QUEENSLAND COURTS

OFFICE OF THE STATE CORONER

NON-INQUEST FINDINGS

CITATION:	**Investigation into the death of Garry Sweetnam and Andrew Mitchell**
TITLE OF COURT:	Coroners Court
FILE NO(s):	2008/586 and 587
JURISDICTION:	Southport
FINDINGS OF:	Mr James McDougall, Southeastern Coroner
CATCHWORDS:	CORONERS: investigation, plane crash, cause of crash, aircraft canopy
Counsel Assisting:	Rhiannon Helsen Anthony Marinac

Mr Garry Sweetnam was 49 years of age at the time of his death. He worked as an engineer for Zenith Zodiac Australia, a company which imported, constructed and sold home made kit aircraft.

Mr Andrew James Mitchell was 33 years of age at the time of his death. He was an experienced aircraft operator and a good friend of Mr Sweetnam.

On 7 March 2008, Mr Sweetnam and Mr Mitchell decided to take a short flight around the Gold Coast in a two-seater Zenith Zodiac CH601 XL aircraft (Reg. VH-ZRS). Mr Sweetnam was responsible for operating the aircraft. Prior to take off, Mr Sweetnam advised Air Traffic Control that the flight was to include some aerobatic manoeuvres.

At around 3:55pm, Mr Sweetnam and Mr Mitchell left from the Coolangatta airport. The aircraft initially tracked to the south west as it left the Gold Coast Airport before turning and tracking north along the coast. At 4:02pm, the aircraft conducted one 360 degree flat turn, which took approximately 26 seconds. Shortly afterwards, a rapid reduction in height without a build up of speed occurred. Radar contact was lost at 4:03:27pm whilst the aircraft was at a height of 4,200 feet above sea level.

The aircraft subsequently impacted the ocean approximately half a nautical mile offshore from Surfers Paradise. Impact occurred in a left wing down, nose low altitude before subsequently sinking to the bottom of the ocean in 17m of water. The crash was witnessed by a number of persons on the beach at the time, as well as lifeguards in the area. Pieces of the canopy were found strewn on the shore.

Police investigation

Recovery of the wreckage

At around 4:10pm on 7 March 2008, police were notified of an aircraft crash into the ocean near Narrowneck at Main Beach. Senior Constable Bruce Kolkka and Constable Jason McGuiness of the Gold Coast Water Police attended. Upon arrival, they observed an oil/fuel slick on the top of the water. Senior Constable Kolkka deployed a datum buoy and anchor to mark the spot.

Prior to police arrival, lifeguards had collected a number of items from the plane which had floated to the surface. These items were subsequently provided to police. Civilians and lifeguards who were sitting on the beach at the time of the crash, also collected debris from the aircraft which had fallen on the beach and grass in front of the Surf Life Saving Club. A large piece of plastic was seen to land on the roof of the Surf Life Saving Club. Witnesses describe seeing the aircraft travelling at a fast speed in a *spiral motion* before crashing into the ocean.

Coastguard and Volunteer Marine Rescue vessels conducted a search for signs of survivors and other pieces of wreckage. The search was abandoned when light faded and all vessels left the area.

Police subsequently obtained details of the aircraft and the identities of the two male persons onboard. A chart was marked with the splash point and a search plan was developed. All property located was listed and photographed. Assistance was also requested from the Police Dive Squad.

Police note that it was difficult to determine the distance and bearing of the location of the aircraft crash from the beach as no reference points were available.

Between 8 and 12 March 2008, police conducted an extensive search, including the use of sonar equipment and police divers. The search was hampered by weather and surf conditions, and ultimately divers from a private vessel identified the wreckage. Police recovered the bodies on that day, and the remaining components of aircraft wreckage in the next two days.

Autopsy results

Dr Nathan Milne conducted autopsies on both bodies on 13 March 2008. Histology and toxicology tests were also undertaken. Both bodies were significantly decomposed, and both deceased were identified from dental records. Both of the deceased suffered from multiple, serious bone fractures and multiple lacerations of various organs, consistent with the impact of the aircraft into the water. Neither of the deceased had any drugs or alcohol in their system at the time of their death.

Dr Milne expressed the view that it was unlikely that either of the deceased had pre-existing conditions likely to have caused their death prior to the crash; and given the severity of their injuries, they are unlikely to have drowned after the cockpit unit became submerged.

