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External Assistance to Recreational Aviation Australia (RA-Aus) – Collision with water 22km NNW Gold Coast Airport, Qld Zenith Zodiac CH601 XL 7 March 2008

Abstract

On 7 March 2008, a Zenith Zodiac CH601 XL aircraft, registered VH-ZRS, impacted the sea near Surfers Paradise, Qld. The pilot and the passenger were fatally injured. Recreational Aviation Australia (RA-Aus) commenced an investigation into the occurrence.

RA-Aus requested assistance from the Australian Transport Safety Bureau (ATSB) in order to examine several pieces of canopy from the aircraft. The examination revealed that the canopy had sustained an in-flight structural failure. The results of the ATSB examination were subsequently provided to RA-Aus investigators.

FACTUAL INFORMATION

History of the flight

On the afternoon of 7 March 2008, at 3:52 PM EST¹, a single engine Zenith Zodiac CH601 XL aircraft, registered VH-ZRS, departed Gold Coast Airport on a private flight under visual flight rules (VFR). On board the two-seat aircraft were the pilot and one passenger. Prior to taking off, the pilot declared that he was intending to

perform some 'mild aerial manoeuvres' to the north of the airport around the Porpoise Point VFR reporting point.

Once airborne and climbing, the aircraft was monitored by the Coolangatta air traffic control radar. The aircraft initially tracked to the south-west, and then turned left to track north along the coast. At 4:03:27 PM, radar contact was lost while the aircraft was at an altitude of 4,200 ft above mean sea level and positioned approximately 22 km NNW of Gold Coast Airport.

At around 4:15 PM, Coolangatta air traffic control was notified by Queensland police that aircraft wreckage had been found in 30 m of water, 0.5 NM from Surfers Paradise. Both occupants were fatally injured.

During the subsequent search and rescue effort, several fragments of canopy from the aircraft were found on land near the Southport Surf Club. One of the fragments was found on the roof of the surf club while the others were located along the beach. Figure 1 details the accident site and flight path of the aircraft, and the approximate location of the canopy pieces.

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time as particular events occurred. Eastern Standard Time is Coordinated Universal Time (UTC) + 10 hours.

Figure 1: Aerial view showing VH-ZRS accident details

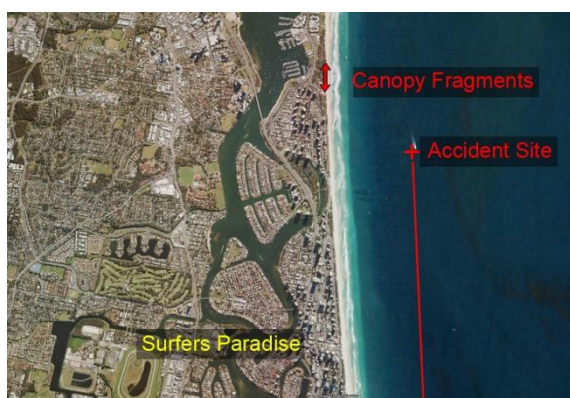


Image Source: Google Earth™ mapping service

ATSB investigation scope

At the request of RA-Aus, and in order to assist their accident investigation, the canopy pieces from the accident aircraft were received by the ATSB for technical examination and commentary regarding the failure mechanism and damage sustained.

Aircraft information

The Zodiac CH1601 XL aircraft was a two-seat, lightweight aircraft that had been originally supplied from the manufacturer in kit-build form. Structurally, the aircraft utilised a low wing design and it had been equipped with a Jabiru 3300A six-cylinder reciprocating engine. The aircraft was first entered onto the Australian civil aviation register in May 2006, in the amateur-built experimental category.

The domed transparent canopy was designed to hinge forward and open for occupant access. It would normally be latched shut during flight. While there are several different canopies available for Zenith Zodiac CH1601 aircraft, product data for the accident aircraft indicated that the canopy had been manufactured using bronze-tinted, 0.125" acrylic plastic sheet. The canopy had initially been supplied in the build kit pre-formed to shape, which was then cut to size, drilled and riveted to the aircraft canopy frame.

Canopy examination

Six fragments of the aircraft canopy were submitted by RA-Aus for examination (Figure 2).

To investigate the possibility of a birdstrike, each canopy fragment was inspected for evidence of biological matter using ultraviolet light (UV). Many organic fluids contain molecules that are known to fluoresce from exposure to UV. The inspection did not reveal any evidence that might have otherwise provided an explanation for the canopy failure.

Comparison and examination of the canopy fragment fracture profiles found no correlation between the individual pieces, and it was generally evident that only a small proportion of the total canopy material had been recovered.

Figure 2: Fragments of the aircraft canopy, as received: note the punctured canopy fragment (arrowed)



One of the canopy pieces showed a central puncture, approximately 20 - 25 mm in size (Figures 3 and 4). Under the stereo-microscope at high magnifications, a series of radiating river lines² were observed extending from the inner surface through to the outer surface. A radiating fracture in the manner observed 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

² A characteristic pattern of cleavage steps running parallel to the local direction of crack propagation on the fracture surface. ASM Handbook, Failure Analysis and Prevention, Volume 11, Page 8.

to have initiated from some of the indents (Figure 5).

Figure 3: The punctured canopy piece referenced in Figure 2



Detailed examination of the fracture surfaces from the other five canopy pieces revealed features consistent with brittle fracture. No evidence of any pre-existing damage such as fatigue cracking, or other anomalous features was found.

Small quantities of sand were noted adhering to the fracture surface associated with the punctured area (Figure 6). Given that all of the canopy fragments were found close to the beach, the presence of sandy deposits was not considered unusual.

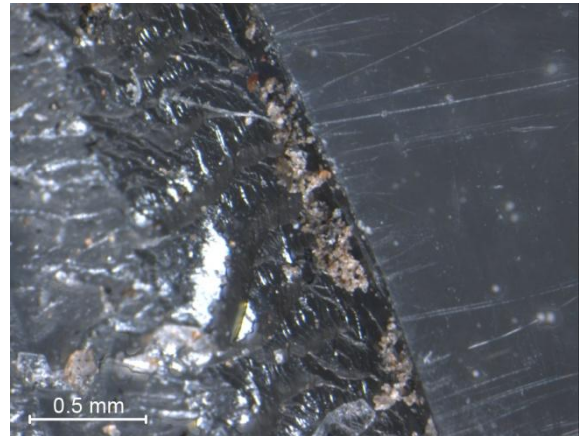
Figure 4: Close-up of the canopy puncture showing several impact marks (circled)



Figure 5: Small crack from impact damage on the inner surface (circled)



Figure 6: Magnified view showing sand on the inner fracture surface



ANALYSIS

Canopy failure

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.

While 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.

Recovered canopy fragments

It was noted that while five of the fragments 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. A birdstrike to the aircraft was considered unlikely to have been a factor leading to canopy failure. A detailed ultraviolet light inspection of the canopy pieces did not reveal any evidence of biological matter. Had a bird been struck, it is expected that residual evidence from such an event would have been found.

FINDINGS

- The acrylic canopy from the Zenith Zodiac CH1601 aircraft, registration VH-ZRS, failed catastrophically in flight. Whether the canopy failed prior to, or moments after the aircraft departed controlled flight could not be established.
- One of the canopy pieces was found to contain a significant through-thickness puncture and numerous secondary cracks. That particular damage was identified to have initiated on the internal surface of the canopy due to repeated impact loading.
- No physical evidence was found of a bird strike.