Transportation Safety Board of Canada

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AVIATION INVESTIGATION REPORT
A10Q0162

BIRD STRIKE ON TAKE-OFF AND COLLISION WITH TERRAIN

MAX AVIATION INC.
BEECHCRAFT B100, C-FISK
MONTMAGNY AIRPORT, QUEBEC
22 SEPTEMBER 2010

Canada

Aviation Investigation Report

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Synopsis

A Max Aviation Inc. Beechcraft B100 (registration C-FSIK, serial number BE-39) operating as flight MAX100 was on an instrument flight rules flight from Montmagny to Montreal/St-Hubert, Quebec, with 2 pilots and 4 passengers on board. At approximately 1700 Eastern Daylight Time, the aircraft moved into position on the threshold of 3010-foot-long runway 26 and initiated the take-off. On the rotation, at approximately 100 knots, the flight crew saw numerous birds in the last quarter of the runway. While getting airborne, the aircraft struck the birds and the left engine lost power, causing the aircraft to yaw and roll to the left. The aircraft lost altitude and touched the runway to the left of the centre line and less than 100 feet from the runway end. The take-off was aborted and the aircraft overran the runway, coming to rest in a field 885 feet from the runway end. All occupants evacuated the aircraft via the main door. There were no injuries. The aircraft was substantially damaged.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

The flight crew reported for work on the day of the accident around 1100 [1] to fly 4 flight segments, the last of which was Montmagny to Montreal/St-Hubert, Quebec. Both pilots flew on the day before the accident and had the rest time required by existing regulations. There was no evidence that fatigue was a factor in this occurrence.

No aviation routine weather reports (METARs) are issued for Montmagny Airport. However, information obtained indicates that the weather at the time of the occurrence was as follows: scattered cloud, visibility over 10 statute miles and wind speed under 10 knots. There was no evidence that weather was a factor in this occurrence.

At approximately 1650, the aircraft taxied for a take-off on Montmagny Airport Runway 26. The aircraft used the sole taxiway, located at the mid-point of the runway, then proceeded to the threshold of Runway 26. While taxiing, the flight crew saw birds near the airport. However, no congregations of birds were seen on or alongside the runway, nor had any been seen on the landing 20 minutes before. A Cessna 206 took off from the same runway about 5 minutes before, and no congregations of birds were seen or reported. When the aircraft was lined up on the runway, the take-off roll was commenced. At that time, no congregations of birds were seen on or alongside the runway.

The take-off was made toward the west on runway 26, which is oriented 257 degrees Magnetic. At the location and time of the occurrence, the sun was 16 degrees above the horizon on a bearing of 270 degrees Magnetic. The crew therefore had the sun to their front and slightly to the right. To reduce the glare from the sun, both pilots were wearing their sunglasses.

The pilot-in-command was the pilot flying (PF) and the co-pilot was acting as the pilot not flying (PNF). The tasks of the PF on the take-off run consisted mainly of controlling the aircraft, and the tasks of the PNF were:

1. setting take-off power;
2. advising the PF when take-off power is set;
3. checking and advising the PF that the engine instrument readings are in the green zone;
4. checking and advising the PF that both speed indicators are activated;
5. calling out the minimum control speed (Vmc)[2] or 85 knots;
6. calling out the rotation speed (Vr) or the speed as briefed.

At the rotation speed, numerous birds were seen (about 100 to 200) straight ahead, roughly in the last quarter of the runway. The birds took flight and suddenly created a whiteout. The bird

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[1] All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

[2] Vmc is the minimum control speed with the critical engine inoperative. The critical engine on the B100 is the left engine. When it is inoperative, greater force must be applied on the rudder in order to maintain heading.

strike occurred and the left engine lost power when the aircraft lifted off. The bird strike and power loss occurred at an estimated altitude of less than 50 feet above ground level. About 20 dead gulls were found on the runway approximately 1000 feet before the runway end.

After the power loss, the aircraft yawed and rolled to the left. The PNF helped the PF to level the wings. However, the aircraft lost altitude and the left wheel touched the runway about 100 feet before the runway end and 28 feet from the line of take-off. The PF aborted the take-off and the aircraft continued its travel in a field, crossed a ditch about 500 feet from the runway end, and came to rest in a second ditch 385 feet farther on.

