Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

AVIATION OCCURRENCE REPORT

LOSS OF CONTROL DURING SINGLE-ENGINE OPERATION

WAGLISLA AIR LTD.
GRUMMAN G21A GOOSE C-FUMG
PRINCE RUPERT, BRITISH COLUMBIA 4 mi S
04 DECEMBER 1993

REPORT NUMBER A93P0249

Canada

MANDATE OF THE TSB

The Canadian Transportation Accident Investigation and Safety Board Act provides the legal framework governing the TSB's activities. Basically, the TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board must not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings.

INDEPENDENCE

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Synopsis

The pilot and the four passengers departed in the amphibious Grumman Goose aircraft from the Seal Cove floatplane base at Prince Rupert, British Columbia, for a 41 nautical mile (nm) flight to Kincolith. After take-off from the water, the aircraft crashed into trees on a hillside 3 nm south of Seal Cove. The pilot and one passenger were fatally injured, and the other three passengers received serious injuries.

The Board determined that the pilot encountered engine problems during the take-off and climb, and, after the left propeller was feathered, lost directional control of the aircraft. The aircraft rolled to the left, descended rapidly, and crashed to the ground.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

The Grumman G21A Goose (C-FUMG) departed from the Seal Cove floatplane base at Prince Rupert, British Columbia, on a charter flight to Kincolith. The aircraft carried one pilot, four passengers, and approximately 600 pounds of baggage and freight. This was the first flight of the day for the occurrence aircraft.

Prior to take-off, the pilot contacted the Prince Rupert Flight Service Station (FSS)[1] by radio and obtained local traffic and weather information. The aircraft took off from the water at approximately 1141 Pacific standard time (PST)[2], and proceeded southbound, following the normal departure path.

During the take-off and climb, one or both of the aircraft's engines did not sound as if they were operating normally. Shortly after take-off, the pilot radioed the company dispatcher at Seal Cove and reported that he was experiencing engine problems, and that he was returning to Seal Cove and would require assistance at the ramp. After the left propeller stopped rotating, the aircraft rolled to the left and descended steeply to the ground.

The aircraft crashed into trees on a hillside, at an altitude of approximately 150 feet, approximately three nautical miles (nm)[3] south of Seal Cove. The pilot and one passenger were fatally injured; the three other passengers received serious injuries.

A search started approximately 45 minutes after the aircraft departed. The aircraft was discovered by a Coast Guard helicopter, which was able to rescue the survivors.

The accident occurred during daylight hours at about 1145 PST, at latitude 54°17'N and longitude 134°14'W.

1 See Glossary for all abbreviations and acronyms.

2 All times are PST (Coordinated Universal Time [UTC] minus eight hours) unless otherwise stated.

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

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	1	1	-	2
Serious	-	3	-	3
Minor/ None	-	-	-	-
Total	1	4	-	5

1.3 Damage to Aircraft

The aircraft was substantially damaged by the impact.

1.4 Other Damage

There was no other damage as a result of this occurrence.

1.5 Personnel Information

	Pilot-in-command
Age	42
Pilot Licence	CPL
Medical Expiry Date	01 Feb 94
Total Flying Hours	12,400
Hours on Type	1,600
Hours Last 90 Days	125
Hours on Type Last 90 Days	30
Hours on Duty Prior to Occurrence	4
Hours off Duty Prior to Work Period	15

1.5.1 General

The pilot had received his initial training on the Grumman G21A aircraft from a previous employer in 1988. His most recent recurrent training and check ride had been conducted under contract with another Grumman G21A aircraft operator, in June 1993. His most recent pilot proficiency check (PPC) on the aircraft type had been conducted by Transport Canada on 06 June 1993, and all items had been assessed as satisfactory.

The pilot was certified, trained and qualified for the flight in accordance with existing regulations. The flight was conducted in accordance with the existing directives in the company operations manual.

