Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A08W0173

AERODYNAMIC STALL – IMPACT WITH TERRAIN

WILDLIFE OBSERVATION SERVICES INC.
CESSNA 337 C-GGDW
BEAVERLODGE, ALBERTA, 15 nm W
17 AUGUST 2008

Canada

Aviation Investigation Report

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Summary

The Wildlife Observation Services Inc. Cessna 337 (registration C-GGDW, serial number 337-0153) was conducting an aerial fire patrol and wildlife survey with the pilot and a biologist on board. The aircraft was based out of Grande Prairie, Alberta. At 1437 mountain daylight time, the pilot lost control of the aircraft during a low-level turn approximately 15 nautical miles west of Beaverlodge, Alberta. The aircraft descended steeply through trees, skidded, and came to rest at the edge of a beaver pond. The aircraft was substantially damaged and the pilot was fatally injured. The biologist, who was seated in the front right seat, sustained serious injuries. The emergency locator transmitter did not activate; however, locating the aircraft and survivor was facilitated by the global positioning system tracking equipment installed in the aircraft and the monitoring software used by Alberta Sustainable Resource Development flight following personnel.

Ce rapport est également disponible en français.

Other Factual Information

The pilot arrived at the Grande Prairie airport at 1300 [1] to conduct a pre-flight inspection of the aircraft. The primary mission was to conduct a fire patrol. In addition, a Trumpeter Swan cygnet survey was to take place in certain areas, to be discussed with the Alberta Sustainable Resource Development (ASRD) wildlife biologist assigned to the flight, if circumstances permitted. They departed the Grande Prairie Airport at 1347.

Trumpeter Swan Survey

The survey is completed twice a year. The spring survey is done to count the breeding pairs returning to the region. In August, a second survey is done to count the number of cygnets produced by the adults. At this time of year the cygnets are not flying and are generally grey in colour. For protection, the cygnets cluster close to their parents or hide in the vegetation while feeding. These conditions require biologists to get quite close in order to make an accurate count. It is not unusual for the aircraft to be at tree top height for the August survey.

Company Information

Founded in 1998, Wildlife Observation Services Inc. had provided air support for news reporters, biologists, surveyors, set location managers, and forestry and conservation officers. The company had valid operations certificates issued under Subparts 702 and 703 of the *Canadian Air Regulations*. The company had two Cessna 337 aircraft and one Cessna 172. In June of 2008, the company was sold, but the original owner and founder had stayed on as chief pilot.

The company operations manual (COM) requires that all flights or series of flights must be authorized, before departure, by the operations manager or the chief pilot, as applicable. Operational control of a flight was delegated to the pilot-in-command by the operations manager, who retained responsibility for the day-to-day conduct of flight operations. In the event that a new requirement for a flight develops when operating away from base, the pilot-in-command has the authority to release the aircraft. The pilot did not communicate to the chief pilot that the occurrence flight would involve a low-level wildlife survey.

Flight Path and Wreckage Information

The aircraft first appeared on NAV CANADA radar at 1347:46 on departure out of Grande Prairie and remained on radar until the accident. The aircraft was not receiving control services from NAV CANADA during the flight. The last radar return with an altitude readout was at 1437:05, indicating an altitude of 2900 feet above sea level (asl), approximately 1500 feet horizontally from the accident site, on a heading of 078°magnetic (M) with a ground speed of 80 knots. Elevation of the accident site was 2700 feet asl.

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[1] All times are mountain daylight time (Coordinated Universal Time minus six hours).

The wreckage trail indicated the aircraft had struck the trees in an approximately 40º left-wing-low attitude, about 40 feet above ground. The trees were estimated to be 35 to 50 feet tall and up to 12 inches thick. The tree swath indicated the descending flight path angle was approximately 45º. The aircraft had skidded and tumbled approximately 80 feet across the shoreline after initial impact with the ground. It came to rest on a small peninsula of land that jutted into the pond. The total length of the wreckage trail, from first tree impact to where the aircraft came to rest, was approximately 136 feet. Aircraft damage indicates that the majority of the impact forces were to the left side of the aircraft.