Before evacuating the aircraft the crew completed the procedure for engine failure on take-off with insufficient runway remaining to stop, by doing the following:

1. selecting the START/STOP control STOP;
2. selecting the master switch OFF;
3. selecting the firewall fuel cock CLOSED.

The normal evacuation procedure was then carried out. There were no injuries.

The aircraft was equipped with an emergency locator transmitter (ELT). The ELT was not damaged, and it activated on impact. Since no one was injured and immediate rescue was not required, the switch was selected OFF to avoid needlessly alerting Search and Rescue (SAR).

Company Information

Max Aviation Inc. holds a valid operating certificate. At the time of the occurrence, the company was operating a fleet of 6 Beechcraft B100 aircraft. The aircraft were operated under the *Canadian Aviation Regulations* (CARs), Part VII, Subparts 2 or 3, as circumstances dictated. In this occurrence, the aircraft was operated under Subpart 3. [3]

Aircraft Information

Aircraft records indicate that the aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures. The engines (Garrett TPE331-6-252B) and engine components were torn down for examination. Undeniable evidence of bird ingestion was found in the left engine, and engine operation had clearly been affected. The right engine showed no signs of bird ingestion. The damage to the right engine was caused by ground impact in the runway overrun.

[3] Air taxi operation.

Cockpit Voice Recorder

C-FSIK was configured with 8 passenger seats. According to the type certificate, the aircraft can be operated with only one pilot on board. On air taxi service, two pilots are required when the aircraft is flown in instrument meteorological conditions (IMC) with passengers on board. However, under the terms of its air operator certificate, [4] Max Aviation Inc. was authorized to operate the aircraft with only one pilot because it had the equipment required under CARs. [5] Although the company met the requirements for operating the aircraft with one pilot, two pilots were on board. The reasons given for this relate to customer service, passenger comfort, confidence of the travelling public in the operator, and safety in general.

The requirements of CARs section 605.33(2) pertaining to CVRs indicate as follows:

subject to section 605.34, no person shall conduct a take-off in a multi-engined turbine-powered aircraft that is configured for six or more passenger seats and for which two pilots are required by the aircraft type certificate or by the subpart under which the aircraft is operated, unless the aircraft is equipped with a cockpit voice recorder.

According to the Canadian Civil Aircraft Register, there are 1635 multi-engine turbine-powered aircraft to which the CVR requirements apply. It could not be determined how many of these are not equipped with a CVR.

On 24 February 2004, Transport Canada (TC) sent enforcement letters to 3 air taxi operators in Quebec, including Max Aviation Inc., regarding the installation of CVRs in their B100 aircraft. Transport Canada gave them 30 days to submit a timetable for corrective action and installation of CVRs.

These operators disputed in Federal Court TC's interpretation of the requirement to install a CVR when the aircraft is operated under Part VII, Subpart 3 with a 2-pilot flight crew. On 14 October 2004, the Federal Court ruled against the operators. That decision was appealed, and on 17 October 2005 the Federal Court of Appeal found in favour of the operators, ruling that they are not required to use a crew of 2 pilots and they can voluntarily operate their B100s with 2 pilots instead of one without having to install CVRs in their aircraft.

Since TC feels this decision runs counter to the original intent of CARs, the Canadian Aviation Regulatory Advisory Council (CARAC) in November 2009 developed a notice of proposed amendment (NPA) to CARs. The aim of the NPA is to make it clear that a CVR is required at all times when this type of aircraft (configured with 6 or more passenger seats) is operated with 2

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4 Operations Specification 011.

5 CARs section 703.66 requires:
(a) an auto-pilot that is capable of operating the aircraft controls to maintain flight and manoeuvre the aircraft about the lateral and longitudinal axes;
(b) a headset with a boom microphone or equivalent and a transmit button on the control column; and
(c) a chart holder that is placed in an easily readable position and a means of illumination for the chart holder.

pilots. CARs have not yet been amended. The NPA must go through a legal drafting process before it can be published in the *Canada Gazette*, Part I for public consultation. Individuals will then have 30 days to submit comments, after which the amendment can be adopted and published in the *Canada Gazette*, Part II.

