National Transportation Safety Board
Aviation Accident Final Report

Location:	McGrath, AK	**Accident Number:**	ANC07FA103
Date & Time:	09/20/2007, 1430 AKD	**Registration:**	N2088Z
Aircraft:	Short Bros. SC-7	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General Aviation - Ferry		

Analysis

The airline transport pilot was departing in a twin engine turboprop airplane on a ferry flight from a remote lodge airstrip that was about 1,000 feet long and 40 feet wide. The airplane had previously received substantial damage to the nose wheel assembly on a previous flight to the airstrip. Repairs were made to the airframe, and the pilot was departing for a maintenance facility. The pilot had flown in and out of the airstrip on numerous occasions, but not in the accident type airplane. The lodge owner reported that the pilot started both engines and taxied the length of the airstrip, stopping momentarily several times. The pilot ran the engines for about 20 minutes, and then began a takeoff to the south. The airplane appeared to accelerate and remain on the centerline of the airstrip, but did not liftoff until the very end of the airstrip. The owner did not notice any unusual sounds or appearance of the engines. After liftoff, the wheels of the airplane struck and broke off the tops of trees and shrubs, that were about 6 to 7 feet above the ground. The airplane immediately veered to the right, and went out of the lodge owner's sight, but he continued to hear the airplane hitting trees until final impact. The airplane crashed in a shallow lake, coming to rest about 300 feet from shore, in about 5 feet of water. The entire cockpit area, forward of the wings, was torn off the airframe. The validity of any postaccident cockpit and instrument findings was unreliable due to the extensive damage to the cockpit. Likewise, structural damage to the airframe precluded determining wing flap settings during takeoff. Performance calculations indicated that the airplane's takeoff distance would have been about 950 feet, although the lodge owner said that in his experience, the accident airplane was capable of lifting off about half way down the airstrip without difficulty. The circumstances of the takeoff indicated that the left engine had been producing sufficient power to chop through several trees during the crash. Testing and inspection of the right engine was inconclusive, and although it was run on a test stand at reduced power, full power could not be attained due to ingestion of foreign material during the test run.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A collision with trees during takeoff-initial climb for an undetermined reason.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. OBJECT - TREE(S)
2. (C) REASON FOR OCCURRENCE UNDETERMINED

Factual Information

HISTORY OF FLIGHT

On September 20, 2007, about 1430 Alaska daylight time, a Short Brothers SC-7 airplane, N2088Z, sustained substantial damage when it collided with trees during takeoff/initial climb from a remote lodge airstrip, about 82 miles east-northeast of McGrath, Alaska. The airplane was being operated as a visual flight rules (VFR) cross-country ferry flight under Title 14, CFR Part 91, when the accident occurred. The airplane was operated by Arctic Circle Air Service Inc., Fairbanks, Alaska. The airline transport certificated pilot received serious injuries during the accident, and was transported to a hospital in Anchorage, Alaska, where he died of his injuries on September 25, 2007. Visual meteorological conditions prevailed, and VFR company flight following procedures were in effect for the flight to Anchorage.

The airplane was departing from Mystic Lake Lodge, adjacent to Amos Lake, elevation 1,719 feet msl. The airplane had previously received substantial damage when the pilot landed at the accident airstrip on September 1, 2007 (reference NTSB report ANC07LA095). During that event, the nose wheel landing gear strut and tire were folded aft and upward, damaging the fuselage structure at the forward edge of the cockpit floor. Temporary repairs were made to the airframe, and a new nose gear assembly was installed by company maintenance personnel. The pilot was to fly the airplane to the company maintenance facility in Anchorage. The airplane was issued a ferry permit by the Federal Aviation Administration (FAA) Anchorage Flight Standards District Office (FSDO).

The lodge owner, who was the only person at the lodge, reported that the pilot started the airplane's turboprop engines and taxied the length of the airstrip, stopping momentarily several times. He indicated that the pilot ran the engines for about 20 minutes, and then began the takeoff run toward the south. The airplane appeared to accelerate and remain on the centerline of the airstrip, but did not lift off until the very end of the airstrip. The owner did not notice any unusual sounds or appearance of the engines. After liftoff, the wheels of the airplane struck and broke off the tops of trees and shrubs, that were about 6 to 7 feet above the ground. The airplane immediately veered to the right, and went out of the lodge owner's sight, but he continued to hear the airplane hitting trees until final impact. The airplane crashed into Amos Lake, coming to rest about 300 feet from shore in about 5 feet of water. The entire cockpit area, forward of the wings, was destroyed. The lodge owner rescued the pilot, and the pilot was transported from the lodge via helicopter.

The lodge owner indicated that in his experience, the accident airplane make and model was capable of lifting off about half way down the airstrip without difficulty.

