Aviation Investigation Final Report

Location:	Coldfoot, Alaska	**Accident Number:**	ANC14FA068
Date & Time:	August 24, 2014, 13:05 Local	**Registration:**	N4827K
Aircraft:	Ryan NAVION A	**Aircraft Damage:**	Substantial
Defining Event:	Controlled flight into terr/obj (CFIT)	**Injuries:**	4 Serious
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Sightseeing		

Analysis

The commercial pilot was conducting a 14 Code of Federal Regulations (CFR) Part 135 commercial air tour flight with three passengers onboard when the airplane impacted rising terrain below the entrance of a high mountain pass. The airplane was substantially damaged, and the pilot and his three passengers were seriously injured. Thirty-five days later, one of the passengers died as a result of his injuries. The pilot initially reported to first responders that he had encountered a severe downdraft while approaching the high mountain pass, which caused the airplane to lose altitude. Review of reported weather conditions at the time of the accident in the area of the pass indicated that the wind speed was 4 to 7 knots, and no indications of sudden downdrafts were discovered.

When interviewed by investigators about 2 weeks after the accident, the pilot stated that the right front seat passenger was not wearing his shoulder harness and had slumped onto the flight controls and become unresponsive after taking a motion sickness drug. The pilot further stated that the two rear seat passengers (who had also taken the drug) were also unresponsive when this occurred. However, none of the three passengers recalled this, and the front seat passenger was found with his seatbelt and shoulder harness on when first responders arrived on scene.

In a written statement dated about 2 months after his interview, the pilot stated that a propeller blade had separated in flight, as one propeller blade was missing and not recovered from the accident site. The passengers did not recall that this had occurred, and postaccident examination of the propeller hub, propeller blade pilot tubes, propeller blade clamps, and the remaining propeller blade indicated that the missing propeller blade had separated during the impact sequence. Evidence that the missing propeller blade separated on impact included the existence of power signatures on the remaining propeller blade and the presence of a large amount of grease in the hub, which was not thrown out in a centrifugal pattern from the missing propeller blade side of the hub as it would have been if the blade had separated in flight. Further findings indicating that the missing propeller blade separated on impact were a broken clamp bolt head found lying inside the clamp bolt cup of the clamp from the missing propeller blade, impact damage on that same clamp, and a shiny-crescent shaped contact mark on the hub butt in the aft

quadrant where the trailing edge of the missing propeller blade would have been located; the crescent-shaped contact mark, which was indicative of aluminum transfer from the missing blade to the hub butt, is typically seen when propeller blades separate during impact. Additionally, metallurgical testing showed that the impact-damaged clamp from the missing propeller blade as well as both of the propeller blade tubes had failed due to overload, and no evidence of fatigue cracking was found.

Postaccident examination of the airframe and engine found no evidence of preimpact mechanical malfunctions or anomalies that would have precluded normal operation of the airplane. Several discrepancies were noted with the engine, including the presence of metallic particulates within the oil filter, contamination of the fuel inlet screen with a rubber-like material, and damage to the oil pump consistent with hard particle passage; however, none of these discrepancies would have prevented the engine from producing power.

Witness statements, passenger statements, photographs taken during the flight by one of the passengers, and GPS data recovered from a GPS receiver onboard the airplane indicated that, after takeoff, the pilot did not climb to a safe cruising altitude to cross through the mountain pass but instead remained at low altitude. After circling a town, he proceeded up a valley that led to the high mountain pass, flying below the tops of the surrounding mountains in close proximity to terrain and obstructions about 500 feet above ground level. This low altitude flying resulted in the airplane reaching the area of the pass, being boxed in by the surrounding terrain, and not having enough energy or performance to climb up and cross over the pass as the terrain at that point was rising faster than the airplane could climb.

Examination of weight and balance information indicated that the pilot had taken off with the airplane loaded over maximum gross weight and that the airplane was near its maximum gross weight when the accident occurred. The pilot's decision to operate the airplane near its maximum gross weight likely contributed to the accident because it reduced the margin of power available for climb.