C-FSIK was not equipped with a flight data recorder (FDR), nor was it required by regulation. The aircraft was not equipped with a CVR. In the previous months, 2 other accidents[6] occurred involving aircraft of similar type which were not equipped with a CVR and were operating as an air taxi service. These 2 accidents resulted in 9 fatalities, and the investigations are still in progress. The lack of a CVR adds to the complexity of these investigations and deprives the investigators of information that is essential to an understanding of how and why these 2 accidents happened. As a result, safety deficiencies that represent a risk to persons, property and the environment may not be revealed.

In the present occurrence, due to the lack of a CVR, it was impossible to clearly establish the activities of and communications between the two pilots as the occurrence unfolded. Consequently, it was not possible to identify potential safety deficiencies and to disseminate them within the industry, and thereby to prevent similar occurrences in the future.

In 2010, TSB published a watchlist describing the safety problems that represent the greatest risks to Canadians and which were investigated by TSB. Among the safety issues identified, TSB noted that data critical to understanding how and why transportation accidents happen are frequently lost, damaged, or not required to be collected.

Flight Crew Information

The flight crew were certified and qualified for the flight in accordance with existing regulations. The pilot-in-command had about 4500 hours of total flying time, with about 2500 hours on the Beechcraft B100 as pilot-in-command. He had his last pilot proficiency check (PPC) on the B100 on 20 March 2009, and it was valid until 1 April 2011.

The co-pilot had about 7800 flying hours, including 675 hours on the Beechcraft B100 as co-pilot. He had his last PPC on the B100 on 9 May 2009, and it was valid until 1 June 2011.

Flight Crew Training

The flight crew were trained in the company training program. Since the company meets the requirements for operating the aircraft with only one pilot, the pilot-in-command was trained to fly alone. The operations specification concerning the operation of an aircraft in IMC with passengers on board and no co-pilot requires that normal and emergency procedures be completed without assistance.

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[6] A09Q0203 and A10Q0098.

The Max Aviation training program includes technical ground training and in-flight training, both initial and annual. The training covers numerous subjects for pilots and air operations support personnel, including normal, abnormal and emergency procedures and aircraft take-off performance.

The initial in-flight training program includes 5 one-hour sessions on the aircraft. Several flying drills [7] are conducted, including:

- calculating take-off data;
- simulation of aborted take-off;
- simulation of critical engine failure on take-off.

To reduce the risk of accidents or incidents during in-flight pilot training, Max Aviation adopted the following training methods:

- in aborted take-off simulations, the drill is initiated at an indicated speed not exceeding 50% of take-off speed; [8]
- in simulations of engine failure on take-off, the drill is conducted at a suitable safe altitude. [9]

Max Aviation uses a level 5 flight training device (FTD) [10] for its pilot training. However, the FTD is used only to train and evaluate flight crew on the use of GPS for the approach and related duties. This type of FTD does not have a system to indicate physical effort (movement), but it has a visualization system.

Take-off Profile

The company's standard operating procedures (SOPs) indicate that take-offs are generally done with no flaps, except where the runway length or soft surface dictate a short or soft take-off. The SOPs indicate that the performance diagrams published in the Aircraft Flight Manual (AFM) are used to determine which technique should be used. The diagrams were not used in this occurrence; the crew were familiar with Montmagny Airport, having taken off and landed there several times; the crew elected a no-flaps take-off. The other option available was a configuration with 30% flaps. The runway was dry at the time of take-off.

Given the outside temperature at the time of the occurrence, [11] aircraft weight, [12] surface winds [13] and pressure-altitude, [14] the take-off distances calculated from the performance

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7 Besides flying drills, the in-flight training covers crew member coordination and cooperation.

8 Take-off speed varies from 88 to 97 knots, depending on aircraft take-off weight. In this occurrence, a speed of 100 knots had been briefed.

