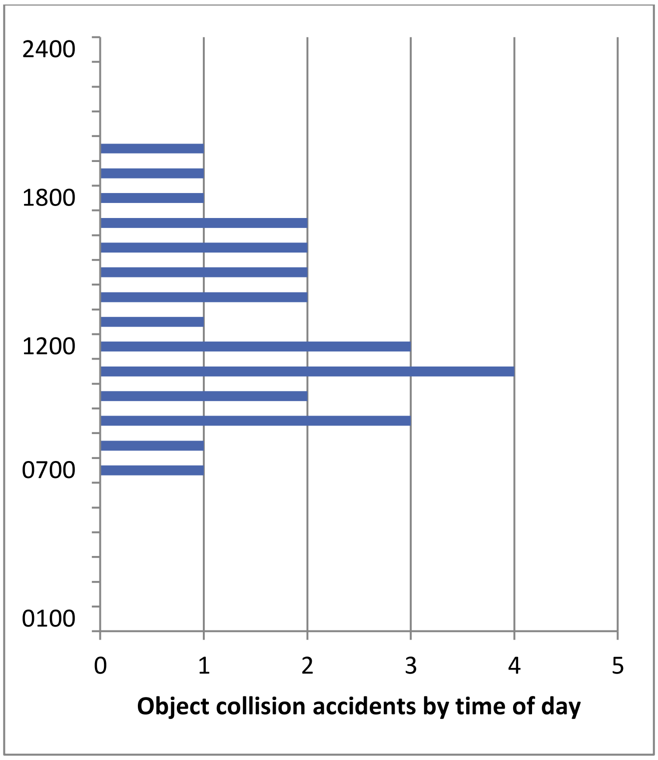
And **particular sectors** are at greater risk for these accidents than others:



Mapping the CFIT accidents by the **time of day they occurred** reveals three distinct periods for when they occur; morning (8-11:30am), late afternoon/evening (2:30-6pm) and night:



In comparison to CFIT, object collisions have a different profile according **to the time of day when the accidents occur**. It appears that the period of distinct risk is the morning period between 9am-12pm:



Summary

A closer reading of the CFIT/object collision accidents and the causal factors assigned reveals a series of patterns in the data: the sequence of events in each accident and the causes behind them varies according to the sector/nature of the operation. One of the charts to the left shows three sectors at special risk for CFIT and object collisions: CTO, private, and agricultural operations. This analysis now moves on to one of these operation types for a close assessment of the factors underlying their accidents. The ultimate goal of each analysis is the identification of steps that can be taken in order for operators to build in resilience to the particular CFIT and object collision risks that they face.

CFIT and other collisions in commercial transport operations

Since 2000 New Zealand's most severe helicopter accidents have been CFIT and other collisions in commercial transport operations. There is significantly more information available about these accidents owing to the fact that they are rigorously investigated and have a higher proportion of TAIC investigations than other sectors. Situational awareness and flight planning are commonly-identified causal factors in these investigations, but the review of the total pool of accidents also revealed that:

a) Passengers themselves often have a role in the accident sequence and,

a) Weather and other inappropriate conditions often feature.

Passenger involvement in occurrences

Since 2000 several incidents and accidents have occurred owing to:

a. **Passengers unbalancing the C of G or inadvertently interfering with controls.**

2005, R22, Molesworth Station: While passenger was disembarking in hover there was an abrupt change in C of G. The main rotor blades struck the hillside. The investigation determined that training of both pilot and passenger would likely have prevented the imbalance.

2002, R22, Mt White: The passenger vacated the aircraft, and while standing on the ground, reached back in to retrieve a strop from under his seat. As the seat was being raised, it came into contact with the cyclic control and pushed it to the right. The pilot was unable to counteract the control movement, and the helicopter rolled to the right. The tail rotor struck the ground, resulting in uncontrollable right yaw.

2011, AS350, Mt Cook: During takeoff at about 8ft agl, when one of the passengers pulled her camera strap, it caught the fuel control lever and pulled it out of its gate causing the engine to go back to idle. The pilot held the collective pitch and landed safely at the aerodrome.

b. **Passengers distracting pilots.**

2006, Hughes 500, Timaru: During a powerline inspection operation, the helicopter struck powerlines while on descent to land. The reason for the descent was that a passenger was sick; the pilot may also have been distracted by this.