The pilot was a training pilot for the (accident) company, and had trained other pilots in these emergency procedures. At the time of the accident, he was writing an operations and training manual for Waglisla Airlines on this aircraft type.

The pilot's original training on this aircraft type was conducted with another company (Trans Provincial Airlines), where he had been asked to perform many landings with a loss of power on one engine as a routine part of his training.

1.5.2 Pilot Training Standards

The manuals used by the company for training on the G21A did not address the handling characteristics of the aircraft. The preferred actions in the event of an engine failure during the initial climb, when airspeed is less than minimum control speed, are to reduce power on the operating engine and land straight ahead. Those actions were discussed during the pilot's G21A recurrent training.

1.6 Aircraft Information

1.6.1 General

Manufacturer	Grumman Aircraft Engineering Corporation
Type and Model	G21A Goose
Year of Manufacture	1944
Serial Number	B145
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	22,683 hr
Engine Type (number of)	Pratt & Whitney R985-AN14B (2)
Propeller/ Rotor Type (number of)	Hartzell HCB3R30-2E (2)
Maximum Allowable Take-off Weight	9,200 lb
Recommended Fuel Type(s)	91 Octane
Fuel Type Used	100 LL

1.6.2 Servicing and Maintenance

The aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures. The maintenance log-books contained no evidence of uncorrected deficiencies relevant to the circumstances of the occurrence.

A 100-hour inspection was carried out on the aircraft on 08 October 1993. The right engine was changed at that time. During the period between the inspection and the occurrence, the aircraft was flown a total of 29.5 hours. The only unscheduled maintenance during this period was to change the starter on the left engine. The left engine (Pratt & Whitney R985-AN14B) had accumulated 668.4 hours of operation since overhaul. The right engine (Pratt & Whitney R985-AN14B) had accumulated 29.5 hours of operation since overhaul.

The aircraft had flown approximately 2.4 hours on the day before the accident flight. No abnormalities with the engine or other aircraft system had been reported.

1.6.3 Weight and Balance

The maximum allowable gross weight of the aircraft is 9,200 pounds with the tip floats in the retracted position, and 8,800 pounds with the tip floats in the extended position. In order to be able to use the higher maximum allowable gross weight, the tip floats are retracted prior to the aircraft becoming airborne, as soon as aileron control is gained during the take-off roll.

A company load control sheet, which listed estimated passenger and cargo weights, had been completed prior to departure. The take-off weight of approximately 8,700 pounds and the centre of gravity were within the prescribed limits.

1.6.4 Aircraft Fuel System

The fuel system consists of two 110-US-gallon-capacity (91.6 imperial gallons) fuel tanks, one in each wing, connected through the fuel selector to a common manifold on the cockpit bulkhead, which then supplies each engine through a bulkhead-mounted sump tank. As a result, both engines would be affected by fuel contamination.

Fuel drain fittings, used to check the fuel system for water and other contaminants, are located on the sump tanks, and are operated with valves accessible to the pilot inside the cockpit. The fuel drain ports are on the outside of the aircraft. When the fuel is drained, a second person is required if a sample is to be collected for inspection. It is normal practice for the company pilots to drain a small sample of fuel onto the ground and inspect that sample visually, from the cockpit, for the presence of water.

Before take-off, approximately 30 imperial gallons of fuel had been added to each fuel tank, bringing the total to 50 imperial gallons per side. It could not be determined if the fuel was checked for contamination prior to the flight.

1.6.5 Aircraft Ignition System

This particular type of aircraft has a history of accumulating moisture in the ignition harness and magnetos, which could cause rough running or misfiring.