9 Chapter 5 of the operations manual indicates that this altitude is 400 feet agl.

10 A level 5 FTD represents a cockpit specific to the aircraft concerned.

11 18.5ºC.

12 10 603 pounds. The maximum allowable take-off weight was 11 850 pounds. The centre of gravity was within the prescribed limits.

13 230º Magnetic at 7 knots.

14 Pressure-altitude of 177 feet.

diagrams were used to estimate the take-off profile on the day of the occurrence (see Appendix A).

Table 1 presents a comparison of the take-off roll length and the horizontal distance required to climb to an altitude of 50 feet for two flap positions: 0% and 30%.

Flap position	Take-off roll	Horizontal distance to climb to 50 ft	Climb gradient
0%	1200 feet	2200 feet	2.862 degrees
30%	1200 feet	2000 feet	3.576 degrees

Table 1. Flap position in the climb

Given the no-flaps climb gradient and the location where the birds were found, the bird strike would have occurred at a height of 40 feet. A take-off with 30% flaps would have placed the aircraft 10 feet higher at the same point.

As for the accelerate-stop distance for a no-flaps take-off, the performance diagrams show that 3300 feet of runway is required to bring the aircraft to a halt if one engine fails at the rotation speed (Vr). For a take-off with 30% flaps, the accelerate-stop distance is reduced to 3200 feet. Although these diagrams are provided in the AFM as a reference, 703 operators are not required to ensure that the usable accelerate-stop distance is equal to or greater than the accelerate-stop distance indicated in the performance diagrams. For 704 [15] and 705 [16] operators, take-off is not permitted if the required accelerate-stop distance exceeds the usable accelerate-stop distance.

According to the company SOPs, the take-off must be aborted if any failure occurs before Vr, and the take-off must be continued if failure occurs after Vr. In this occurrence, the loss of power resulting from the bird strike occurred just after Vr. The take-off was aborted following the loss of altitude and touchdown on the runway.

Airport Information

Montmagny Airport is located close to the St. Lawrence River astride the boundary between the municipalities of Montmagny and Cap-Saint-Ignace, Quebec. The airport has one asphalt-surfaced runway, 08/26, which is 3010 feet long and 75 feet wide.

The airport is operated by the Quebec Department of Transport, which holds the operating certificate issued by TC. The Quebec Department of Transport operates 24 certified airports in the province.

Montmagny Airport has no aircraft rescue and fire fighting services (ARFF). ARFF are not mandatory under CARs. However, in an emergency, the fire department in the municipality of

15 Commuter air service.
16 Commercial air service.

Montmagny, 6.7 km from the airport, acts as first responder. When this accident occurred, the fire department was not called because there appeared to be no risk of fire.

According to the airport operations manual, the large numbers of migratory birds in spring and fall do not represent a risk for airport operations. However, the presence of gulls in spring and summer require the use of bird control procedures.

As required by CARs, [17] the Quebec Department of Transport developed a wildlife management plan. The necessity of a plan for Montmagny Airport stems largely from the presence of geese and gulls and a waste disposal facility less than 15 km from the airport. The investigation also found that there is a goose and duck farm about 500 metres south of the runway. The farmer feeds the geese and ducks with bread, which attracts gulls looking for food.

Bird Strike

A search for bird strikes in the Civil Aviation Daily Occurrence Reporting System (CADORS) revealed that 3784 strikes were reported in Canada between 1 January 2005 and 31 December 2009. The 4 provinces reporting the highest numbers of bird strikes are Ontario with 1293, British Columbia with 993, Alberta with 446 and Quebec with 339. Four of these 3784 occurrences resulted in an accident, [18] with a total of 2 injured persons. Only one bird strike was reported at Montmagny Airport in the last 5 years, but it did not cause an accident or injuries.

Transport Canada published a brochure [19] to help pilots reduce the risk of bird strike and minimize the consequences if a strike occurs. The brochure advises that, up to 80 or 90 knots, birds have time to get out of the way, but the higher the speed, the greater the chance of a strike. Although there is no conclusive evidence that birds see and avoid aircraft lights, they will make the aircraft more visible. It is therefore suggested that landing lights be used during the take-off and landing, as most bird strikes occur during these phases of flight. In this occurrence, the landing lights were on.