PERSONNEL INFORMATION

Pilot Information

The pilot held an airline transport pilot certificate with airplane single-engine land, multiengine land ratings, and commercial privileges with an airplane single-engine sea rating. He also held a flight instructor certificate with airplane single-engine and multiengine, and instrument airplane ratings. His most recent first-class medical certificate was issued on April 17, 2007, and contained no limitations.

According to the Pilot/Operator Aircraft Accident Report, (NTSB Form 6120.1) submitted by

the operator, the pilot's total aeronautical experience was about 15,000 hours, of which about 2,600 hours were in the accident airplane make and model. In the preceding 90 and 30 days prior to the accident, the pilot flew a total of 260 and 89 hours.

The operator reported that the pilot had flown to and from the accident airstrip on numerous occasions in a variety of airplanes, including a de Havilland DHC-3; however, the pilot had not flown from the airstrip in the accident airplane make and model.

Company Information

Operational control of company flights is listed in the company Flight Operations Manual, Section 4. Personnel listed are the director of operations, chief pilot, director of station operations, and station managers. In addition, flight coordinators are delegated operational control to coordinate aircraft loads, assignment of crews, acceptance and coordination of charter flights, and flight following.

The operator indicated that the company's flight operations manual states, among other items, that the pilot is responsible for familiarizing themselves with all available information concerning flights, including runway lengths, and takeoff and landing distances contained in each airplane's approved flight manual. In addition, the operations manual stipulates that "extreme caution and sound judgment must be exercised when operating into bush runways. This judgment is to be based on operating experience into the particular airport, taking into consideration such things as geographic location, prevailing temperatures, wind, known conditions of runway surface contaminations to include snow, water, mud and ice. If airport conditions become hazardous to safe operations, flights will be canceled until such time as safe operations can be resumed."

The operator reported that the accident pilot was the only one in the company to fly into and out of the accident airstrip. The company did not have a data base of airport information that included the accident airstrip. That knowledge resided with the accident pilot, and he would have been responsible for validating the accuracy of the runway length and condition.

AIRCRAFT INFORMATION

The airplane sustained damage to the nose gear assembly and adjacent fuselage on September 1, 2007. The operator submitted drawings and a repair plan to an FAA Airworthiness Inspector, and requested a ferry permit once the temporary repairs were concluded. The repairs consisted of a welded and bolted metal angle steel frame attached to the fuselage, and installation of a new nose gear assembly.

At the most recent inspection on August 30, 2007, the airplane had a total time in service of 10,730 hours. It was maintained under an Approved Aircraft Inspection Program (AAIP). The engines had 114 hours since their most recent inspection.

The left engine had a total time in service of 5,840 hours, and the right engine had a total time in service of 13,805 hours.

The engines have a negative torque sensing (NTS) system that automatically changes the pitch settings of the propeller blades in response to a loss of engine power. If an engine begins to lose power, the propeller blade pitch is changed to achieve a minimum drag configuration. The engines are not equipped with an auto-feather feature, nor an auto-relight feature.

The feather handles for each engine are located in the overhead panel. To feather an engine,

the feather handle must be pulled and moved aft to engage a notch on the handle shaft, with a retaining notch on the panel. Via a series of connecting linkage, activation of the feather handle moves a mechanical fuel valve to "OFF" and activates the feather valve on the engine.

The propeller blades are spring-loaded to the feather position. Engine oil pressure is utilized to change the pitch angle of the blades, and a loss of oil pressure will result in the blades moving to a feather position under the action of their spring.

The airplane has a flight control locking feature that will prevent the flight control surfaces from moving when the airplane is parked. The engines cannot be started unless the flight control lock is placed into the "OFF" position.

The flap system, nose wheel steering, elevator trim, and brakes are hydraulic. A self-contained electric power pack, with an emergency accumulator, provides about 2,500 psi.

The takeoff flap position is 18 degrees, and the normal liftoff speed is 70 knots. Maximum flaps are 50 degrees.

Using a takeoff altitude of 1,719 feet at Amos Lake, an estimated temperature of 50 degrees F, an estimated airplane weight of 10,370 pounds provided by the operator, and about a 1 percent downsloping runway, the NTSB IIC calculated an estimated takeoff distance using the Short Brothers performance charts. The estimated takeoff distance to a height of 50 feet, with both engines producing maximum power from a hard, dry runway, was about 950 feet. The estimated rate of climb on two engines was about 1,760 feet per minute. The operator concurred with the estimates.