Review of Federal Aviation Administration (FAA) records revealed that, from 2007 to 2012, the pilot had a history of accidents, incidents, reexaminations, and checkride failures. Despite the pilot's history and concerns voiced by numerous FAA personnel during the certification process, the FAA issued a certificate to the pilot in 2012 to conduct commercial air transportation pursuant to 14 CFR Part 135.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's improper inflight planning and improper decision to deliberately operate the airplane at low altitude in close proximity to obstructions and rising terrain. Contributing to the accident were the pilot's improper preflight planning and the Federal Aviation Administration's inappropriate decision to issue a 14 *Code of Federal Regulations* Part 135 certificate to the operator despite the pilot's history of accidents, incidents, reexaminations, and checkride failures.

Findings

Personnel issues	(general) - Pilot
Personnel issues	Decision making/judgment - Pilot
Environmental issues	(general) - Decision related to condition
Aircraft	Altitude - Incorrect use/operation
Personnel issues	(general) - Pilot
Aircraft	(general) - Capability exceeded
Personnel issues	Flight planning/navigation - Pilot
Personnel issues	Weight/balance calculations - Pilot
Organizational issues	Oversight of operation - FAA/Regulator

Factual Information

History of Flight

Prior to flight	Preflight or dispatch event
Prior to flight	Aircraft loading event
Enroute	Low altitude operation/event
Maneuvering	Controlled flight into terr/obj (CFIT) (Defining event)

On August 24, 2014, about 1305 Alaska daylight time, a Ryan Navion A, N4827K, was substantially damaged when it impacted terrain while maneuvering in mountainous terrain, approximately 56 nautical miles north-northeast of Coldfoot, Alaska. The airplane was operated by Kirst Aviation, as an on-demand sightseeing flight under the provisions of 14 Code of Federal Regulations (CFR) Part 135. The commercial pilot and the three passengers were seriously injured during the accident. The right-front seat passenger died 35 days after the accident as a result of his injuries. Visual meteorological conditions prevailed, and a visual flight rules (VFR) flight plan was filed for the flight, which originated at Fairbanks International Airport (PAFA), Fairbanks, Alaska about 1003.

According to Federal Aviation Administration (FAA) records, earlier that day the pilot filed a VFR flight plan indicating that he intended to depart from PAFA, stop at Bettles Airport (PABT), Bettles, Alaska; Deadhorse Airport (PASC), Deadhorse, Alaska; and Barter Island LRRS Airport (PABA), Barter Island, Alaska, before returning to PAFA. He indicated that the airplane had approximately 7 hours and 20 minutes of fuel on-board.

The accident occurred during the flight between PABT and PASC in Atigun Pass, which is a high mountain pass that crosses the Brooks Range at an altitude of 4,739 feet above mean sea level (msl), at the head of the Dietrich River, where the Dalton Highway and the Trans-Alaska Pipeline, cross the Continental Divide. Review of the Fairbanks Sectional Chart and the World Aeronautical Chart for the area around Atigun Pass that was published by the FAA effective at the time of the accident revealed that it contained a warning that stated: "RAPIDLY RISING TERRAIN" and advised to "USE CAUTION DURING PERIODS OF LOW CEILING AND VISIBILITY."

Pilot Interview

On September 9, 2014, NTSB investigators conducted an interview with the pilot. During the interview, the pilot stated that he had received a call about 2 weeks prior to the accident flight from the male passenger inquiring about flightseeing and observing polar bears at Barter Island. Originally, the flight was to be for two passengers who were from a group that was traveling on a cruise ship, but was later changed to three passengers.

He recalled departing PAFA about 1000 for PABT and recalled that the 1.5-hour flight to PABT was uneventful. The male passenger was seated in the airplane's right front seat, and the two female passengers were seated in the airplane's two rear seats. The pilot stated that the male passenger weighed

262 pounds and had positioned his seat to its rearmost position.

During the flight, one woman became queasy but not sick. Motion sickness pills were offered by the male passenger but were declined since they induce sleep. They stopped in PABT for a bathroom break and a brief walk around. The pilot reported he did not purchase fuel at PABT.

The flight from PABT to Atigun Pass took about 20 minutes. During this segment of the trip, the pilot reported that the three passengers seemed much more subdued. The pilot stated that, to facilitate moving around the cabin for taking pictures, the available four-point harnesses were not being used by the passengers.