If birds are seen ahead, the pilot should attempt to pass above them according to the brochure, as birds usually breakaway downward when threatened. Gulls are proficient gliders, but they cannot accelerate quickly to avoid an approaching aircraft. Some gulls may try to out-fly the aircraft instead of getting out of the way like other types of birds do.

Gulls are big enough to cause severe damage, so it is not surprising that they are considered the most dangerous species around airports in many countries, including Canada. If a bird strike occurs during the take-off run and there is enough runway remaining, TP 12422 suggests that the take-off be aborted. If the take-off must continue with engine trouble, the pilot should follow the applicable emergency procedures and come back and land if possible. If a bird strike occurs, pilots are urged to not be distracted by blood, feathers or odour.

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[17] CARs 302.305(1).

[18] Report numbers A05O0271, A06W0179, A08O0226 and A08P0083.

[19] TP 12422 – Bird Avoidance Brochure.

The risk of bird strike is highest during 3 periods of the year. The first is in March and April during spring migration; the second is in July and August when young birds are learning to fly; and the third is in September and October during the fall migration.

The take-off is a critical phase of flight; collision statistics [20] show that 31% of bird strikes happen during this phase. At airports where no air traffic services (ATS) are provided or where ATS are available for limited periods, vigilance is especially important. Before take-off, it may be necessary to taxi to the end of the runway to check for birds and mammals.

Before commencing the take-off, it is important to check the runway a second time because many birds use paved surfaces to keep warm and watch for predators. While rolling down the runway, pilots should mentally prepare for a collision with birds or mammals on take-off. And it is essential that crews be aware of the conditions that could hinder their ability to abort the take-off, as well as conditions that could hinder the continuation of the flight if aircraft performance is diminished.

Implications of Land-Use Activities Near Airports

The farmer near the airport feeds his geese and ducks with bread, which attracts gulls looking for food. However, this activity takes place outside airport property and beyond the airport operator's sphere of influence.

According to the *Wildlife Control Procedures Manual* (TP 11500), "the goal of airport zoning regulations is to prohibit hazardous land uses outside airport properties. These land uses include:

- garbage dumps;
- food-waste landfill sites;
- sewage outlets;
- fish plants;
- fish piers;
- abattoirs;
- pig farms; and
- bird-attractant agriculture."

According to a Transport Canada guideline contained in *Land Use in the Vicinity of Airports* (TP 1247), no bird-attractant land use should be allowed within an 8-kilometre radius of airport reference points. The operative word, however, is *guideline*: this minimum distance is not enforced under current Transport Canada regulations except at the 55 Canadian airports which have a waste disposal clause contained within their zoning regulations.

In this occurrence, even if a zoning regulation had been in place, it would not have applied to the goose and duck farm near the airport because the activity is not listed as one of the hazardous land uses that are prohibited in the vicinity of airports.

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[20] TP13549 – *Sharing the Skies*.

Gulls

According to the *Wildlife Control Procedures Manual*, gulls are a very hazardous species for aircraft. Since 1993, they have caused more collisions at Canadian airports than any other bird species. Their size, low flying speed, gregarious behaviour and rapid adaptation to most deterrents make them particularly dangerous. The flat, open spaces afforded by airports are ideal areas for them to rest and feed. The species most often seen at Montmagny Airport and vicinity are gulls, geese, crows and ravens.

The wildlife management plan for Montmagny Airport includes a bird hazard risk assessment component. The risk assessment reveals that gulls and geese pose a high risk and crows and ravens pose a moderate risk. For that reason, and also because they are present all day at Montmagny Airport during the summer, gulls are considered the management priority. The gull is a medium-size bird (1 to 1.8 kg) which forms groups of 40 to 50 individuals that congregate on the runway. It is noted that the *Canada Flight Supplement* (CFS) reports extensive bird activity at Montmagny Airport from May to October.

