AVIATION OCCURRENCE REPORT

BIRD STRIKE

WISCONSIN AVIATION INCORPORATED
CESSNA 441 CONQUEST N441CA
FORT FRANCES AIRPORT, ONTARIO
18 JUNE 1994

REPORT NUMBER A94C0105

Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

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Synopsis

During take-off, the Cessna Conquest lost power in the left engine. The pilot recognized the power loss after rotation speed had been achieved, and elected to continue the take-off. The pilot could not maintain control of the aircraft in flight and the aircraft crashed on the airfield. The passengers sustained minor injuries and the aircraft was substantially damaged.

The Board determined that the pilot lost control of the aircraft during take-off when the left engine lost power as a result of bird ingestion. Contributing to the loss of aircraft control were a take-off weight in excess of the maximum allowable, and a centre of gravity aft of the centre of gravity limit.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

The pilot of the Cessna 441 Conquest was conducting an international charter flight from General Mitchell International Airport in Milwaukee, Wisconsin, to Gods Lake Narrows, Manitoba. The pilot landed the aircraft at Fort Frances, Ontario, to clear customs and refuel, and then continued his visual flight rules (VFR[1]) flight to Gods Lake Narrows. During the take-off at Fort Frances, the aircraft experienced a power loss in the left engine. The pilot elected to continue the take-off but was unable to control the aircraft after it became airborne. The aircraft veered to the left and crashed on the airfield.

The accident occurred at 0425 central daylight time (CDT), at night, on the Fort Frances Municipal Airport, at latitude 48°39'N, longitude 93°29'W, at an elevation of 1,125 feet above sea level (asl).

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	1	6	-	7
Total	1	6	-	7

1 See Glossary for all abbreviations and acronyms.

1.3 Damage to Aircraft

The aircraft incurred substantial damage. The nose cone and nose baggage compartment were torn open and the nose landing gear was torn from the aircraft. The left engine was torn from the engine mounts and came to rest to the right and slightly behind the aircraft. The flaps and aileron were torn from the right wing and the left main landing gear retraction mechanism was driven through the upper surface of the left wing. The aircraft fuel tanks were ruptured; however, there was no fire.

1.4 Other Damage

The aircraft fuel spill necessitated removal of the soil in the area where the aircraft came to rest.

1.5 Personnel Information

	Captain
Age	27
Pilot Licence	ATPL (U.S.A.)
Medical Expiry Date	17 Jan 95
Total Flying Time	4,800 hr
Total on Type	40 hr
Total Last 90 Days	40 hr
Total on Type Last 90 Days	40 hr
Hours on Duty Prior to Occurrence	6 hr
Hours off Duty Prior to Work Period	48 hr

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

The pilot had received in-house Cessna 441 ground school and flight training as well as Flight Safety Foundation ground school and five hours of simulator training.

1.6 Aircraft Information

Manufacturer	Cessna Aircraft Company
Type	Cessna Conquest
Year of Manufacture	1978
Serial Number	441-0046
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	2,447 hours
Engine Type (number of)	Airesearch TPE 331-8 (2)
Propeller/Rotor Type (number of)	Hartzell HC-B3TN-5E (2)
Maximum Allowable Take-off Weight	9,850 pounds
Recommended Fuel Type(s)	Jet-A, A-1, Jet-B, JP4, JP5
Fuel Type Used	Jet-B

A review of available records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures.

The *Pilot's Operating Handbook and Approved Airplane Flight Manual* (POH) recommends that the aircraft be accelerated to 98 knots before rotation for take-off to provide additional safety in case of engine failure. The POH states that:

> the decrease in performance upon engine failure, is not quite as severe as in other airplanes due to the airplane's high power to weight ratio; additionally the negative torque sensing system (NTS) will automatically increase the propeller blade angle on the inoperative engine, thereby decreasing the drag normally associated with a windmilling propeller.