QPS interim coronial report

On 13 March 2008, the State Coroner ordered police to undertake a full police investigation into Mr Sweetnam and Mr Mitchell's deaths. Senior Constable Bruce Kolkka of the Gold Coast Water Police was the investigating officer. In the event, a multi-agency investigation was undertaken, primarily with Recreation Aviation Australia (RAA), who in turn was assisted by the Australian Transport Safety Bureau (ATSB). Subsequently, Senior Constable Kyle Hutchinson was tasked with completing the coronial report on the incident. An Interim Report was submitted on 9 June 2009. It should be noted that the interim report was provided before RAA's report was completed. A final coronial report has not been submitted by the QPS.

The Interim Report notes that prior to Mr Sweetnam and Mr Mitchell taking flight, a radio transmission to Air Traffic Control suggested that the flight was to include some aerobatic type manoeuvres adjacent to Jupiter's Casino.

The Interim Report indicates that video footage taken from a camera linked to an internet website, Coastalwatch, showed the final seconds before the aircraft entered the water. The aircraft did not appear to be in controlled flight as it was almost vertical when it entered the water at a very high speed. A low-altitude stall was considered to be the most likely cause.

Fragments of the canopy were found a substantial distance from the main wreckage, which indicates that the canopy broke up whilst in flight, as opposed to on impact. Police submit that it is highly likely that canopy failure or involuntary release of the canopy has caused the aircraft to stall and descend rapidly.

Other possible causes, such as an overstress of the airframe, or a cabin fire caused by an electrical fault, were also considered however the condition of the wreckage after recovery made consideration of these theories difficult. In the end, the Interim Report concluded that there was no evidence to support these theories.

Recreational Aviation Australia report

RAA is a non-profit organisation that self administers single and two seat aircraft under 600kg maximum take off weight on behalf of the Civil Aviation Safety Authority. RAA were requested by the Gold Coast Water Police to provide expert advice

regarding the accident. RAA subsequently inspected the wreckage a number of weeks after the accident. A report was then compiled by the CEO, Mr Lee Ungermann.

Mr Ungermann's view was that at 4:02pm, the aircraft conducted one 360 degree turn (analogous to a car going fully around a roundabout), which took approximately 26 seconds. Radar suggests that the turn was approximately 14 degrees per second turn rate at an estimated angle of bank of 45-60 degrees. Shortly afterwards, a rapid reduction in height without a build up of speed occurred. Radar contact was lost at 4:03:27pm whilst the aircraft was at a height of 4,200 feet above sea level.

Mr Ungermann reported that the aircraft impacted the ocean approximately half a nautical mile offshore from Surfers Paradise. Impact occurred in a left wing down, nose low altitude before subsequently sinking to the bottom of the ocean in 17 metres of water. He concluded that the location of the main wreckage site, in relation to the last known radar return, indicates the high probability of an uncontrolled descent from altitude.

The RAA report considered the aircraft in detail. The Zodiac CH 601 XL is a single engine, low wing, metal semi-monocoque aeroplane. The term 'monocoque' refers to an engineering structure whereby the structural strength of the aircraft comes from the skin, or shell of the aircraft, rather than from any internal frame or skeleton. Aircraft VH-ZRS was first registered in May 2006 under the Australian General Aviation Amateur Built Experimental Category (CASA 21.195) and was issued a Special Certificate of Airworthiness experimental design. The aircraft was a demonstration aircraft for Sport Air Aviation Services.

The aircraft was fitted with a Jabiru 3300A engine, which had been fitted when the aircraft was built. The aircraft and engine had undertaken 96 hours of flight time prior to the incident.

Factors which did not cause the crash

The RAA report considered a number of factors which may have contributed to the accident, but concluded they did not:

- The pilot (Mr Sweetnam) was well known and experienced as a pilot, maintainer, and inspector of amateur built aircraft. The passenger (Mr Mitchell) was licensed as a commercial pilot. Both of the occupants of the aircraft were therefore experienced aviators.

- Weather conditions were normal, with an 18 knot wind from the south-east. Weather was not considered to be a factor in the crash.

- It is possible that with two people on board and a full tank of fuel, the aircraft's maximum takeoff weight might have been exceeded; however there was no evidence to this effect.

- Examination of the engine after the wreckage was recovered suggests that there was no separation of the engine from the aircraft prior to the crash.

