

**Aviation Safety Investigation Report
199501051**

**Pitts Aviation Enterprises
S-2A**

09 April 1995

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Occurrence Number: 199501051 **Occurrence Type:** Accident
Location: Near Gatton
State: QLD **Inv Category:** 3
Date: Sunday 09 April 1995
Time: 1739 hours **Time Zone:** EST
Highest Injury Level: Fatal
Injuries:

	Fatal	Serious	Minor	None	Total
Crew	1	0	0	0	1
Ground	0	0	0	0	0
Passenger	0	0	0	0	0
Total	1	0	0	0	1

Aircraft Manufacturer: Pitts Aviation Enterprises
Aircraft Model: S-2A
Aircraft Registration: VH-IXY **Serial Number:** 2248
Type of Operation: Non-commercial Practice
Damage to Aircraft: Destroyed
Departure Point: Gatton Qld
Departure Time: 1730 EST
Destination: Gatton Qld

Crew Details:

Role	Class of Licence	Hours on	
		Type	Hours Total
Pilot-In-Command	Private	23.0	616

Approved for Release: Friday, February 9, 1996

Sequence of events

On the morning of 8 April, the pilot flew the aircraft from Archerfield to Gatton to practise aerobatics. That afternoon he carried out two flights during which he performed an aerobatic sequence known as a "free program", which is a sequence of manoeuvres designed by the pilot to meet certain criteria. The following morning, the pilot carried out a check flight with an instructor to obtain approval in accordance with Civil Aviation Regulation 155(3), to conduct aerobatics down to a minimum height of 1,500 ft above ground level. The minimum height for aerobatics is 3,000 ft above ground level unless this approval is obtained.

Early in the afternoon, the pilot commenced a flight to practise his "free program" again. The flight was observed from the ground by other pilots, one of whom was in radio communication with the pilot. On this occasion it was planned to critique the flight via the radio. The pilot on the ground, who was an experienced aerobatic pilot, stated that about half way through the sequence he could see there was a problem. The aircraft had been inverted for 5 or 6 seconds after a half loop, before performing a half loop downwards and returning to upright flight. The observing pilot said that after reaching a horizontal attitude, the nose of the aircraft pitched up 40-60 degrees and the aircraft rolled to the right. He immediately queried the pilot as to what he was doing, but received no response. The aircraft continued rolling slowly to the right and several more transmissions were made, but there was still no response. The aircraft then appeared to stabilise, and the pilot responded saying that he thought he might have blacked out, but that he was all right now. He then said that he thought he would land and have a rest for a while.

The landing appeared to be normal, and shortly afterwards the events of the flight were discussed with the pilot. The pilot said that he could remember the nose of the aircraft coming up to the horizon, but he did not remember anything after that until the aircraft was near the downwind leg of the circuit. A discussion was held on "G-LOC" (g-induced loss of consciousness) and its possible effects including disorientation. After further discussion the pilot decided that he would make another flight later that afternoon, as he did not appear to have suffered any after effects. A technique was then discussed which would reduce the g force during the manoeuvre and help prevent the situation from recurring during the sequence.

At about 1730 EST, the pilot took off to practice the "free program" sequence again. He was in radio communication with his brother, a highly experienced pilot and flying instructor. The pilot had said that he would increase the base height for the sequence as an added safety margin. The sequence was commenced and proceeded normally and the manoeuvre which had previously caused the problem was performed with what appeared to be the suggested modifications. However, shortly after recovery to the straight and level attitude from the downward half-loop, the nose of the aircraft pitched rapidly to 10 degrees nose-up and the aircraft began to diverge slowly to the right with the nose continuing to rise slowly. The aircraft then commenced a continuous roll to the left. During this time, the ground observer made several unsuccessful attempts to contact the pilot by radio. The nose of the aircraft dropped and the aircraft dived almost vertically into the ground from a height estimated by witnesses as 2,000-2,500 ft.

Wreckage examination

Examination of the wreckage did not reveal any defects or failures which may have been present before impact, and which could have contributed to the development of the accident.