He advised that he was climbing through 5,500 to 5,700 feet with a target altitude of 6,000 feet around Chandalar Shelf, when the male passenger slumped into the yoke and blocked the throttle and landing gear controls as they encountered rising terrain and a downdraft. The inflight cruise speed of 130 knots then increased to 160 knots, near the airplane's placarded never exceed speed (Vne). The pilot yelled at the unresponsive passenger and attempted to push him away from the engine controls and off the yoke. The pilot advised that he was pinned by the unresponsive passenger and that the back seat passengers were unresponsive during the entire time that the male passenger was unresponsive.

The pilot lowered the wing flaps half way and opened the canopy 6-inches to facilitate a post-crash exit. Postimpact, the pilot was able to shut off the fuel, master switch, and magnetos, remove his seatbelt, open the canopy, and exit the airplane. The three passengers were unresponsive after the crash and remained in the airplane.

When Alyeska Pipeline personnel arrived, they informed the pilot that the three passengers were in the airplane and that the airplane was not stable and could slide down the embankment. One of the female passengers was airlifted from the accident site to Fairbanks by helicopter. The pilot and two remaining passengers were transported to Galbraith Lake for subsequent medical air transport.

When asked, the pilot reported that there were no mechanical malfunctions or anomalies that would have precluded normal operation of the airplane.

Pilot's NTSB Form 6120.1

Approximately 2 months after the interview, on November 7, 2014, the pilot submitted a signed Pilot/Operator Aircraft Accident/Incident Report (NTSB Form 6120.1). On the form, the pilot stated the following: "Part 135 flight with three passengers. Standard pre-flight before take-off, including proper weight and balance calculation-about 70 gallons for flight. Flight from Fairbanks to Bettles was uneventful. Stopped and took a break at Bettles and then proceeded to Prudhoe Bay via Atigun Pass. While operating at approximately 5,600', encountered abrupt and unexpected aircraft instability. Took steps to correct but actions were ineffective. Made decision to protect passengers and myself in light of conditions. Aircraft hit the ground nose up and came to rest on side of hill. Made my way out of aircraft and was rescued. Have strong feelings about what happened but am awaiting the results of ongoing investigation, will reconsider providing further info after receiving results."

He checked the box indicating a mechanical failure and stated that there was a "propeller bolt failure

causing blade to become unindexed and blade separation in flight."

Passenger Interviews

According to the right front seat passenger, who was interviewed by FAA inspectors on August 27, 2014, after stopping in PABT, they proceeded up the valley. The air was smooth, under a "clear blue sky." Everyone had their shoulder harnesses on. Enroute to PASC, the pilot provided wildlife photo opportunities before the accident occurred. He could not remember the impact or the details leading up to it.

According to one of the rear seat passengers, who was interviewed by a Transportation Safety Board of Canada investigator on September 12, 2014, they departed PABT and flew about 1 hour. They followed a pipeline with everyone taking photographs. A moose was observed at a lake, and photographs were taken while they circled the moose. After circling the moose, all three passengers took motion sickness pills (Gravol) that were given to them by the front right seat passenger. They proceeded into a mountain valley approximately 20 minutes later, and she remembered entering the mountain valley halfway between the tops of the mountains and the ground. Just prior to the accident, the passenger felt the airplane bank slightly and then drop as if "into an air pocket." She described it as "when it drops and you feel your tummy rise up." The rear seat passenger did not remember hearing anything unusual, observing or hearing the pilot struggling, or hearing anything that would have indicated any concern by the pilot regarding the front seat passenger. Immediately prior to the accident, she remembered that the pilot was flying a relatively straight course. Her next memory was waking up after the accident.

According to the other rear seat passenger, who was interviewed by FAA inspectors on September 8, 2014, after stopping at PABT, they followed the pipeline. She started feeling queasy and took a motion sickness pill. About 10 minutes later, they "hit an air pocket," and she felt her body being pressed into the seat in a "downward pull." She did not recall hearing any different or unusual sounds and was not aware that anything was wrong before the impact.

Witness Statements

According to several witnesses, just prior to the accident, they observed the airplane flying slowly in a northerly direction in the vicinity of Atigun Pass. The airplane was flying at low altitude, following the contours of the surrounding terrain, "like he was looking for game." As the airplane passed over a work truck at an estimated altitude between 500 and 800 feet above ground level (agl), the engine sounded like it was "running strong." Moments later, the airplane impacted sloping terrain at an elevation of approximately 4,600 feet on the east side of the Dalton Highway. It then slid about 35 feet across the loose rock of the slope and came to rest.