The maximum allowable take-off weight of the aircraft is specified in the POH as 9,850 pounds (lb). The flight centre of gravity limits prescribed at maximum take-off weight are:

i) Aft Limit: 178.07 inches aft of reference datum; and

ii) Forward Limit: 173.35 inches aft of reference datum.

The company Flight Manifest/Weight and Balance Form for the occurrence flight indicated a take-off gross weight of 9,850 lb and a flight centre of gravity 177.5 inches aft of reference datum. Under the conditions of the flight, this take-off gross weight required a ground run of approximately 1,950 feet. After the occurrence the baggage was weighed and each passenger was asked to confirm his personal weight. Using these revised weights, the take-off gross weight and flight centre of gravity were re-calculated. The re-calculation gave a take-off gross weight of 10,471 lb and a centre of gravity 180.0 inches aft of reference datum. The POH does not provide take-off distance charts for gross take-off weights in excess of 9,850 lb.

1.7 Meteorological Information

The closest weather reporting station for the Fort Frances Airport is International Falls, Minnesota, five miles to the south of Fort Frances. At the time of the occurrence, the weather at International Falls was reported as clear with visibility restricted to 1/2 mile in patchy ground fog. The wind was reported as 240 degrees at four knots with a temperature of 11 degrees Celsius.

Similar environmental conditions were reported by witnesses located on the Fort Frances Airport.

1.8 Take-off Sequence

The pilot began the take-off at the threshold of runway 30 and accelerated to the required rotation speed of 98 knots. As the pilot rotated the aircraft, he observed a bird flying towards the left side of the aircraft. As he rotated, he experienced a yawing motion to the left and noted a reduction in the torque indication for the left engine as he prepared to raise the landing gear. The aircraft was now heading for the side of the runway and, because the speed had reached 98 knots, the pilot elected to continue the take-off. He could not maintain control of the aircraft, and the aircraft crashed off the left side of the runway with the landing gear down. When the aircraft came to rest, the pilot assisted in the evacuation of passengers and then ran to the passenger terminal for assistance.

1.9 Aerodrome Information

The Fort Frances Municipal Airport is an uncontrolled aerodrome and is operated by the Municipality of Fort Frances. The main runway, 30/12, is 4,500 feet long by 100 feet wide. The crossing runway, 03/21, is 2,600 feet long by 75 feet wide and crosses the main runway at right angles, 3,100 feet from the threshold of runway 30. The *Canada Flight Supplement* (CFS) aerodrome sketch for Fort Frances indicates that the surrounding airspace is an aerodrome traffic zone (ATZ) for a radius of five nautical miles to 4,100 feet above ground level (agl). The visibility minimum for VFR flying in an ATZ is three miles.

The pilot stated that he did not notice the ATZ designation on the aerodrome sketch and believed the visibility minimum for Fort Frances to be the uncontrolled airspace visibility minimum of one mile.

1.10 Flight Recorders

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

1.11 Wreckage and Impact Information

Bird feathers and a bird wing were found to the left of the runway centre line approximately 1,600 feet from the threshold of runway 30. The remains were sufficient to identify the bird type as gull.

Two tire marks on runway 30 began approximately 1,800 feet from the threshold, curved to the left and ended about 400 feet later, approximately 2,200 feet from the threshold. The distance between the tire marks corresponded to the span between the main wheels of the occurrence aircraft. The left-hand tire mark was much lighter than the right-hand one, and both marks became lighter the further they continued from the threshold of runway 30. Both marks stopped about 20 feet before the edge of the runway was reached.

A gouge mark in the grass began about 2,900 feet from the threshold of runway 30, about 146 feet to the left of the edge of the runway, and arced to the left in line with the tire marks and the aircraft wreckage. The left wing-tip light was located at the start of the gouge mark. The gouge mark, the two tire marks on the runway and the main wreckage trail were aligned, following the same curved path.