The canopy had been previously broken when a radio detached from its mounting in the rear cockpit during aerobatics. Two parallel cracks extended laterally across the top of the canopy over the rear cockpit. A repair had been carried out by stitching the cracks with locking wire. The impact site and wreckage did not initially yield a representative quantity of perspex (only about 20 per cent was found) and the site was then excavated. Approximately 60 per cent by weight of the canopy perspex was recovered from the impact crater, including the lockwire stitching with some perspex still attached. The remainder of the canopy perspex probably broke into fragments smaller than those recovered. A thorough ground and air search was carried out for perspex under the flight path but none was found. This evidence indicates that the canopy is unlikely to have failed in flight.

Impact information

Microscopic examination of both airspeed indicator faces revealed a pointer impact indicating 195 kts on one instrument. The aircraft impacted the ground vertically making a crater approximately 1.3 m deep. The impact forces were not survivable.

Medical

The pilot was assessed as medically fit for issue of a Class 2 medical certificate in December 1994, and appeared to be in good health on the day of the accident. Pathological examination showed evidence of coronary artery stenosis which could have affected the pilots g tolerance. However, medical opinion was that this could not be categorically stated to be the cause of a low g tolerance, or a contributing factor to the accident.

Research and analysis

From the available evidence it appears that the fatal flight was a repeat of the previous flight, except that on this occasion the pilot was unable to regain consciousness before the aircraft struck the ground. The aerobatic sequence up until the time of control loss was, in the opinion of witnesses, flown with more precision and was of a higher standard than on the previous flight. The manoeuvres were described as being tighter, and the pilot was probably generating more g than on the previous flight. He had been advised to reduce power during the manoeuvre that had previously caused the symptoms consistent with G-LOC, to enable the downward portion of the manoeuvre to be conducted at a slower speed and therefore reduced g. Witnesses said that a power reduction was heard during the inverted part of the manoeuvre, but the entry speed is not known.

A BASI Air Safety Research Report produced in February 1988, "The possibility of G-Induced loss of consciousness (G-LOC) during aerobatics in a light aircraft", stated that with sustained moderate rates of onset of g force, G-LOC is preceded by visual symptoms such as grey-out and then black-out (loss of vision). G-LOC is due to the reduced flow of blood to the brain when the magnitude of g in the vertical axis (Gz) passes beyond a particular value, the G-LOC threshold. Beyond this value, neurones fail to function in the absence of the oxygen replenishment provided by the normal blood flow and G-LOC occurs.

The report stated that with a rapid g onset (1g per second for more than 3 to 5 seconds) sudden loss of consciousness may occur without the prior visual warning symptoms. High performance aerobatic aircraft such as the Pitts S2 are quite capable of achieving rapid g applications, and rapid g onset is frequently experienced by competitive aerobatic pilots.

Centrifuge research has shown that there is a period of functional incapacitation following G-LOC lasting an average of 15 seconds. Full recovery may take 30 seconds or longer from the initiation of the manoeuvre that induces G-LOC. An aircraft descending vertically at an average speed of 120 kts will take approximately 15 seconds to reach the ground from 3,000 feet.

Gz tolerance is reduced by various factors such as fatigue, hypotension (low blood pressure), hypoglycaemia (low blood sugar), dehydration, and illness. The pilot was, by all accounts, in good health at the time of the accident, but it is not known what factors may have affected his g tolerance.

Conclusion

Findings

1. The pilot was correctly licenced and endorsed to carry out the flight.
2. The pilot probably experienced G-LOC on the flight previous to the accident flight and was subsequently advised on a means of avoiding a recurrence.
3. The accident flight was commenced some hours later for the purpose of the pilot practising the same manoeuvres as on the previous flight.
4. The aircraft was seen to go out of control at the same part of the sequence as on the previous flight.
5. The pilot did not answer repeated radio transmissions after the aircraft had gone out of control.
6. The pilot had a medical condition which may have reduced his tolerance to g.
7. There were no mechanical defects found which may have contributed to the development of the accident.

Significant factors

1. For reasons which could not be positively determined, but probably related to G-LOC, the pilot lost control of the aircraft.
2. The pilot did not regain control of the aircraft before it struck the ground.