When witnesses and first responders reached the airplane, all the occupants were in the airplane and conscious. The pilot instructed the first responders on how to unlatch the canopy and open it. Their first attempts to get the pilot out of the airplane were unsuccessful as the pilot discovered that his leg "wasn't working right." They lifted the pilot out and found a place for him to sit as they went back to the airplane to get the passengers out. As the pilot sat on the rocks the pilot stated, "What happened? What the hell happened?" He also made a comment about his business stating something similar to, "Well, I guess I'm out of business" or "Well there goes my business." He later was heard to say, "I don't know

what happened – I guess I was too low, I don't know."

Later, the pilot advised a first responder that he was flying at an altitude about 1,000 feet over the top of the pass, when a strong downdraft caused the airplane to lose altitude. The pilot elaborated that he had tried to compensate by adding power and lowering the flaps to half. First responders also noted that the front seat passenger had his shoulder harness and seatbelt on when they reached the airplane, and they had to remove the harness and seat belt in order to extricate him from the airplane.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	57,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 3, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 5, 2013
Flight Time:	4759 hours (Total, all aircraft), 657 hours (Total, this make and model), 4600 hours (Pilot In Command, all aircraft), 102 hours (Last 90 days, all aircraft), 32 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

The pilot held a commercial pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, and instrument airplane. He also held a flight instructor certificate with ratings for airplane single-engine and instrument airplane, as well as a mechanic certificate with ratings for airframe and powerplant, and an inspection authorization. His most recent FAA second-class medical certificate was issued on April 3, 2014. On the NTSB Form 6120.1 completed by the pilot, he reported that he had accrued 4,759 total hours of flight experience, 657 of which were in the accident airplane make and model.

Review of FAA and NTSB aircraft accident records revealed that the pilot had been involved in two previous accidents. On December 26, 2007, the pilot was involved in an accident (NTSB Case No. ANC08LA030) while providing flight instruction to a student pilot in a Piper PA-22 during civil twilight. While on approach to an unlighted, snow-covered gravel runway, the pilot instructed the student pilot to go-around when he realized that the airplane was not lined up with the runway. He said that his verbal command to immediately apply full engine power and initiate a go-around was followed, but the engine did not respond. According to the pilot, he then took control of the airplane, confirmed that the throttle was at maximum, and then landed the airplane in the deep snow. As the main and nose wheels touched down in the deep snow off the left side of the runway, the airplane decelerated rapidly, and the nose landing gear collapsed. The airplane sustained substantial damage to the fuselage and wings. An FAA airworthiness inspector reported that his postaccident inspection of the airplane disclosed a number of maintenance deficiencies, but found none that would have accounted for the loss of engine power. The NTSB determined that the probable cause of the accident was a loss of engine

power for an undetermined reason during an attempted go-around, resulting in a forced landing and a collision with snow-covered terrain. The NTSB also determined that a factor associated with the accident was the lack of suitable terrain for a forced landing.

On November 14, 2008, the pilot was involved in another accident (NTSB Case No. ANC09LA011A) while providing instruction to a student pilot in a Cessna 152 in day visual meteorological conditions. The Cessna 152 was on the right downwind leg for landing behind a Cessna 182R that was on final approach. The Air Traffic Control Tower (ATCT) specialist asked the Cessna 152 pilots if they had the landing traffic in sight, and the pilot said that they did. Review of radar data and radio communications from the ATCT revealed that the Cessna 152 joined the final approach course slightly behind and above the Cessna 182R. As the two airplanes continued toward the runway, the ATCT specialist issued instructions to the Cessna 152 to make a right 360-degree turn. According to the pilot, at about the same time the nose of the Cessna 182R appeared under his Cessna 152 and he applied full power and began a left climbing turn while advising ATCT of his actions. The left wingtip of the Cessna 152 collided with the top right side of the Cessna 182R's rudder. The pilot of the Cessna 182R reportedly never saw the other airplane. Both airplanes landed without further incident. The NTSB determined that probable cause of the accident was the failure of the instructor in the Cessna 152 [the pilot] to maintain separation from another landing airplane and his failure to follow the tower controller's instructions.