Injuries and Survivability

The autopsy report from the Chief Medical Examiner identified the immediate cause of death as blunt cranial trauma. This is consistent with the aircraft striking the ground on its left side and the pilot coming into contact with the aircraft structure. The cabin space in the front right area, where the biologist was seated, was not compromised; however, the impact forces resulted in multiple fractures and lacerations. Both occupants were wearing the supplied three-point lap and shoulder harnesses. Neither occupant was wearing a helmet, nor were they required to by regulation, ASRD, or company policy.

Rescue Information

Aircraft operating under contract to ASRD are required to check-in every 30 minutes during flight. The pilot made his first 30-minute check-in call at 1419. At 1454, ASRD flight following personnel attempted to call C-GGDW because they had missed their check-in call. At approximately 1525, ASRD had commenced its emergency procedures program in response to a possible missing aircraft. At approximately 1650, ASRD flight followers began disseminating the last recorded position from the resource tracking software (RTS) to all search aircraft. The RTS system utilizes global positioning system (GPS) coordinates broadcast via satellite communication from a portable unit that the biologist had brought on board the flight. By 1715, the RCMP and the Rescue Coordination Centre had been advised of a missing aircraft and that four rotary and one fixed-wing aircraft were searching for it. No emergency locator transmitter (ELT) signals were received by the searching aircraft or by the search-and-rescue satellite system. At 1925, C-GGDW was located and a successful aeromedical evacuation took place at 2035.

The ELT antenna had been mounted on the top surface of the inboard end of the right wing. Wreckage examination indicated that the antenna cable had pulled out of the connectors at both ends during the impact sequence. This would have prevented signal transmission even though the ELT unit itself functioned properly when tested.

Weather

Weather at the time of the accident as reported at Grande Prairie was a few clouds at 7000 feet above ground level (agl); wind light out of the southwest with a temperature of 30ºC. The altimeter setting was 29.75 inches of mercury. These conditions would have resulted in a density altitude of 5509 feet for an altitude of 2850 feet above sea level (average aircraft altitude just prior to impact).

Aircraft Information

Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures, and was being operated within its load and centre of gravity limits. There was nothing found to indicate that there was any airframe failure or system malfunction prior to or during the flight. It was concluded that the aircraft was complete, intact, and functioning normally before it struck trees. The aircraft was configured with flaps at 1/3 and gear up at the time of impact.

C-GGDW was manufactured in 1967. A Horton STOL Craft Inc., short take-off and landing (STOL) kit was installed in 1994 in accordance with supplemental type certificate (STC) SA937CE. The kit consisted of leading edge cuffs, stall fences, droop wing tips, and vortex generators on the lower cowling of the rear engine. The STC did not require any amendments to the aircraft's flight manual with regards to stall speeds or other performance graphs. The purpose of the STOL kit was to give a greater margin of safety to the pilot when operating at higher angles of attack. Flight test data acquired from Horton STOL Craft Inc. did not include stall speeds for angles of bank beyond 30º with 1/3 flap and power on. The flight test summary indicated that the aircraft was controllable throughout the various stall manoeuvres.

The track log data from the handheld GPS receiver recovered from the accident site were analyzed for speeds, altitudes, and bank angles for the last 10 minutes of flight. The last two turns immediately preceding the loss of control were in excess of 50º angle of bank with a maximum reaching 55° on the final turn. The ground speed and altitude of the aircraft during the final turn was approximately 83 knots at 2850 feet asl or 150 feet agl.

The aircraft flight manual indicated that the aircraft would stall at a calibrated air speed of 84 knots with the landing gear down, power off, flaps at 1/3, maximum gross weight, and an angle of bank of 60º. Based on a GPS groundspeed of 83 knots and a density altitude of 5509 feet asl, the approximate calibrated air speed during the final turn averaged 76 knots.

Pilot Information

The pilot was licensed, certified, and qualified in accordance with existing regulations. He had approximately 580 hours total time, of which 105 hours were on the Cessna 337. He was hired by Wildlife Observation Services Inc. in May of 2008 and completed his training and pilot proficiency check (PPC) on 17 July 2008. A week after the PPC, he travelled to Grande Prairie to fly on the contract with ASRD. He obtained fire detection training from ASRD on 25 July 2008. He had completed seven wildlife survey flights after starting the contract with ASRD.

The pilot had been exposed to low-level mountain operations while flying in South America in 2007. On poor weather days, he would observe in the right seat as a more experienced pilot performed the low-level flying in the mountainous terrain from the left seat.