1.7 Meteorological Information

1.7.1 General

According to the weather aftercast from the Environment Canada Atmospheric Environment Service, surface winds in the Prince Rupert area were less than 5 knots and variable in direction at the time of the accident. Upper level winds were likely out of the west or southwest at 10 to 15 knots between 1,000 and 4,000 feet. The air mass was fairly moist and convectively unstable. Cloud cover in the area was generally scattered to broken with layers of stratocumulus based at 3,000 feet to 6,000 feet and topped at 8,000 feet. A few embedded towering cumulus based at 2,000 feet and topped at 12,000 feet were generating isolated rainshowers. The visibility was generally 15 miles except locally one-half mile in snowshowers above 500 feet. The freezing level was near 1,000 feet. Moderate clear icing would occur in the towering cumulus cloud and light mixed icing would occur in the stratocumulus layers. The winds were too light to generate significant mechanical turbulence but occasional moderate turbulence would occur in the vicinity of the towering cumulus cloud.

The visibility in the area near the time of the occurrence was reported as suitable for visual flight rules (VFR) flight, but mixed rain and snow showers, and some fog, were present.

1.7.2 Weather Conditions Conducive to Carburettor Ice Formation

Carburettor icing is a phenomenon associated with ice build-up in the carburettor throat, which may lead to restriction of inlet air flow and associated loss of power. Carburettor icing is possible at a wide range of temperatures and relative humidities (normally measured in terms of temperature/ dew-point spread), but is most likely at temperatures near freezing.

At the time of the occurrence, the temperature and dew point at Prince Rupert were three degrees and one degree Celsius, respectively. According to the Transport Canada *Aeronautical Information Publication* (AIP, AIR 2-3), these conditions could induce serious carburettor icing at any engine power setting.

1.8 Aerodrome Information

The Seal Cove seaplane base is located adjacent to the city of Prince Rupert. The company base for floatplane/ amphibian operations is located next to dock facilities and a ramp, which permits loading of the Goose on land. The aircraft can then taxi down the ramp into the water for take-off.

For take-offs in a southerly direction, approximately 8,500 feet of water surface is available for the take-off run. Departing aircraft then fly over the Butze Rapids, which widen into Morse Basin. Aircraft proceeding northbound toward Kincolith can reverse course in the wider area of Morse Basin.

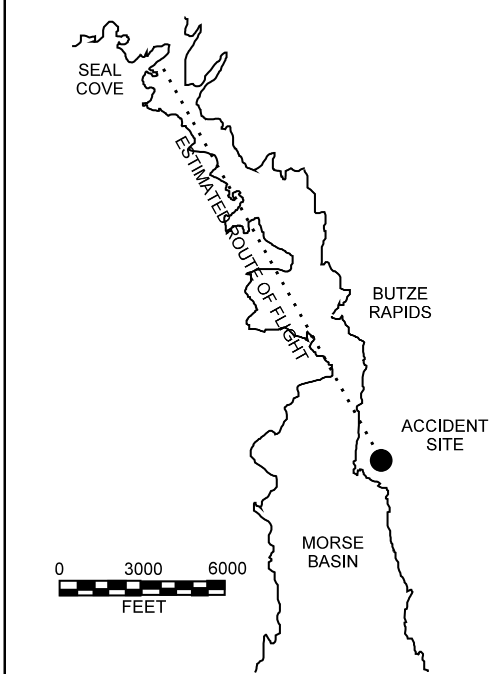

Figure 1 - Estimated flight path

Suitable areas for water landing in the event of an emergency are available from Seal Cove to the accident site, with the exception of Butze Rapids, which is narrow and has a strong, variable tidal current.

1.9 Flight Recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, nor was either required by regulation.

1.10 Wreckage and Impact Information

1.10.1 General

Impact damage to the trees along the aircraft flight path suggests that the aircraft was rolling to the left, with the left wing low, when it struck approximately 100-foot-high trees near their tops, shearing off the left wing outboard of the left engine. The fuselage, with the right wing and the tail attached, struck more trees before striking the ground in a near vertical position. The aircraft fuselage continued to move forward, so that the fuselage pivoted on the nose, and the aircraft came to rest in a nose-down and left-wing-low attitude. The front of the aircraft was crushed to a point near the bulkhead separating the passenger cabin from the cockpit.

