

AVIATION OCCURRENCE REPORT

STALL DURING INITIAL CLIMB

**PIPER PA-12 SUPER CRUISER C-GEDA
HIGH PRAIRIE AIRPORT, ALBERTA
25 MAY 1994**

REPORT NUMBER A94W0078



The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Occurrence Report

Stall During Initial Climb

Piper PA-12 Super Cruiser C-GEDA
High Prairie Airport, Alberta
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Synopsis

The owner of the PA-12 was conducting a demonstration flight with a prospective purchaser who was occupying the rear seat of the aircraft. Immediately after taking off from the High Prairie Airport, the aircraft climbed steeply to approximately 150 feet above the runway, pitched nose down, and plunged vertically to the ground. A post-crash fire ensued and both occupants sustained fatal injuries.

The Board determined that the aircraft stalled on departure for reasons unknown. The low altitude at which the stall occurred precluded a successful recovery.

Ce rapport est également disponible en français.

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1.0 *Factual Information*

1.1 *History of the Flight*

The owner/pilot was selling his Piper PA-12 and had arranged for a prospective purchaser to examine the aircraft at the High Prairie Airport, Alberta. The purchaser and an aircraft maintenance engineer (AME)¹ had been flown to High Prairie in a private aircraft on the day of the accident. The owner/pilot had flown the PA-12 to High Prairie from his nearby farm and landed after the private aircraft. The three men walked around the aircraft and spoke briefly while on the airport ramp. The owner/pilot then agreed, at the purchaser's request, to take the purchaser on a short demonstration flight. The aircraft was observed to perform a normal take-off roll on runway 07. Immediately after lift-off the aircraft climbed steeply to approximately 150 feet above ground (agl), pitched nose down, entered a one-quarter turn spin, and plunged vertically to the ground. An intense post-crash fire ensued and both occupants sustained fatal injuries.

This accident occurred at 1022 mountain daylight time (MDT)² during the hours of daylight at latitude 55°23'N, and longitude 116°28'W.

1 See Glossary for all abbreviations and acronyms.

2 All times are MDT (Coordinated Universal Time minus six hours) unless otherwise noted.

1.2 *Injuries to Persons*

	Crew	Passengers	Others	Total
Fatal	1	1	-	2
Serious	-	-	-	-
Minor/None	-	-	-	-
Total	1	1	-	2

1.3 *Damage to Aircraft*

The aircraft was destroyed by the severe impact forces and the intense post-crash fire.

1.4 *Other Damage*

No other significant property damage occurred.

1.5 *Personnel Information*

1.5.1 *General*

	Pilot-in-Command	Passenger
Age	54	51
Pilot Licence	Private	Private
Medical Expiry Date	01 January 95	01 April 95
Total Flying Time	2,000 hr	765 hr
Total on Type	210 hr	N/A
Total Last 90 Days	6.6 hr	N/A
Total on Type Last 90 Days	6.6 hr	N/A
Hours on Duty Prior to Occurrence	1 hr	N/A
Hours off Duty Prior to Work Period	N/A	N/A

1.5.2 *The Owner/Pilot*

The owner/pilot was characterized as a successful, self-employed farmer, and businessman. He had obtained his private pilot aeroplane licence in 1978. The licence was valid for single and multi-engine land aeroplanes, with a night rating and a current licence validation certificate. He had owned the PA-12 since 1987 and had owned several other aircraft previously. He had flown approximately 10 hours in the 12 months prior

to the accident. There was no evidence that he had received recurrent dual training in recent years. His hobby interests had recently changed and he had decided to sell the PA-12 due to low utilization. He represented the aircraft as a good performer and had been discussing the performance advantages of the "Borer" propeller installation with the purchaser immediately prior to boarding the aircraft for the demonstration flight.

1.5.3 The Purchaser

The purchaser held a private pilot licence, with a current licence validation certificate, valid for single and multi-engine land and sea aeroplanes, with a night rating. He had placed a pre-purchase deposit on the aircraft before travelling to High Prairie.

1.6 Aircraft Information

1.6.1 General

Manufacturer	Piper Aircraft Corporation
Type	PA-12
Year of Manufacture	1947
Serial Number	12-2740
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	2,134 hours
Engine Type (number of)	Avco Lycoming O-320-A2B (1)
Propeller/Rotor Type (number of)	McCaughey 1A175-GM8241 (1)
Maximum Allowable Take-off Weight	1,750 pounds
Recommended Fuel Type(s)	80/87 minimum grade aviation
Fuel Type Used	Unleaded automotive

1.6.2 The Aircraft

The aircraft was fitted with dual controls. The aircraft was not fitted with a stall warning device, nor was one required by existing regulations.

A review of the log-books indicated that the aircraft had last been inspected and certified on 20 April 1994. The pilot had since flown approximately three and one-half hours.

The aircraft was at or near the maximum gross weight of 1,750 pounds and the centre of gravity (C of G) was within the prescribed limits.