METEOROLOGICAL INFORMATION

The closest official weather observation station is McGrath, Alaska, which is 82 nautical miles west southwest of the accident site. At 1416, an Aviation Routine Weather Report (METAR) was reporting, in part: Wind, 210 degrees (true) at 5 knots; visibility, 8 statute miles in light rain; clouds, 300 feet scattered, 2,900 feet broken, 3,400 feet overcast; temperature, 48 degrees F; dew point, 46 degrees F; altimeter, 29.57 inHg.

The lodge owner described the weather as scattered clouds, and calm winds.

COMMUNICATIONS

There was no communication received from the airplane.

AIRPORT AND GROUND FACILITIES

The operator stated that the gravel surfaced airstrip is oriented north/south, and is about 1,000 feet long, and about 40 feet wide. The runway slopes slightly downhill to the south, toward Amos Lake. Trees are located along the sides and at the departure end. The lodge owner confirmed the runway length as 1,000 feet.

WRECKAGE AND IMPACT INFORMATION

During recovery operations, recovery personnel noted that they saw a swath of damaged and cut tree branches from the departure end of the runway to the impact site at Amos lake. The cut trees and branches were only found along the left side of the airplane's path through the trees. The path of the airplane curved to the right from the end of the runway to the lake. Several cut segments of tree branches were transported to the recovery yard with the wreckage.

The National Transportation Safety Board investigator-in-charge (IIC), and the parties to the investigation, examined the airplane wreckage at a recovery yard in Wasilla, Alaska, on October 30, 2007. The engines were externally examined at the recovery yard on November 7, during which the propellers were removed to facilitate crating of the engines for shipment.

The entire nose section, from about airframe station 74, including the cockpit floor with the front seats attached and the nose gear assembly, was separated from the fuselage. The instrument panel, and the vertical sidewalls of the cockpit, were displaced downward and to the left. The center cockpit console, along with the flight control columns, engine power levers, and the lower third of the aft "broom closet" containing portions of the flight control push-pull tubes, remained attached to the cockpit floor.

The upper two thirds of the broom closet, and the flight deck roof console containing the fuel selectors, flight control lock lever, and the engine feather handles, was separated from the cockpit floor and the cockpit ceiling. The deck roof console was dented and deformed. The left and right engine fuel selectors were in the "OFF" position. The balance cock lever, utilized to interconnect the left and right fuel tanks, was in the "OFF" position. The flight control lever was in the "Unlocked" position. The red-painted left engine feather "T" handle was broken at the top of its shaft, and a red smear of paint was found in a dented area of the panel, adjacent to the broken handle shaft. The right engine feather "T" handle was in place, but the shaft was broken about 2 inches below the top of the handle.

The flap selector was in the full down position, and the flaps appeared to be in the full down position. The power levers were about in the air start position (midrange), and the engine rpm levers were about in the air start position (also midrange).

Aft of the pilot's seat, the fuselage was intact, however the leading edges of the landing gear sponsons and lift struts had aft crushing and denting. The empennage appeared to be undamaged.

The front windshield, with various gauges and switches still attached along its upper edge, was separated from the instrument panel and fuselage.

The right wing was bent aft and upward, and separated just outboard from the lift strut attach point. The aileron remained attached to the separated segment. The leading edge had several aft crush points and denting. The leading edge of the left wing had several aft crush points and denting.

Application of air pressure into the fuel lines in each wing revealed that the right wing-mounted fuel valve was "ON." The left wing fuel valve was "OFF." The fuel valve control cables, leading from the cockpit to the wings, were cut during disassembly of the wings for recovery.

Due to impact damage, the flight controls could not be moved by their respective control mechanisms, but continuity of the flight control system was established from the cockpit to all control surfaces.

The left propeller blades were found off their start locks. They had impact, bending and gouging signatures. Impact crushing and denting was present on the engine intake area.

The right propeller blades were found off their start locks. They had minor damage and appeared to be near a feathered position. The propeller spinner had an impact crush on one side, and impact crushing and denting was also present on the engine intake area.

Under the direction of the NTSB IIC, both engines were removed and shipped to the manufacturer's facility in Phoenix, Arizona, for examination between January 22, and 24, 2008. The operator and FAA personnel did not attend the examination.

The interior of the right engine was initially examined by borescope. No damage was observed. Unburned green pine needles and brown bark material was found in the combustion liner. The engine turbine to accessory gearbox torsion shaft was intact. The manual fuel shut-off valve was "OFF" and the feather valve was activated. The engine appeared capable of running, and was placed on an engine test cell dynamometer. A shaft, routed through a load producing assembly to simulate propeller load, was attached to the propeller flange. The engine was started and attained flight idle, and was shut down. A second start to flight idle was accomplished, but sparks began emanating from the tailpipe and the engine was shut down. The engine was restarted a third time, rpm was advance to 100 percent, and a load of 10,000 inch pounds of torque was applied. This equated to about 44 percent torque. Sparks continued to emanate from the tailpipe, and the test run was terminated due to safety concerns.