There was a strong smell of fuel at the site as damage to the aircraft allowed fuel to escape from the tanks. The left propeller was found with the blades in the feathered position. The right propeller incurred minor damage to two blades and substantial damage to the other blade, which had separated from the hub. The left wing separated near the centre section joint and also outboard of the engine due to tree strikes on the leading edge. The left engine was detached from the wing, and the right engine was partially detached. The front of the fuselage was crushed back to a point near the bulkhead separating the passenger cabin from the cockpit. The two fuel sight gauges were broken. The rear fuselage was bent, and the left elevator was torn off. All the seats that were occupied by the passengers had broken from their mountings.

The tip floats were in the retracted position at impact. All control surfaces were accounted for and all damage to the aircraft was attributable to the severe impact forces.

1.10.2 Engine and Propeller Examination

The engines and the propellers were removed from the site and transported to the TSB Regional wreckage examination facility. No pre-impact failure or malfunction of either engine was found during disassembly and examination.

The left propeller was less badly damaged than the right. One blade of the right propeller had separated during the accident sequence, and another had shifted in its clamp. The right propeller blades exhibited chordwise scratching and torsional damage which are consistent with some power being produced at impact.

Both propeller governors met operating specifications. However, the right propeller governor only reached 2,108 rpm, rather than the specified 2,340 rpm, because the input arm was damaged by the impact and could not be operated through the full travel range during testing.

Traces of water were discovered in both the left carburettor float chamber and the right carburettor accelerator pump. The origin of the water could not be determined, and the amount of water was not sufficient to cause engine problems.

The engine-driven fuel pumps were tested, and met the requirements for flow, pressure, and internal leakage. The rotor and the inside of the left pump were corroded, probably as a result of water being pooled in the pump since after the accident.

The magnetos from each engine were bench-tested. The right engine magnetos were both in excellent condition and performed well, producing a good spark at both high and low rpm. Although some corrosion was found near the points, both left engine magnetos also performed well, producing a good spark at high and low rpm.

Both of the engine carburettor heat controls were found in the cold (off) position. However, as the connecting cables had been found severed, the position of these controls at impact could not be verified.

Examination by the TSB Engineering Branch Laboratory determined that the left mixture control rod end had failed in overload, likely due to impact forces.

1.10.3 Aircraft Fuel System Examination

The fuselage wreckage was further examined at the TSB regional office, after return from the site, approximately one month after the occurrence.

The left and right sump tanks were drained. The left sump contained about a half-pint of water and a small amount of fuel. The right sump contained about one pint of water. The fuel tank drain plugs were removed and about two gallons of fuel and a little water were collected from the left tank. The right tank held a small amount of fuel and a trace of water.

The bottom access panel of each fuel tank was taken off to allow examination of the interior of the tanks. Inside, the tanks were clean and appeared to have been recently refurbished. The finger filters in both tanks were in good condition. The right tank walls and top were beaded with water; the left tank walls and top were also moist but not so heavily beaded as the right.

The right fuel cap was intact and appeared to make a good seal on the fuel tank filler neck. The left cap had been damaged by impact and the top cover (convex dome) was missing; however, the plug part of the cap with the seal remained in the filler neck. This seal was not in as good a condition as the right one, but was adequate.

1.10.4 Aircraft Fuel Sample Analysis

The origin of the water found in the fuel tanks during aircraft examination could not be determined. The first laboratory examination of the fuel/ water sample concluded that the water was possibly tap-water. A second examination was conducted for verification, and concluded that the sample was probably sea-water.

1.10.5 Fuel Source Sample Analysis

Fuel samples taken from the refuelling source at Seal Cove were tested and found to be free of contamination. There were no reports of contaminated fuel from other users of the refuelling facility.