Several modifications had been incorporated on the aircraft. A 150-horsepower Lycoming O-320-A2B engine had been installed in accordance with Supplemental Type Certificate (STC) SA83AL, and a McCaughey 1A175-GM8241 ("Borer") propeller had been installed in accordance with STC SA279AL. Piper PA-12s were originally fitted with Lycoming O-235 series engines producing 100 to 115 horsepower. The aircraft had been fitted with larger tires in accordance with Transport Canada Approval Number W89-114. The aircraft had also been fitted with Piper PA-18 elevators. STCs exist for the tailplane modification; however, there was no STC approval identified in the aircraft records. The aircraft was not equipped with flaps.

The aircraft was fitted with the original single-pulley cable-operated pitch trim system. Slippage of the trim cable is a common service problem in this model of aircraft; however, the pilot had not reported this to have occurred in the past and no log entries pertaining to trim slippage were found.

During the investigation, it was determined that the owner/pilot was using unleaded automotive fuel in the aircraft. There was no evidence that the required log entries had been made or that an STC or Supplemental Type Approval (STA) permitting the use of automobile fuel had ever been incorporated on the aircraft, as required by Transport Canada document TP 10737, *Use of Automotive Gasoline (Mogas) in Aviation*.

1.7 Meteorological Information

Good visual meteorological conditions existed at the time of the occurrence. A witness estimated the winds to be easterly at 5 to 10 knots. A supplementary aviation weather observation, taken approximately 10 minutes after the accident, recorded the sky condition as 7,000 feet scattered, visibility greater than 15 miles, and winds 140 degrees true at 22 knots. The temperature was 25 degrees Celsius.

1.8 *Communications*

A UNICOM air-to-ground communications facility, operated by the Airport Manager, existed at the airport. The designated Aerodrome Traffic Frequency (ATF) was 122.8 megahertz (MHz). There was no reported communication with the aircraft on the ATF frequency.

³ Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

1.9 *Aerodrome Information*

The High Prairie Airport is a registered airport. Runway 07/25 is 3,272 feet long and 75 feet wide. The runway surface is asphalt. The aerodrome elevation is 1,974 feet above sea level (asl)³.

1.10 *Wreckage and Impact Information*

The aircraft came to rest on the flat graded area about 1,640 feet from the threshold of runway 07 and approximately 47 feet to the north of the runway edge. The wreckage was spread within a very limited area. Damage and ground scars indicated that the aircraft had struck the ground in a near-vertical, nose-down attitude.

The forward legs of the pilot's seat were found detached from the supporting structure. The seat assembly was forwarded to the TSB Engineering Branch Laboratory to determine if this had contributed to a loss of control. An examination determined that the pilot's seat was structurally intact prior to impact, and there was no evidence of the seat being in a weakened condition prior to the accident. The crash loads far exceeded the design ultimate loads of the seat.

The PA-12 utilizes a variable incidence horizontal stabilizer for longitudinal trim. The leading edge position is adjusted through the stabilizer yoke which has a range of travel of approximately 17 threads on the stabilizer adjustment screw. Post-crash examination of the horizontal stabilizer determined that the stabilizer yoke was positioned approximately one thread from the bottom of the stabilizer adjustment screw. This positions the leading edge of the horizontal stabilizer near the bottom limit of travel. The effect is a nose-up trim condition.

Due to the almost complete destruction of the aircraft by the crash and fire, it could not be conclusively determined whether any pre-impact failure or system malfunction contributed to this accident; however, none was identified.

1.11 *Medical Information*

There was no evidence that physiological or psychological factors affected the pilot's performance. Post-mortem examination of both occupants did not identify any evidence of incapacitation. The owner/pilot was occupying the front seat of the aircraft. Severe thermal injury to the hands and feet of both occupants made it impossible to determine which individual was operating the aircraft controls at the time of the crash.

1.12 Fire

Both wing-mounted fuel tanks ruptured at impact. The intense, fuel-fed, post-crash fire consumed all of the airframe fabric covering and the cabin interior.

The High Prairie Municipal Fire Department responded to the accident after being notified by the airport manager.

1.13 Survival Aspects

The accident was not survivable as impact forces exceeded the limits of human tolerance. The aircraft was fitted with seat-belts which utilized obsolete metal-to-fabric type buckles. The aircraft was not fitted with shoulder harnesses. The emergency locator transmitter (ELT) was destroyed by the post-crash fire.

1.14 Tests and Research

After the accident, an experienced PA-12 pilot and owner conducted trial flights in a similar aircraft, in different configurations, to ascertain the control forces with a nose-up trim condition. The trials revealed that a pilot should be able to physically over-ride the nose-up trim condition, as in the occurrence aircraft, to maintain the desired attitude and climb airspeed.

1.15 Additional Information

1.15.1 Landing Trim Setting

The pilot was observed to perform a normal three-point landing on arrival at the High Prairie Airport. Weight and balance calculations determined that with only the pilot on board, the C of G would have been near the

forward limit. The three-point landing would have been most easily accomplished with the trim near the full nose-up setting.