- The aircraft had been maintained approximately 27 flying hours prior to the crash, and was not due for further maintenance until it had flown a further 73 hours.

- The aircraft's instruments and controls all appear to have been functioning effectively at the time of the crash.

- An elevator separated from the aircraft, but does not demonstrate signs of fatigue or stress fractures. There is no way to know for certain whether the elevator separated from the aircraft in-flight, on impact, or during recovery of the aircraft.

- The propeller of the aircraft appeared to be in good working order.

- The fuel state of the aircraft was unknown, as the fuel system was extensively damaged in the crash.

For completeness, it should be noted at this point that various tests were also undertaken by the ATSB and another organisation, Ecosure, to determine whether bird-strike may have caused the crash. There was no evidence of a bird-strike in this incident.

Focus on the aircraft canopy

During the RAA investigation, the nature of the wreckage and the history of this aircraft type (see below) led the RAA to focus on the aircraft's canopy, which was fragmented either during the flight, or on impact. Due to the fragmented nature of the canopy and the difficulty in recovery, not all sections of the canopy were recovered. Several fragments of the canopy recovered from the beach, land and rooftop of the Southport Surf Club were sent to ATSB for analysis. Due to the fractured nature of the canopy pieces and the incomplete quantity provided, it was difficult to determine a fracture initiation point and the overall failure mode in flight.

One piece of the canopy was scrutinized further due to the localised impact damage observed. ATSB Report AE-2008-029 concludes that the impact damage sustained by this fractured piece of canopy was initiated from the inside of the canopy.

The canopy rails, which support the canopy, were severely distorted and due to the impact damage it cannot be ascertained if the metal canopy structure failed in flight. However the internals of the left hand side of the canopy latch appeared functional upon inspection.

Due to the type of canopy latch used in the Zodiac CH 601 XL and its normally concealed nature, it was difficult to ascertain its position when the canopy is lowered into the flying position and locked. Numerous reports of the canopy latching mechanism failing in flight due to incorrect operation are documented. A further report indicates similar canopy latching mechanisms failing under side or torsional load in turbulent flight conditions, leading to aircraft pitch instability.

The RAA report made the following relevant findings about the incident:

- The aircraft experienced turbulent airflow over the elevator disrupting pitch control while sections of the canopy failed under torsional load venting the cockpit to the outside airflow. This decreased the controllability of the aircraft by disrupting the airflow over the aircraft control surfaces of the elevator and rudder.

- The location of the canopy pieces, in relation to the final location of the aircraft after impact with the ocean, was consistent with a high altitude departure of the fractured pieces from the aircraft structure.

- Unfortunately, it cannot be ascertained if a loss of aircraft control led to overstress of the airframe and canopy, initiating the in-flight failure of the canopy. It may also be possible that an unintentional canopy release in flight led to subsequent control difficulties and eventual loss of aircraft control. It is highly unlikely that the flaps were deployed at the initial point in which the in-flight event commenced. The selection of the flap may have occurred to assist the pilot to recover control of the aircraft. It is possible that this may have further exacerbated the forward pitching moment and contributed to a further loss of longitudinal control.

Among its recommendations, the RAA recommended that the aircraft manufacturer supply an alternative canopy retrofit kit to all customers of Zenith CH601 XL aircraft. The RAA recommended that this alternative design should be approved by an independent engineer for use with special emphasis on redesign of the latching mechanism and visual confirmation from the cockpit of locked status.

Most importantly, on 13 January 2009, RAA released a Recreational Aircraft Airworthiness Notice to all Zenair Zodiac XL owners in Australia in relation to the fitment of a secondary canopy latching mechanism. This safety measure is designed to prevent the unwanted opening of the aircraft canopy in-flight. The Notice states that the canopy in the aircraft is of a relatively light construction and is prone to distortion during flight, which can cause the latches to release. In addition, the locking mechanism can be latched without locking adequately. All owners and operators were required to manufacture and fit a secondary locking mechanism to the canopy, which has the capacity for 'quick release' in case of an emergency. It was also recommended that the aircraft be fitted with the upgraded locking mechanism available from the aircraft manufacturer in addition to the requirement listed above. Consideration was also to be given to replacement of the complete canopy with a heavier modified type.