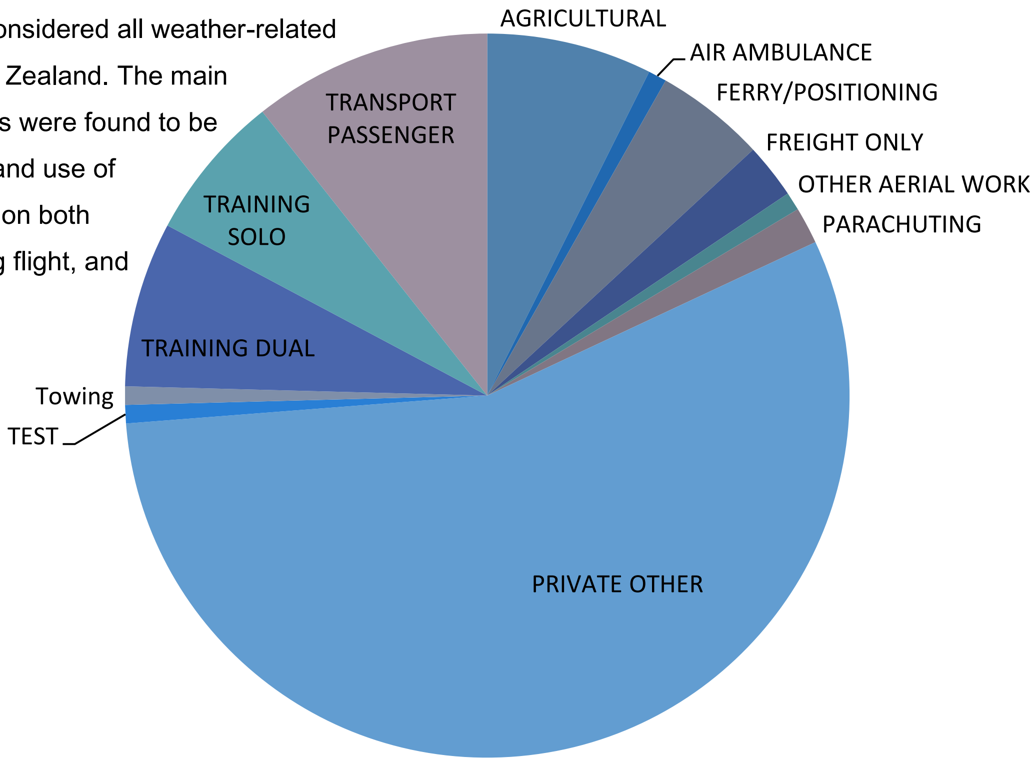
2008, Hughes 500, South Island: passenger threw vehicle keys to another person, keys went through rotor disc. Engine was shut down all blades inspected. Minor dents were found on leading edge of stainless cap on one blade.

2000, AS350, Clinton Valley: The helicopter was on approach to a riverbank landing site when the passenger pointed out some ducks to the left. This momentarily distracted the pilot and the tail rotor struck a rock in the riverbed. Despite the destruction of the tail rotor blades and severe damage to the drive train and tail boom, the pilot was able to land safely.

Weather conditions and CTO accidents

While the majority of weather-related accidents involve private pilots or private flying operations, commercial transport operations surprisingly are the second-highest sector involved (11% of accidents):

Weather-related accidents by flight type, helicopter and fixed-wing



This chart is the product of a separate study, one that considered all weather-related accidents in New Zealand. The main underlying causes were found to be pilots' collection and use of weather information both before and during flight, and the extent to which they incorporated this into their 'go/no go decision' and then their overall flight plan. For helicopter CTO accidents involving weather, the investigations suggest that the passengers themselves become incorporated into the weather-calculating exercise, obscuring the level of risk posed by the weather. This accident to the right describes such an instance where the perceived needs of one of the passengers lead to a 'go' decision into marginal conditions.

2001, R44, Ureweras: The helicopter collided with trees and caught fire, in conditions of low cloud and poor visibility. The pilot was attempting to fly two hunters out from a remote area. The pilot and one passenger were killed. The pilot persevered with the flight in adverse weather and at low level. The TAIC investigation concluded that "*The pilot probably treated the flight as an emergency flight because he understood that a passenger was running out of his medication. In fact, the pilot's probable perception of urgency was not necessary.*"

2000, AS350), Mt Karioi: (from the TAIC report) *"After checking that all 3 passengers were properly strapped into their seats, she asked the pilot how he would get to Mount Karioi. This was because she had observed that the upper third of the mountain was obscured by cloud. The pilot's reply was non-committal, but to the effect that they would have a look."* The helicopter crashed into the mountain after losing visibility, killing all four occupants.