With Wildlife Observation Services Inc., the pilot received training on telemetry techniques for tracking animals, low-level circling (minimum 500 feet agl), and mountain flying in May 2008.

Operational Supervision / Oversight

On 19 April 2007, Wildlife Observation Services Inc. entered into a three-year, casual fixed-wing contract with ASRD. Companies contracted by ASRD had to meet aircraft specifications and air crew qualifications as set out in the *ASRD Pilots' Handbook*. For this contract, the handbook specified that for twin-engine aircraft, the pilot shall have 1200 hours total flying time with 100 hours multi-engine, 200 hours PIC, and at least six months operational experience. While the occurrence pilot met the multi-engine and PIC experience requirements, he did not possess 1200 hours total flying time, nor did he have six months of operational experience.

In an attempt to consolidate resources and make better use of aircraft time, ASRD decided to combine wildlife missions with the smoke/fire patrols in June of 2008. Biologists and pilots were trained in smoke patrol/fire detection. The Forest Protection Group of ASRD was responsible for all the aircraft operations and contracting under ASRD. With this dual role, forest protection duties were primary and wildlife duties secondary.

Wildlife surveys of this nature require the aircraft to be operated at lower altitudes and slower speeds than fire patrols. Speeds and altitudes were always at the pilot's discretion. The investigation determined that it was not unusual for the stall warning horn to sound during these operations. The COM did not specify training or standard operating procedures for low-altitude wildlife surveys. The only reference to low-altitude flying was contained in the safety training practices section of the COM, which stated that any training shall not be conducted below 500 feet agl or in the vicinity of wildlife.

In 2005, ASRD completed a hazard assessment and control report for aerial surveys, telemetry, and smoke patrols using single-engine fixed-wing aircraft. For low-level work, the risk classification was determined to be high with one risk identified: ground hazards (towers and power lines). The only proactive risk controls envisaged were to conduct pre-flight briefings and to perform advanced scouting to identify potential hazards. The latter did not occur in this instance.

The investigation of a similar fatal accident in 1997 (TSB investigation A97W0018) involving a Cessna 180 hired by the Saskatchewan Provincial Government for a deer survey identified the following causal factors: the acceptance of a survey method that entailed repetitive turning at low altitude and near stall air speeds without an appropriate standard operating procedure in place, and the lack of an effective safety management system within the management structures involved in the aerial survey project. Since the Aerial Safety Directives were developed by the Saskatchewan Provincial Government following this accident, there have been no further accidents in wildlife surveys in that province.

Analysis

There were no indications that any aircraft systems contributed to the loss of control and subsequent impact with trees and the beaver pond. Therefore, the analysis will focus on aircraft handling and the organizational environment in which the aerial surveys were conducted.

The steep descent through the trees, short wreckage trail, low groundspeed, and steep angle of bank point to a loss of control at low altitude due to aerodynamic stall. Although the aircraft flaps were set at 1/3 and it was equipped with a STOL kit, the combination of the low air speed, high angle of bank, and high-density altitude contributed to the wings achieving an angle of attack that resulted in an aerodynamic stall.

Due to the low altitude, the pilot would have been unable to recover in time to avoid impact with the trees. The biologist in the right seat survived due in part to the aircraft striking a fairly soft terrain feature (marshy swamp) after decelerating through several trees and impacting primarily on the left side of the aircraft. Survivability for the pilot could have been enhanced had he been wearing head protection in the form of a helmet.

Search-and-rescue efforts were delayed because the ELT, though fully functioning, was not able to transmit because the antenna leads were severed during the impact sequence. The GPS tracking system yielded a position that was instrumental in finding the aircraft and surviving biologist before dark.

Wildlife Observation Services Inc. specialized in wildlife telemetry, however, its COM and standard operating procedures did not address the risks associated with low-level flight. Additionally, the company allowed a pilot to command who did not meet the ASRD requirements. Wildlife Observation Services Inc's operational control was insufficient to mitigate the risks associated with low-level flight. As a result, the pilot entered into an operational situation that exceeded his abilities.

The following TSB Engineering Laboratory reports were completed:

LP 111/2008 — GPS Data Recovery

LP 126/2008 — Flight Path Analysis

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

Findings as to Causes and Contributing Factors

1. The pilot had not been provided with sufficient guidance and training pertaining to low-level aerial surveys; consequently, the pilot's handling of the aircraft was not consistent with safe operations in the low-level environment.