ATSB Report, June 2009

In June 2009, the ATSB published a transport safety report detailing its examination of several pieces of canopy from the aircraft (only a small proportion of the total canopy material had been recovered).

One of the canopy pieces showed a central puncture, approximately 20-25mm in size. Under the stereo-microscope at high magnifications, a series of radiating river lines were observed extending from the inner surface through to the outer surface. This suggested that the puncture had originated on the inner surface and propagated through to the outer surface. The fracture features also suggested that the canopy had been punctured from a single impact event of short duration.

Numerous discrete indentations surrounding the puncture were also noted on the inner surface of the canopy fragment. Minor cracks were observed to have initiated from some of the indents. Detailed examination of the fracture surfaces from the other five canopy piece revealed features consistent with brittle fracture. No evidence of any pre-existing damage such as fatigue cracking, or other anomalous features were found.

Examination of the recovered canopy items and an assessment of their distribution in relation to where the aircraft impacted the sea, suggested that the canopy had failed catastrophically and was lost from the aircraft during flight. The location and confined spread of the recovered canopy pieces suggested that the canopy breakup occurred at an altitude and position close to where the aircraft was last observed on radar.

Whilst only a small portion of the canopy was available for examination, the fracture surfaces of those fragments presented an entirely brittle fracture mechanism. In the absence of manufacturing or mechanical defects, and assuming no significant material degradation had occurred in the time following canopy manufacture, it can be suggested that structural failure of the canopy occurred from exposure to overstress conditions during flight. It could not be established whether the canopy breakup occurred in controlled flight, or after control of the aircraft had been lost.

It was also noted that whilst five of the fragments recovered were 'undamaged', one of the canopy fragments had been punctured from the internal surface. Fracture surface morphology around this region suggested that the canopy had been punctured in an outward manner. Numerous related indentations were also located around the puncture on the internal surface and small cracks had initiated from some of those sites due to repeated impact loading. Given the confined spread of that damage, it is probable that the puncture had been produced by an object from within the cockpit while the canopy was still intact.

History of crashes involving Zodiac 601XL aircraft

Unfortunately the coronial investigation into this accident revealed an extensive history, in Australia and overseas, of aircraft crashes involving this aircraft type.

The majority of these fatal incidents involved issues with the structure of the aircraft, in particular the wings and control surfaces, resulting in the wings 'folding up' or separating from the aircraft in flight. There is no suggestion that this occurred in the current case.

Another issue in relation to the Zodiac is the potential for the canopy of the aircraft to open, more or less spontaneously, during flight. Several instances of this occurring in Australia have been reported to the RAA. In addition, internet pilot forums include discussions on both the propensity of the Zodiac canopy to fail, and on various makeshift ways to prevent this from occurring. Following the deaths of Mr Sweetnam and Mr Mitchell, the RAA released the airworthiness notice indicated above. Importantly, no further canopy failures have been reported in Australia since that time.

The RAA was subsequently asked to report specifically on in-flight canopy failures in the Zodiac CH601 XL. The RAA advised:

> *A review of accidents and incidents involving CH601 aircraft on the Aviation Safety Network by the online provider, Flight Safety Foundation indicated that there have been a total of 34 incidents and accidents outside of Australia since January 2009. Two of these referenced canopies opening in flight.*
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> *In Australia, RAA have received 11 incident and accident reports involving the CH601 aircraft. An accident involving a possible canopy detachment occurred in December 2008. More recently, an incident occurred on 31January 2013. In this instance, the builder had opted to construct the canopy to hinge from the side (not from the front as it was in the VH-ZRS). Given the canopy does not hinge from the front, the existing Airworthiness Directive, issued after this incident, to attach a secondary latch does not apply to this aircraft. RAA is following up and discussing this incident with the owner to determine whether further modifications may be required to this type of design.*

Consideration is also being given as to whether the Airworthiness Directive will need to be updated to require secondary latches to be fitted to all configurations of 601XL canopies.

Final police coronial report

Investigating Officer, Senior Constable Hutchinson subsequently provided a final Police Coronial report, dated 18 February 2014, to be considered in conjunction with the interim report previously submitted on 3 July 2009.