The observation and response log submitted to TC by the Quebec Department of Transport indicates that, between 1 and 17 September 2010, three groups of gulls varying from 15 to 50 birds were observed, and 28 of them were destroyed by shotgun fire. Two groups were observed on and near the runway at distances ranging from 1200 to 2000 feet from the runway 26 threshold, while the third group was seen in the last third of runway 26.

Several measures were put in place to mitigate the risk, including selective killing and the use of a propane-powered cannon near the runway edge (see Photo 1). The cannon was installed at Montmagny Airport in June 2010. Malfunctions were reported from 27 to 31 August 2010. Although the supplier was contacted for repair action and the cannon was put back in operation, it was not working on the day of the accident.

This propane cannon produces both visual and auditory stimulus to scare birds. The cannon produces thrust to propel a mechanism that causes a fringed rubber disk to slide up a pole mounted on a tripod. The mechanism drops back rapidly, but the disk descends more slowly, somewhat like a parachute. This decoy is designed to imitate a falcon hunting a bird. The cannon is reported effective within a 150-metre radius.

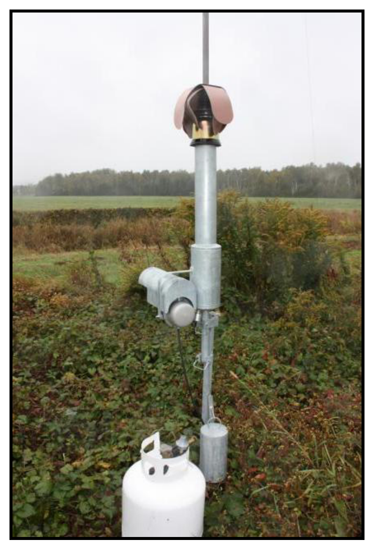

Photo 1. Propane-powered cannon

According to the publication entitled *Evaluation of the Efficacy of Products and Techniques for Airport Bird Control* (TP 13029), the explosions produced by a cannon may initially scare birds away. But without any concurrent measures to signal to birds that the noise of the cannon represents danger, birds soon become accustomed to the noise.

Moreover, birds quickly get used to propane cannons that produce explosions at regular intervals and are never moved. The cannons become totally ineffective within a relatively short period. Best results can be achieved if the explosions are timed at different intervals, the number of explosions per sequence is varied, and if the cannon is moved and pointed in different directions. One good technique is as follows: 2 or 3 explosions in quick succession, with different intervals between firing sequences, and rotating the cannon after every explosion. The cannon used at Montmagny is at a fixed location, and the intervals between explosions can be varied from 2 to 4 minutes.

TP 13029 indicates that cannons should not be relied upon as the sole or even the major component of a bird control program. Cannons are recommended for occasional use as part of an integrated airfield bird control program, in conjunction with other products and techniques. At Montmagny, killing and a flare gun are techniques used to supplement the propane cannon. However, on the day of the occurrence, none of these techniques was used because no congregations were seen or reported.

Analysis

Since the very beginning of aviation, bird strikes have posed a hazard to aircraft. Gulls, which are a medium-size bird, have caused more collisions at Canadian airports than any other species since 1993. Due to the proximity of the St. Lawrence River, Montmagny Airport (including the vicinity) experiences bird activity. The airport operator and the flight crew were aware of this fact. The CFS also reports extensive bird activity at the airport from May to October.

To reduce the risks associated with bird activity, a wildlife management program was in place. Although only one bird strike was reported at Montmagny Airport in the last 5 years, the bird hazard risk assessment by the Quebec Department of Transport found that gulls and geese pose a high risk at this airport. For that reason, bird control measures were in place, including selective killing and the use of a flare gun and a propane cannon. Since no bird congregations were seen prior to the take-off, selective killing and the flare gun were not used. The only bird control measure remaining was the propane cannon. However, the cannon was out of order on the day of the occurrence.

Although bird control measures are in place at the airport, they can be nullified by the goose and duck farming operation less than 500 metres from the runway. This activity takes place outside airport property and beyond the airport operator's sphere of influence. In this case, gulls will continue to use the airport as a rest stop before looking for food or after feeding.