As these descriptions make clear, underlying each accident is a choice to fly that does not assign proper weight to the marginal weather conditions that prevail. There have been a number of similar 'near miss' incidents of this type where pilots on helicopter operations have (wisely) abandoned the operation mid-way owing to the deteriorating conditions – choosing 'no' instead of 'go' (see below). Such incidents further demonstrate the nature and importance of individual judgement when weather conditions deteriorate in transport operations.

2009, Operator's incident report: Weather conditions at the time were approximately 10kts southerly wind with sun on the pad and cloud in the vicinity. There were several areas clear of cloud and what the pilot felt was a good clear escape area to the west. After about 5 minutes on the snow the whole area clouded in quickly from all sides. The pilot loaded the passengers and prepared to depart. Conditions did not immediately improve so the pilot hover taxied about 100m down the ridge. Conditions still did not improve so the pilot elected to land again and shut down. They waited approximately 45 minutes in which time the wind dropped completely and so at 1700hrs the pilot elected to walk the clients to the walking track which was approximately 200metres from the parked helicopter.

Reviewing research conducted by agencies overseas, helicopter transport operators' judgement calls involving weather may be influenced by any of the following:

a) Perception of passenger needs

b) 'Get-there-itis'

c) Commercial pressures

While many CFIT accidents involve weather-related decision making, the risks above should be considered specific to passenger transport operations. The accidents analysed reveal that the presence of passengers can have subtle, difficult-to-detect effects on flight decision-making which can lead to operations being undertaken that, given the conditions and circumstances, should not have been.

To conclude, the role of passengers in CTO CFIT and object collision accidents has been found to be both

2001, R44, Ureweras (continued): *"The pilot told the hunters he had to "sneak in" through the fog, and that he would try to fly them out, but if conditions were too bad they would return to the campsite and wait for better weather. The rear passenger had a restricted view during the flight because of the box on his lap. He described the helicopter climbing, following valleys or ravines, and turning to avoid "fog banks" while keeping beneath the low cloud. He saw that they were at tree top level just before he heard a "bleep" sound, and saw the main rotor taking off the top of a tree on his left. He heard the pilot say "sorry, guys", and saw that they were falling alongside the tree."*

active (distraction, helicopter imbalance), and passive (as a factor in decision making).

Resilience against the risk

This final section lists some practical steps that can be taken to protect CTO operators against the threat of CFIT and other collisions. Please bear in mind that these lessons have come at an enormous cost: the accidents described in this bulletin resulted in 7 fatalities and around 2.5 million dollars in lost machines and repair costs.

1. If your operation involves people entering or leaving the helicopter whilst hovering, run some calculations to establish what tolerance exists for significant C of G displacement and then make sure that your pre-flight training and briefing ensures things remain within controllability limits. What has worked previously with your 80kg loader-driver might become something more of a handful when a replacement weighing 120kg shows up unexpectedly.

2. Even with experienced aviation personnel involved in the operation the risk of interference with flight controls is a very real threat. Briefings only go so far in mitigating this risk so it might be worth looking at what options/modifications exist to provide better protection of critical controls. Some of them are very simple and relatively inexpensive. Things like guarded switches, protective covers, and floor level barriers around engine controls have been developed as a result of someone else's misfortune, normally have an STC, and are well worth consideration.

3. When it comes to weather conditions to be anticipated during the flight, technology delivers assistance that pilots back in the early 2000's could only have dreamed about. No longer do you need to "go and have a look" because webcams and MetService Rain Radar and satellite communications with the hunters waiting in the bush render it unnecessary. With not too much effort, and in most cases zero cost, you can get a real time picture of what conditions are like on your smartphone. You don't need to use it every time, but if things are looking a bit marginal have a few links on your phone (or local farmers on speed dial) to quickly update on how things are looking down the proposed track.

4. Always remember that even with the best of pre-flight planning things can change for the worse enroute. Never hesitate to discontinue the flight or carry out a precautionary landing if things don't play out as you expected them to.

5. For those that have the option of transferring to instruments if faced with a degraded visual environment, remember to keep your instrument flying skills up to speed … and have a think about what personal triggers you use to make the decision to switch to instruments.