Accordingly, Officer Hutchinson submitted that the following relevant findings could be made in this matter:

- In relation to the further information supplied by the RAA, Officer Hutchinson notes that it has been reported in instances where the canopy of a CH601XL opens in-flight, a large vacuum sucks objects out of the cockpit with some force. In an incident in the United States on 29 March 2013, a student pilot, who failed to secure his seatbelt, was sucked out of the cockpit when a canopy opened in-flight. The instructor was able to re-secure the canopy latch and safely land the aircraft. In this incident, it was noted that the canopy gradually opened before the securing latch failed.

- The relevance of this new information relates to the results of the analysis conducted by the ATSB with respect to canopy fragments located after the crash of VH-ZRS. The analysis gave some indication that the canopy was struck and fractured from inside the cockpit. Officer Hutchinson submits that it is probable that objects from within the cockpit were sucked out and struck the inner surface of the canopy after the canopy detached from a secure position. This lends weight to the suggestion that the canopy failed first in flight and the subsequent stalling of the aircraft occurred as a probable consequence of the canopy opening in-flight.

- Officer Hutchinson maintains his opinion that the cause of the crash of VH-ZRS was the failure of the canopy latching mechanism to secure the canopy in-flight. The subsequent stalling effect of the open canopy on the elevator surfaces of the tail section caused the aircraft to dive rapidly. The pilot may have recovered from the dive momentarily before the aircraft entered into an unrecoverable dive and crashed to the sea.

Final advice from RAA

At the conclusion of the coronial investigation, Mr Ungermann of the RAA was requested to provide further advice, specifically on the question of whether it is more likely that a structural failure (or failure of the control surfaces), or alternatively a canopy failure, caused this crash. The RAA sourced advice from Mr Ungermann (who now works for CASA). Mr Ungermann's advice was that the actions of the aircraft on loss of control (an immediate pitch downwards) were consistent with a canopy failure, and inconsistent with other forms of structural failure.

Conclusions

The circumstances surrounding this aircraft crash, which caused Mr Sweetnam and Mr Mitchell's death on 7 March 2008, have been thoroughly and professionally investigated by the police and RAA. I am satisfied that the conclusions reached by the RAA and police are appropriate and accord with the evidence retrieved from the scene.

It seems clear that just prior to or just after the aircraft departed from controlled flight, an event occurred involving the aircraft canopy. On the balance of probabilities, the submission by Officer Hutchinson that the cause of the incident was most likely the opening of the canopy in-flight, which subsequently caused the aircraft to stall, seems probable and accords with the evidence and ATSB's findings. While there is insufficient evidence to be certain why the canopy opened, two possibilities are a failure of the canopy latches, and flexing of the thin canopy structure during the aerobatic manoeuvre which immediately preceded the loss of control.

It is likely that the damage to the canopy observed by the ATSB's microscopic analysis of the recovered canopy pieces arose from the canopy striking the tailplane of the aircraft after becoming disengaged from the fuselage (or after losing integrity and breaking up after opening).

I am satisfied that the subsequent action taken by the RAA in issuing an Airworthiness notice requiring the compulsory fitment of a secondary latch in 2009, as well as the significant modifications made since by the aircraft manufacturer to the design of the Zodiac CH601, has now satisfactorily addressed the safety concerns and issues held in relation to the aircraft. RAA have made it clear that they do not hold any immediate concerns regarding the airworthiness of the aircraft. This view is supported by the fact that there haven't been any further reported incidents in Australia involving the canopy detaching in-flight for the Zodiac CH601 aircraft.

Based upon the material obtained during the coronial investigation, I am satisfied that the circumstances surrounding the aircraft crash have been sufficiently examined and there are no further matters, which require consideration. Furthermore, I am of the view that there are no recommendations, which I could make to prevent a similar incident from happening in the future. As such, I do not propose to proceed to inquest on this matter.

Formal findings as required by s. 45 *Coroner's Act 2003*

1. I find that Garry Sweetnam, aged 49 years and Andrew James Mitchell, aged 33 years died at about 4.04pm on 7 March, 2008.

2. They died from injuries received when the Zenith Zodiac CH601 XL aircraft in which they were flying (Mr Sweetnam as pilot and Mr Mitchell as passenger) impacted with the ocean approximately half a nautical mile offshore from Narrowneck at Main Beach, Surfers Paradise.

3. I find that, on the balance of probabilities, the plane crashed for the reasons set out in my conclusions.

4. The cause of death in each case is multiple fractures and internal lacerations as a consequence of heavy impact in a plane crash.

James McDougall
South Eastern Coroner
15 October 2014