The take-off took place in visual meteorological conditions (VMC) with all aircraft systems operating normally. There was no evidence found of any airframe failure or system malfunction during the flight, except the loss of power in the left engine caused by ingestion of gulls.

The flight crew were familiar with Montmagny Airport and were aware of the bird activity that occurs there throughout the year. However, when they initiated the take-off, there was no indication that there was a congregation of birds straight ahead. On the landing about 20 minutes earlier, and on the taxi to take-off, no bird congregations were seen on the runway. Further, a Cessna 206 had not seen or reported birds when it took off about 5 minutes before.

The investigation could not determine when the gulls landed on the runway. They may have arrived on the runway when the Cessna 206 took off. Since the Cessna's take-off roll was shorter than that of the B100, it was able to lift off well before the spot where the gulls were and overfly them at a height which did not scare them. Subsequently, when taxiing to take-off, the flight crew may not have seen the birds, either due to inattention or because they were occupied with other tasks, such as completing the check-list. It is also possible that the birds landed on the runway while the aircraft was taxiing back to the runway 26 threshold. During this time, the flight crew were facing away from the bird congregation.

Although the crew members were wearing sunglasses to counteract the glare from the sun just above the horizon to their front, the pilots did not see the birds until the aircraft was in the rotation. The tasks of the PNF on take-off require more attention inside the cockpit than outside, which may account for the fact that he did not see the birds until the aircraft was in the rotation. As for the PF, he may have directed his attention closer to the nose of the aircraft, rather than looking farther down the runway, to counteract the glare from the sun during the take-off run. That would explain why he also did not see the birds until the rotation. At that time, the aircraft was about 800 feet from the group of birds and it was travelling about 100 knots and accelerating. The flight crew had very little time to decide whether to abort or continue the take-off. As explained in a study by France’s Bureau d’Enquêtes et d’Analyses [investigation and analysis board]:

> Reaction time cannot be considered a constant. It depends on the pilot and the aircraft. It is comprised of recognition of the target [birds], analysis of the potential for a collision, a decision as to avoidance action, control input, and the response time of the aircraft. Several seconds are needed to complete this sequence. Moreover, the element of surprise may have delayed or impeded the pilot’s reactions. [21] [Translation]

Even if the take-off had been aborted at that point, the aircraft would have travelled about 300 feet past the runway end. The aircraft would have sustained less damage, since it would have come to rest before the first ditch.

The flight crew could not predict what the birds would do. The birds could have dispersed on both sides of the runway, stay where they were or continue flying at low altitude, with the result that the strike would not have occurred. However, the high speed of the aircraft increased the risk of bird strike. Further, gulls sometimes try to out-fly the aircraft instead of avoiding it. This unpredictable behaviour may have been a factor in the occurrence.

The take-off and the landing are critical phases of flight, and accident statistics indicate on the whole that most accidents occur during these 2 phases. As regards bird strikes, an aircraft is much more vulnerable on the take-off than on landing. Also, the power loss occurred in the left

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21 Bureau d’Enquêtes et d’Analyses pour la sécurité de l’aviation civile [civil aviation safety investigation and analysis board (France), report entitled *Abordages 1989-1999* [in French only], www.bea.aero/etudes/abordages/abordages.htm (address valid when this report was published).

engine – the critical engine – which is more problematic than a power loss in the right engine. The pilot had to exert more effort on the rudder to maintain heading. The engine power loss caused an unintended loss of altitude and the wheels touched down less than 100 feet from the runway end, providing insufficient distance to stop the aircraft on the runway. The loss of altitude may be the result of decreased lift due to roll or momentary easing off control column input, or a combination of the two. The element of surprise caused by the bird strike noise and the bird whiteout may have affected aircraft control.

Successfully aborting or continuing a take-off after engine failure requires specific skills and good crew coordination, since aircraft performance is limited under these conditions. Although the crew had taken the company training program and the PF had been trained to carry out emergency procedures without assistance, the pilots were not well prepared for an engine failure or power loss at low altitude. Training included the use of a flight training device, but it was used mainly for GPS training. The company does not use a flight simulator to train pilots for this type of failure, nor is this required by regulation. When they are conducted in flight, engine failure drills are practised at a minimum altitude of 400 feet agl to provide a margin of safety in case of control problems. As a result, flight crews cannot learn the specific skill that is required to control the aircraft when failure occurs close to the ground.