1.10.6 Instrument Examination

Eight of the aircraft flight and engine instruments, although damaged severely during impact, were examined by the TSB Engineering Branch Laboratory in Ottawa (refer to Engineering Branch Report LP 02/ 94).

Engine instrument analysis provided evidence that, at impact, the left engine was turning at low rpm, consistent with the propeller being feathered, and that the right engine was running at approximately 1,300 rpm. The airspeed indicator did not provide reliable evidence as to airspeed at impact. The vertical airspeed indicator showed 2,000 feet per minute down, the full-scale descent rate indication.

1.11 Medical Information

There was no evidence that incapacitation or physiological factors affected the pilot's performance.

1.12 Fire

There was no evidence of fire either before or after the occurrence.

1.13 Survival Aspects

1.13.1 Flight Following

The company dispatcher is on duty at the Seal Cove base throughout normal flying hours. After he received the radio call from the pilot, the dispatcher sent the dock attendant to the seaplane ramp to meet the returning aircraft and provide assistance if required. When the aircraft did not return immediately, the dispatcher assumed that the pilot no longer required assistance and was proceeding to Kincolith as planned.

1.13.2 Emergency Locator Transmitter

The emergency locator transmitter (ELT) did not activate on impact. The ELT, a Pointer C4000, was installed in the rear baggage compartment and was found with the switch in the OFF position. The cable was attached to the cockpit-mounted remote switch receptacle. The position of the remote switch at impact could not be determined because of the badly damaged cockpit. However, as the switch on the unit was in the OFF position, the ELT would not activate, regardless of the position of the remote switch.

1.13.3 Occupant Protection and Survival

The aircraft was not equipped with shoulder harnesses, and Transport Canada regulations do not require this category of aircraft to be fitted with shoulder harnesses. The use of shoulder harnesses might have reduced the seriousness of the rear occupants' injuries.

The reduction in internal volume that resulted from the severe damage to the forward section of the fuselage during impact with the ground significantly reduced the front occupants' chances for survival.

1.14 Aircraft Handling Characteristics

1.14.1 Aircraft Certification Requirements

The TSB Engineering Branch researched information about the aircraft certification requirements, in particular, the single-engine performance and handling qualities. No flight test data were found and the only information related to the aircraft's flight characteristics was in the aircraft flight manual. However, the information in the aircraft flight manual was limited in its description of the aircraft's single-engine handling, controllability, and performance.

The basis of certification of the G21A aircraft was the United States Federal Aviation Administration Aeronautics Bulletin No. 7-A (1934). This document specified that if a single engine failed after minimum take-off speed had been attained, the aircraft should still be able to climb from sea level to 1,000 feet above sea level (asl). Further, at 1,000 feet asl, the aircraft should be able to maintain a straight line in level flight.

The Transport Canada engineering files for this aircraft type were examined at the National Archives, back to the file origins in 1937. No references were found dealing with the single-engine handling characteristics of the aircraft.

1.14.2 Aircraft Single-Engine Performance and Handling

The aircraft was designed in accordance with 1937 certification standards, and those standards were not as stringent as those for contemporary aircraft.

Experienced pilots familiar with the aircraft report that it has limited performance and poor handling qualities during single-engine operations. When the aircraft is loaded to a weight near that of the occurrence aircraft, single-engine performance does not permit sustained level flight.

In particular, the single-engine minimum control speed (V_{mca}) on the G21A is approximately 10 to 15 knots less than the normal two-engine climb speed. When one engine becomes inoperative, aircraft drag will cause the airspeed to decrease rapidly. If the speed decreases to a value less than V_{mca}, there will be a resulting loss of directional control.

Because of the aircraft's reportedly poor handling qualities during an engine failure, immediate action is required (i.e. lowering the nose of the aircraft) to maintain the airspeed above V_{mca}. As such, a significant loss of altitude may result.

Should the airspeed decrease below V_{mca}, the preferred action in the event of an engine failure during the initial climb is to reduce power on the operating engine and land straight ahead.