Impact marks and aircraft debris were located on the embankment of a drainage ditch which runs parallel to the crossing runway about 35 feet east of the runway edge. Tire skid marks and debris continued across the runway in line with the main wreckage. There were impact marks and debris in a second drainage ditch to the west of the crossing runway. The marks and debris indicated that the aircraft was travelling tail first as it crossed the runway. The aircraft turned again after the impact with the second ditch and came to rest on a westerly heading, about 100 feet west of the crossing runway and about 300 feet south of runway 30. The right engine was still attached to the aircraft. The left engine had separated from the aircraft and was located to the right of the wreckage.

The intake of the left engine displayed extensive evidence of bird ingestion with blood splatter and debris. The engine smelled of burned feathers. The propeller blades of the left propeller were almost straight. The blades of the right propeller were bent.

1.12 Medical Information

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

1.13 Fire

There was no fire either before or after the occurrence. Emergency response services (ERS) were available.

1.14 Survival Aspects

After the pilot assisted the passengers in the evacuation, he ran from the crash site to the passenger terminal to get assistance. The crash had not been observed because of the darkness and the patchy ground fog moving over the airfield. The airport manager implemented emergency response procedures as soon as the pilot reached the terminal building. Emergency response was immediate, and the passengers were transported to hospital for examination in International Falls, Minnesota.

The baggage was not restrained by cargo nets or ropes but did not move forward.

The emergency locator transmitter (ELT) did not activate. Post-occurrence examination revealed that the ELT was

serviceable. The ELT carried in the aircraft was of a type which activates with deceleration along the aircraft's longitudinal axis while the aircraft is in forward motion. The ELT was correctly mounted and aligned in the aft fuselage of the aircraft and selected to the ARM position.

1.15 Bird Hazard

Transport Canada recommends that garbage dumps not be located within five miles of an airport and describes garbage dumps within this distance as "extremely hazardous."[2] The garbage dump for the city of Fort Frances is located approximately one mile to the south of the Fort Frances airport. Hundreds of gulls were observed at the dump site on the day after the occurrence. There is no warning of the potential bird hazard at Fort Frances in the CFS.

There are no statistical data available concerning bird strikes at Fort Frances in the Transport Canada data banks. Transport Canada reports that a large portion of their information is obtained from Transport Canada operated airports and commercial airlines.[3] There were no records of any occurrences involving birds at Fort Frances in the computerized information system of the Transportation Safety Board of Canada.

The *Aeronautical Information Publication* (AIP) provides information with respect to bird strike reporting. The bird strike reporting form described by the AIP specifies the Canadian Aviation Safety Board as the responsible agency for receipt of the report and the National Museum of Natural Sciences as the agency for the receipt of bird remains. The Canadian Aviation Safety Board has been replaced with the Transportation Safety Board of Canada and the correct agency to assess bird remains is the Canadian Museum of Nature.

2 Transport Canada Airport Wildlife Management Bulletin, TP8240, No.14, Winter 1994, *Land Use Adjacent To Airports*.

3 Transport Canada, TP10573E, *Bird Strikes to Canadian Aircraft*, 1991 Summary Report.

2.0 Analysis

2.1 Power Loss

The evidence on the runway and in the left engine indicates that a gull or gulls were ingested by the left engine. The lack of bending of the left propeller blades on impact, and the pilots' observation of low left engine torque and left yaw indicate that the bird ingestion resulted in a power loss in the left engine.