The purpose of the training simulator is to improve safety by avoiding putting crews in risk situations before they are prepared. From a training standpoint, the quality of knowledge transfer is generally linked to the realism of the devices used in the training experience: the more realistic the device, the more positive the knowledge transfer. Although the use of an aircraft for in-flight training is advantageous in terms of realism, some restrictions [22] are put in place to ensure that the training flight can be completed safely. When a highly realistic flight simulator is used, the training environment is safer and flight crews are better prepared in the event of an in-flight emergency, in particular, engine failure on take-off.

The take-off was executed with no flaps on a runway whose length was less than the accelerate-stop distance as determined from the performance diagrams. Performance calculations showed that even with 30% flaps, the aircraft would still have overrun the runway if the take-off had been aborted at Vr. Unlike operators subject to CARs Subparts 704 and 705, operators subject to Subpart 703 are not required to ensure that the usable runway length is equal to or greater than the accelerate-stop distance of the aircraft as calculated from the performance diagrams. Consequently, the occupants of aircraft operated under Subpart 703 are exposed to the risks associated with a runway overrun when a take-off is aborted.

Post-accident analysis of the material recorded by CVRs has on numerous occasions confirmed the value of the CVR in furthering commercial aviation safety over the course of aviation history. In this investigation, as in the investigations into 2 other similar aircraft, essential information is unavailable and will probably never be found. The problem concerning the regulatory requirement to install CVRs in aircraft operated under CARs Subpart 703 has existed since 2004. An NPA was developed in 2009, but no amendments have been made as yet. Given the existing regulatory provisions, other carriers using similar aircraft could elect to not install a CVR. In that case, it will be harder to ascertain material facts. Investigations can take more time, resulting in delays which compromise public safety.

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22 For example, a safe altitude of 400 feet agl when simulating engine failure.

Findings As To Causes and Contributing Factors

1. The bird strike occurred on take-off at an altitude of less than 50 feet. Gulls were ingested in the left engine, which then lost power.

2. After the loss of engine power, the flight crew had difficulty controlling the aircraft. The aircraft touched the ground, forcing the pilot flying to abort the take-off when the runway remaining was insufficient to stop the aircraft, resulting in the runway overrun.

Findings As To Risks

1. Although a cannon was in place, it was not working on the day of the accident, which increased the risk of a bird strike.

2. The presence of a goose and duck farm outside the airport perimeter but near a runway increases the risk of attracting gulls.

3. Operators subject to *Canadian Aviation Regulations* Subpart 703 are not prohibited from having an aircraft take off from a runway that is shorter than the accelerate-stop distance of that aircraft as determined from the performance diagrams. Consequently, travellers carried by these operators are exposed to the risks associated with a runway overrun when a take-off is aborted.

4. The absence of a CVR makes it harder to ascertain material facts. Consequently, investigations can take more time, resulting in delays which compromise public safety.

Safety Action Taken

Max Aviation Inc.

The company compiled a list of the airports where the usable runway length is 3500 feet or less. The object was to advise flight crews of the procedures for this type of operation and the precautions to take before landing or taking off.

In response to this occurrence, the company amended its standard operating procedures (SOPs) to make it mandatory to calculate the take-off distance and use a short take-off technique when any of the following factors are present:

- the usable take-off distance is less than 4000 feet;
- the temperature is over 30°C;
- the pressure-altitude is over 2000 feet.

Also, the check-list used by flight crews now includes a performance table indicating the accelerate-stop distances for different flap configurations used on take-off.

Farm Operator

Following the occurrence, the farm operator adopted new bird control practices and techniques to reduce the risk of attracting gulls:

- its birds will normally be fed inside a shed;
- when they are fed outside, their feeders will be hidden in the woods;
- a net was installed around the facilities with cables overhead;
- a plastic owl was mounted on the roof of the house.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 09 June 2011.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – Estimated take-off profile