Individual G21A aircraft may also exhibit somewhat different flight performance and handling characteristics, likely due to the different and numerous rigging adjustments over the life of the aircraft.

2.0 Analysis

2.1 Introduction

The pilot was certified and qualified for the flight. There was no evidence that physiological factors affected his ability to conduct the flight safely.

No evidence was found of any pre-impact failure of the airframe or malfunction of either engine; all the damage to the aircraft was attributable to the impact. Due to the serious damage to the forward section of the aircraft caused by the impact, the accident was not survivable for the pilot and the front-seat passenger.

The analysis will examine the possible explanations for the engine problems encountered during the take-off and climb, the single-engine handling and performance characteristics of the G21A aircraft type, and the loss of directional control.

2.2 Engine Problems During the Take-off and Climb

2.2.1 Engine Examination

The cause of the engine problems encountered during the take-off and climb could not be determined. There was no evidence identified during the disassembly and examination of both engines which would preclude their normal operation or would prompt the pilot to feather the left propeller.

The corrosion damage to the rotor, to the inside of the left engine-driven fuel pump, and near the points of the left magneto may have resulted from exposure to environmental conditions after the accident and would not have affected engine performance and operation prior to the occurrence.

As evidenced by the tachometer indication of 1,300 rpm and the damage to the right propeller, the right engine was producing some power at impact. However, it could not be determined whether this lower-than-normal power output was due to the engine problems encountered during the take-off and climb, or was a result of the pilot reducing the power prior to impact.

2.2.2 Fuel Contamination

There was sufficient fuel for the flight. There is no evidence indicating that fuel from the refuelling source was contaminated. It was not determined whether the aircraft fuel system had been drained and checked for contamination prior to the flight. Nonetheless, the method used by the company to check the fuel system for contamination was inadequate. It would likely not be possible to successfully check for relatively small amounts of water or other contamination by observing from the cockpit the puddle of fuel drained onto the ground.

The amount of water found in the fuel tanks during aircraft examination may have been sufficient to cause an engine to run poorly or to malfunction. As the two fuel sample analyses produced conflicting results, the origin of that water could not be determined. Consequently, it could not be determined whether the fuel in the aircraft tanks was contaminated prior to the accident. However, it is possible that the water was present as a result of condensation that formed in the partially filled tanks after the occurrence.

The traces of water found in the engines following the accident are not consistent with severe fuel tank contamination; moreover, it is unlikely that those traces of water would have been sufficient to cause an engine to run poorly or malfunction.

2.2.3 Carburettor Icing

There was no evidence found of carburettor icing. However, the temperature and dew point at the time of the occurrence were conducive to serious carburettor icing at all engine rpm values.

A reduction in engine rpm and power, as would have resulted from carburettor icing, may be consistent with the engine problems encountered during the take-off and climb, and the right engine running at 1,300 rpm at impact. However, it could not be determined whether carburettor icing affected either engine's performance or operation.

2.3 *Aircraft Certification and Single-Engine Handling*

The aircraft was designed in accordance with 1937 certification standards. However, the aircraft does not meet current certification criteria established by modern regulations.

The G21A reportedly has limited performance and poor flight characteristics during single-engine operations. Because of the 10 to 15 knots difference between the single-engine minimum control speed (V_{mca}) and the normal two-engine climb speed, immediate action is required in order to prevent the airspeed from decaying below V_{mca} should one engine become inoperative. If the airspeed decays below V_{mca}, the pilot should reduce power on the operating engine to maintain directional control and land straight ahead. Although the manuals used by the company for training on the G21A did not address the aircraft's handling characteristics, these preferred actions for single-engine handling were discussed and practised during the pilot's training.

2.4 *Loss of Directional Control*

As the aircraft was not equipped with a flight data recorder and cockpit voice recorder, the actual position and altitude of the aircraft during the departure and the exact sequence of events could not be determined. However, the fact that the aircraft rolled to the left and descended rapidly to the ground indicates that directional control was lost soon after the left propeller was feathered.