1.15.2 Piper PA-12 Operating Limitations

The *Piper PA-12 Handbook of Operating Limitations and Information* states that the aircraft's stall speed is 49 mph true indicated airspeed (TIAS). The best rate-of-climb speed is identified as 75 mph TIAS in the normal category. It was not determined what airspeed the pilot normally used for climb. A witness reported that the engine appeared to be at full power when the nose of the aircraft pitched down and that the power appeared to have been reduced and reapplied an instant before the aircraft struck the ground.

1.15.3 Stabilizer Yoke Orientation

During the investigation, it was noted that the horizontal stabilizer yoke assembly was installed with the flat side up. In the *PA-12 Parts List*, the stabilizer yoke is illustrated as being installed with the flat side down. Consultation with the manufacturer determined that the stabilizer yoke is oriented upside-down in the *Parts List* illustration, and that the stabilizer yoke was correctly installed in the aircraft.

1.15.4 Minimum Liability Insurance

Although not considered a factor in the accident, the aircraft was being operated without the minimum liability insurance required by *Air Regulations*, Series VI, No. 10.

2.0 *Analysis*

2.1 *Introduction*

A credible witness account and the nature of the impact damage indicate that the aircraft stalled at low altitude during the initial climb. No pre-impact mechanical discrepancies which could have resulted in a loss of control were identified during the field examination of the wreckage, and the weather conditions were suitable for the flight. The analysis will therefore focus on the operational factors which are considered to have contributed to a departure stall and subsequent loss of control.

2.2 *Aircraft Control*

It could not be determined why the aircraft entered the steep, rapid climb and subsequent stall after take-off; however, several factors were considered. The owner/pilot had minimal recent flying experience, having flown only 10 hours in the previous 12 months. This would likely have resulted in a deterioration of his flying skills. The extent would be difficult to measure; however, it is probable that his ability to recognize the onset of a stall and to recover with a minimum loss of altitude would have been adversely affected. The detrimental effects of minimal recent flight experience may be offset by dual flight training; however, there was no evidence that the pilot had received dual training in recent years. This, coupled with the lack of a stall warning device on the aircraft, may have delayed his recognition of the stall.

Knowing that the purchaser was very interested in the aircraft may have encouraged the owner/pilot to over-demonstrate the climb performance, and effect a steep, initial climb at low airspeed.

The position of the adjustable stabilizer yoke indicates that the stabilizer trim was set to a landing position at the time of the accident. Although independent flight testing determined that the pilot should have been able to override the trim forces easily, the aircraft would have exhibited a nose-up tendency at take-off power. Trim cable slippage may have occurred after lift-off and distracted the pilot as he attempted to retrim the aircraft; however, there was no evidence to confirm this possibility.

Departure stalls must be recognized instantly and recovery initiated without delay, as the available altitude for recovery is very limited. The low altitude at which the aircraft stalled precluded an effective recovery.

3.0 *Conclusions*

The aircraft stalled on departure for reasons unknown. The low altitude at which the stall occurred precluded a successful recovery.

3.1 *Findings*

1. The aircraft stalled during the initial climb, at low altitude, which precluded a successful recovery.
2. The stabilizer trim was set near the full nose-up position.
3. There was no evidence found of any pre-occurrence airframe failure or system malfunction.
4. The aircraft was not fitted with a stall warning device, nor was one required by existing regulation.
5. There was no record that the PA-18 elevator installation had been accomplished in accordance with an applicable STC.
6. The aircraft was operated with unleaded automotive fuel; however, there was no evidence that the requirements of Transport Canada document TP 10737, *Use of Automotive Gasoline (Mogas) in Aviation* had been complied with.
7. The stabilizer yoke is oriented upside down in the *PA-12 Parts List* illustration.
8. The aircraft was fitted with seat-belts which utilized obsolete metal-to-fabric type buckles.

3.2 *Causes*

4.0 *Safety Action*

4.1 *Action Taken*

4.1.1 *Parts List Illustration*

The Parts List illustration for the PA-12, and also those for the Piper J-3 and PA-11 aircraft, incorrectly depicts the orientation of the horizontal stabilizer yoke assembly. An Aviation Safety Information Letter apprised Transport Canada of this anomaly.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Gerald E. Bennett, Zita Brunet, the Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 17 February 1995.

Appendix A - List of Supporting Reports

The following TSB Engineering Branch Laboratory report was completed:

LP 79/94 - Seat Structure Analysis.

This report is available upon request from the Transportation Safety Board of Canada.

Appendix B - Glossary

agl	above ground level
AME	aircraft maintenance engineer
asl	above sea level
ATF	aerodrome traffic frequency
C of G	centre of gravity
ELT	emergency locator transmitter
hr	hour(s)
lb	pound(s)
MHz	megahertz
mph	miles per hour
STA	Supplemental Type Approval
STC	Supplemental Type Certificate
TIAS	true indicated airspeed
TSB	Transportation Safety Board of Canada
UNICOM	a private advisory station located at an uncontrolled aerodrome