Post run examination of the right engine found several small metal fragments in the cross-over duct, unseen during the prerun borescope. The source of the fragments was not determined. Metal spray was found on the second and third stage turbine wheels that was not present before the engine run. The second stage compressor impeller was gouged and battered, damage that was not present before the engine run.

A borescope examination and teardown of the left engine revealed rubbing of several compressor and turbine wheels on their respective shrouds. The gearbox planetary housing mounting lugs were fractured. The turbine to accessory gearbox torsion shaft was fractured. The manual fuel shut-off valve was "OFF" and the feather valve was activated. The starter/generator shaft was sheared. The combustion liner contained no plant material. Fuel was found in the fuel lines at the fuel control unit. The fuel control drive gear was intact.

On February 6, 2008, an FAA inspector from the Scottsdale FSDO, Scottsdale, Arizona, participated in an examination of both engine's fuel control units and propeller governors. No mechanical malfunction was found.

MEDICAL AND PATHOLOGICAL INFORMATION

A postmortem examination of the pilot was done under the authority of the Alaska State Medical Examiner, 4500 South Boniface Parkway, Anchorage, Alaska, on September 28, 2007. The cause of death for the pilot was attributed to blunt force impact injuries.

A toxicological examination was conducted by the FAA's Civil Aeromedical Institute (CAMI) on October 22, 2007, and was negative for alcohol or drugs.

SURVIVAL ASPECTS

Initially, the lodge owner was the only person at the lodge when the accident occurred. After finding the airplane in the lake, he made a satellite phone call to the operator to report the accident and requested medical help. He began extraction of the pilot by standing/wading in the lake, and was later assisted by a local guide who was flying overhead and saw the wreckage. Both men cut the pilot from the wreckage and floated him to shore on an improvised backboard constructed of Styrofoam insulation panels. A military helicopter arrived with paramedic personnel about 1730, and transported the pilot to McGrath, and onto Anchorage. The lodge owner said that the pilot was unconscious throughout the rescue.

ADDITIONAL INFORMATION

The Safety Board released the airframe wreckage, located at Wasilla, Alaska, and the engines, located at Phoenix, Arizona, to the owner's representatives on February 21, 2008.

Pilot Information

Certificate:	Airline Transport; Flight Instructor; Commercial	**Age:**	45, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without Waivers/Limitations	**Last Medical Exam:**	04/01/2007
Occupational Pilot:		**Last Flight Review or Equivalent:**	08/01/2007
Flight Time:	15000 hours (Total, all aircraft), 2600 hours (Total, this make and model), 15000 hours (Pilot In Command, all aircraft), 260 hours (Last 90 days, all aircraft), 89 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Short Bros.	**Registration:**	N2088Z
Model/Series:	SC-7	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	SH-1963
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	08/01/2007, AAIP	**Certified Max Gross Wt.:**	12500 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo Prop
Airframe Total Time:	10730 Hours	**Engine Manufacturer:**	Garrett
ELT:	Installed, not activated	**Engine Model/Series:**	TPE331-2-201A
Registered Owner:	Arctic Air Group	**Rated Power:**	715 hp
Operator:	Arctic Circle Air Service Inc.	**Air Carrier Operating Certificate:**	Commuter Air Carrier (135); On-demand Air Taxi (135)
Operator Does Business As:		**Operator Designator Code:**	ACSA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	PAMC, 338 ft msl	**Observation Time:**	1416 ADT
Distance from Accident Site:	82 Nautical Miles	**Direction from Accident Site:**	295°
Lowest Cloud Condition:	Scattered / 300 ft agl	**Temperature/Dew Point:**	9°C / 8°C
Lowest Ceiling:	Broken / 2900 ft agl	**Visibility**	8 Miles
Wind Speed/Gusts, Direction:	5 knots, 210°	**Visibility (RVR):**	
Altimeter Setting:	29.57 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:	Light - Rain		
Departure Point:	McGrath, AK	**Type of Flight Plan Filed:**	Company VFR
Destination:	Anchorage, AK (PANC)	**Type of Clearance:**	None
Departure Time:	1515 ADT	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	62.858333, -152.626667

Administrative Information

Investigator In Charge (IIC):	Scott Erickson	**Adopted Date:**	07/30/2008
Additional Participating Persons:	Terry Musick; FAA-AL-ANC FSDO 03; Anchorage, AK Erv Terry; Arctic Circle Air Service Inc.; Anchorage, AK Jim Allen; Honeywell Aerospace; Phoenix, AZ		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.