2.2 Pilot Actions

Based on the bird remains on the runway, the bird ingestion occurred after 1,600 feet of ground run. The skid marks on the runway are the first indications of left yaw developing at about 1,800 feet of ground run. The main wheel tire marks on the runway were probably caused by the pilot inadvertently applying toe pressure to the brakes on the rudder pedals as he pushed the right rudder pedal forward to correct for the left yaw that was developing. The negative torque sensor on the left engine reduced the amount of left yaw experienced initially and, thus, the pilot was not immediately alerted to the developing power loss as he accelerated to rotation speed. Because of the aircraft's high power-to-weight ratio, the rotation speed of 98 knots was attained. After rotation, the pilot realized the yaw was pronounced, and confirmed the power loss in the left engine by reference to the torque gauge. At this point, he also observed a gull pass in close proximity to the left side of the aircraft. The pilot had the option of aborting the take-off or continuing. He had achieved rotation speed and elected to continue the take-off. The aircraft lifted off after about 2,200 feet of ground run, as indicated by the end of the skid marks on the runway.

2.3 Flight Manual Limits

When the pilot continued the take-off, he could not control the aircraft. His inability to control the aircraft was likely contributed to by a take-off weight over the maximum allowable and a centre of gravity that was outside of the aft limits specified in the approved Flight Manual.

2.4 Bird Hazards

The absence of any reports of bird strikes at Fort Frances is likely the result of the organization of the reporting system rather than an absence of any bird strikes, because the reporting system is supported primarily by Transport Canada operated airports and commercial carriers. Based on Transport Canada guidelines, the proximity of the garbage dump to the airport would classify Fort Frances as an extremely hazardous airport for bird strikes. The observation of significant numbers of gulls at the dump on the day after the occurrence would tend to substantiate the conclusion that an extremely hazardous bird site exists within one mile of the Fort Frances airport.

2.5 Deceleration Force

It is likely that most of the deceleration of the aircraft occurred as the aircraft was travelling backwards over the crossing runway and into the second drainage ditch. Thus, the main deceleration force acted to retain the baggage in the aft cabin where it was stored. The direction of the force was also opposite to that required to activate the ELT and consequently the ELT did not transmit a signal.

3.0 Conclusions

3.1 Findings

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

2. Aircraft documentation indicated that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

3. The take-off weight was over the maximum allowable and the centre of gravity was outside of the aft limits specified in the approved Flight Manual.

4. The left engine ingested a bird or birds and lost power.

5. The pilot lost control of the aircraft after take-off.

6. The ELT did not activate because most of the deceleration force acted opposite to the force direction required for activation.

7. The cargo in the passenger compartment was not properly restrained.

8. The pilot did not notice the ATZ designation on the aerodrome sketch for Fort Frances.

9. AIP Canada guidance on the reporting of bird strike hazards is inaccurate.

10. An extremely hazardous bird site exists within one mile of the Fort Frances airport.

11. There is no warning of the bird hazard in the CFS entry for Fort Frances airport.

3.2 Causes

The pilot lost control of the aircraft during take-off when the left engine lost power as a result of bird ingestion. Contributing to the loss of aircraft control were a take-off weight in excess of the maximum allowable, and a centre of gravity aft of the centre of gravity limit.

4.0 Safety Action

4.1 Action Taken

Following the accident, the TSB issued Aviation Safety Advisory Letter No. 940206, requesting that Transport Canada (TC) amend the *Canada Flight Supplement* entry for Fort Frances Airport to include a warning of the bird hazard at Fort Frances. An Aviation Safety Information Letter, No. 940207, was also issued to inform TC of inaccuracies in the bird hazard reporting procedures outlined in the *Aeronautical Information Publication*.

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 26 January 1995.

Appendix A - Glossary

agl	above ground level
AIP	Aeronautical Information Publication
asl	above sea level
ATPL	Airline Transport Pilot Licence
ATZ	aerodrome traffic zone
CFS	Canada Flight Supplement
CDT	central daylight time
ELT	emergency locator transmitter
ERS	emergency response services
hr	hour(s)
lb	pound(s)
NTS	negative torque sensing system
POH	Pilot's Operating Handbook and Approved Airplane Flight Manual
TC	Transport Canada
TSB	Transportation Safety Board of Canada
VFR	visual flight rules
°	degree(s)
'	minutes(s)