2. The pilot flew the aircraft at low air speed, an angle of bank in excess of 50^{o}, and a high-density altitude; this resulted in an aerodynamic stall.

3. The low altitude of the aircraft prevented recovery from the stall prior to striking the trees.

Findings as to Risk

1. Having pilots operate aircraft at low altitudes without specific guidance and training increases operational flight risk.

2. Although functioning, the emergency locator transmitter signal did not transmit because the antenna leads were severed during the impact sequence; this extended the search-and-rescue mission and increased the risk to those on board.

Other Findings

1. The pilot was not wearing a helmet, which contributed to the severity of the head injury he received.

2. The operator allowed a pilot who did not meet the Alberta Sustainable Resource Development (ASRD) requirements to conduct flights for the ASRD contract.

3. The global positioning tracking system yielded a position that was instrumental in finding the aircraft and surviving biologist before dark.

Safety Action Taken

The Transportation Safety Board

On 15 October 2008, the Transportation Safety Board sent Aviation Safety Advisory A08W01733-D1-A1, Procedures for Low-Level Wildlife Observations in Fixed-wing Aircraft to Alberta Sustainable Resource Development (ASRD). In response, ASRD drafted standard operating procedures for wildlife surveys and low-level aircraft operations.

Alberta Sustainable Resource Development

The following changes to the ASRD Standard Operating Procedures, Aircraft Management for low-level operations for fixed-wing aircraft have been made:

> 6.13 Low-Level Operations (<500 feet above ground level [agl])
>
> The following are procedures for activities which do not have a specific set of procedures similar to those developed for Fire Bombing, Rappel, Aerial Ignition, and Hover Exit:
>
> 6.13.1 General
>
> 1. The company, pilot, and aircraft will be qualified by Transport Canada for 702 Aerial Work.
>
> 2. Flight crews are to be fully engaged in "flying the aircraft" and not be distracted by other work being done.
>
> 3. Wherever possible, SRD staff should operate radios on SRD-assigned frequencies, including telemetry receivers. The pilot can monitor these radios if the cockpit workload permits.
>
> 4. Except were specifically permitted in *Canadian Air Regulations* sections 602.12-602.16, no flights over the built-up area of a community shall be conducted at altitudes below 1000 feet above ground level (agl).
>
> 5. A hazard and risk assessment is to be done for the specific task undertaken, requiring low-level operations including the need for the flight and alternate means of accomplishing the task identified.
>
> 6.13.3 Fixed Wing
>
> 1. With the exception of a wings-level pass, the profile shall remain at an altitude of at least 300 feet above ground level (agl).

2. The maximum angle of bank while operating below 500 feet agl shall be 30 degrees.

3. Other than takeoffs and landings, at no time shall the flight profile go below the adjacent tree canopy.

In level flight, the indicated forward air speed must not drop below 1.3 times the configured stall speed. If the aircraft will be in a turn, the air speed must be maintained at 1.5 times the stall speed or higher.

Wildlife Observation Services Inc.

The following changes to the Wildlife Observation Services Inc. COM (company operations manual) were approved by Transport Canada:

- Training to include the process and use of mandatory mission briefings and the practical incorporation of pilot decision-making using the AESOP [2] error prevention tool.

- Clarification of the need for communications with the chief pilot (policy) when activities are requested that may be outside of the usual duties or pilot training and/or experience.

- A training program that will result in each pilot being endorsed to perform certain activities (control) only after demonstrating that they meet the knowledge and competency standards for that activity

- A technical and flight training syllabus for each aerial work activity (and Air Operator Certificate operations specification) that includes stated competency standards for each flight exercise and knowledge subject. The program will allow for progressive pilot authorization in areas such as operation at lower altitudes or in various terrain and environments and a document similar to a PPC [pilot proficiency check] card will indicate each pilot's authorized aerial work activities. The syllabus in the COM has been significantly expanded.

The company has enhanced its flight following and emergency response capability with the addition of a global positioning system/satellite communication asset management system and a telephone and messaging system that has a toll-free number and voice-to-text/text-to-voice messaging.

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[2] The Error Prevention Institute Inc. AESOP model is a quick check before taking any action to assess the assignment, hazards, obstacles, and personnel and to stop the activity if indicators are not "GO". The acronym stands for Assignment, Equipment, Situation, Obstacles, and Personnel.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 30 June 2009.

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