The loss of directional control to the left suggests, first, that the airspeed decayed below V_{mca} while power was maintained on the right engine and, second, that the preferred actions to maintain control of the aircraft in the event that the airspeed decays below V_{mca} after an engine failure during the initial climb were either not immediately taken or not effective. The pilot may have reduced power on the right engine prior to impact.

It is also possible that the pilot experienced a complete engine failure while attempting to turn back with a rough running engine, and that the result of that engine failure caused the aircraft to rapidly lose airspeed to an extent that control was lost.

2.5 *Emergency Locator Transmitter*

The ELT did not activate on impact because the switch on the unit was in the off position. The remote switch installed in the cockpit would not have been able to turn the unit on, nor would the automatic activation mechanism on the ELT have functioned following ground impact.

3.0 Conclusions

3.1 Findings

1. The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

2. The pilot was certified, trained, and qualified for the flight in accordance with existing regulations.

3. Based on medical examination and medical records, there is no evidence to indicate that the pilot's performance was degraded by physiological factors.

4. There was no evidence found of any airframe failure prior to or during the flight.

5. The weight and centre of gravity were within the prescribed limits.

6. One or both engines did not sound as if they were operating normally during the take-off and climb.

7. The left propeller was feathered and directional control of the aircraft was subsequently lost.

8. The cause of the engine problems encountered during the take-off and climb could not be determined.

9. There was no mechanical problem that precluded normal engine operation.

10. It could not be determined whether carburettor icing affected either engine's performance or operation.

11. There is no evidence indicating that fuel from the refuelling source was contaminated.

12. It was not determined whether the aircraft fuel system had been drained and checked for contamination prior to the flight.

13. Procedures in use by the company pilots for daily fuel tank draining were not adequate to detect water or other contamination in the fuel system.

14. As the analysis of the two samples produced conflicting results, the origin of the water found in the aircraft fuel tanks could not be determined.

15. It could not be determined whether the fuel in the aircraft tanks was contaminated prior to the accident.

16. Because of the 10 to 15 knots difference between the single-engine minimum control speed and the normal climb speed, immediate action is required in order to prevent the airspeed from decaying below V_{mca} should one engine become inoperative.

17. The occurrence aircraft type did not meet design criteria established by modern regulations.

18. The manuals used by the company for training on the G21A did not address the handling characteristics of the aircraft.

19. The emergency locator transmitter did not activate on impact because the switch on the unit was in the off position.

3.2 Causes

The pilot encountered engine problems during the take-off and climb, and, after the left propeller was feathered, lost directional control of the aircraft. The aircraft rolled to the left, descended rapidly, and crashed to the ground.

4.0 Safety Action

The Board has no aviation safety recommendations to issue at this time.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Hugh MacNeil, authorized the release of this report on 16 May 1995.

Appendix A - List of Supporting Reports

The following TSB Engineering Branch laboratory reports were completed:

LP 001/94 - Control Factors Analysis Grumman G21A Goose;
LP 170/93 - Rod End Failure Analysis; and
LP 002/94 - Instrument Analysis (Report on Findings).

These reports are available upon request from the Transportation Safety Board of Canada.

Appendix B - Glossary

asl	above sea level
CPL	commercial pilot licence
ELT	emergency locator transmitter
FSS	Flight Service Station
lb	pound(s)
LL	low lead
nm	nautical miles
PPC	pilot proficiency check
PST	Pacific standard time
rpm	revolutions per minute
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
V_{mca}	single-engine minimum control speed
°	degrees

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PETROLIA, ONTARIO
Pipeline and Rail
4495 Petrolia Street
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Pipeline, Rail and Air
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Pipeline, Rail and Air
17803 - 106 A Avenue
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CALGARY, ALBERTA
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Sam Livingstone Building
510 - 12th Avenue SW
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