Aircraft and Owner/Operator Information

Aircraft Make:	Ryan	**Registration:**	N4827K
Model/Series:	NAVION A	**Aircraft Category:**	Airplane
Year of Manufacture:	1949	**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility; Restricted (Special)	**Serial Number:**	NAV-4-1827
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 14, 2014 Annual	**Certified Max Gross Wt.:**	3150 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	4027 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	C91A installed, not activated	**Engine Model/Series:**	E225-4
Registered Owner:	On file	**Rated Power:**	225 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	On file	**Operator Designator Code:**	K70A

The accident aircraft was a single-engine, four-seat, low-wing airplane of conventional metal construction. It was powered by a 225 horsepower, Continental E-225-4 engine, driving a two-blade Hartzell, variable pitch, constant speed propeller.

According to maintenance records, the airplane was manufactured in 1949. Its most recent annual inspection was completed by the pilot on June 14, 2014. The records indicated that, at the time of the

inspection, the airplane had accrued 4,027.4 total hours of operation, and the engine had accrued 334.1 hours since major overhaul. The records showed that the pilot had been conducting the majority of the maintenance on the airplane, engine, and propeller since June 2011.

Review of maintenance records further indicated that the propeller was overhauled on May 31, 2011, by a certified repair station and installed on the airplane by the pilot on June 6, 2011, approximately 3 years prior to the accident. According to the records, since the June 2011 installation, the propeller had been removed and remounted three times by the pilot to inspect and/or replace the propeller hydraulic bladder diaphragm, as required by Hartzell Alert Service Bulletin No. HC-ASB-61-338. The most recent removal and reinstallation of the propeller was on February 1, 2013.

Weight and Balance Information

On the NTSB Form 6120.1 completed by the pilot, he reported that he completed a "standard pre-flight before take-off, including proper weight and balance calculation-about 70 gallons for flight." When the pilot was interviewed on September 9, 2014, he stated that he calculated the weight of fuel, bags, and people to be "about 40 pounds below gross weight" before he departed PAFA.

Review of published fuel flow data for the Continental E-225-4 engine indicated that, at 65% power, fuel flow would have been about 76 pounds (lbs) of fuel per hour, which equated to a minimum fuel load of approximately 100 gallons (not including fuel for taxi, takeoff, and climb) in order to have 7 hours and 20 minutes fuel onboard on departure from PAFA as listed on the pilot's flight plan. Weight calculations were performed using estimated weights of 160 lbs for the pilot, 230 lbs for the right front seat passenger, 180 lbs for one of the rear seat passengers, 150 lbs for the other rear seat passenger, 30 lbs of baggage, and 100 gallons of fuel on departure from PAFA. The calculations indicated that the airplane was approximately 187 pounds above maximum gross weight on takeoff from PAFA, approximately 37 pounds over maximum gross weight on landing at PABT, and approximately at maximum gross weight of 3,150 pounds 30 minutes into the accident flight after departure from PABT.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PABT,647 ft msl	**Distance from Accident Site:**	85 Nautical Miles
Observation Time:		**Direction from Accident Site:**	212°
Lowest Cloud Condition:	Few / 8000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	30°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.87 inches Hg	**Temperature/Dew Point:**	17°C / 5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Bettles, AK (PABT)	**Type of Flight Plan Filed:**	VFR
Destination:	Deadhorse, AK (PASC)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

At 1253, the reported weather at PABT, located 85 nautical miles southwest of the accident site, included wind 030 degrees at 9 knots, temperature 17 degrees C, dew point 5 degrees C, and an altimeter setting of 29.87 inches of mercury.

At 1344, the reported weather at Chandalar Shelf Airport (5CD), Chandalar Camp, Alaska, located approximately 4 nautical miles southwest of the accident site, included wind west-northwest at 1 knot, temperature 7 degrees C, dew point 4 degrees C, and an altimeter setting of 30.04 inches of mercury.

Review of FAA aviation weather camera images at 5CD indicated that visual meteorological conditions prevailed around the time of the accident with a scattered to broken layer of clouds at approximately 8,000 feet.

Review of data from a Snow Telemetry (SNOTEL) site, located approximately 0.2 nautical miles from the accident site at an elevation of 4,800 feet, indicated that, at 1300, the wind was from 059 degrees. Peak wind was approximately 9 knots. Average wind was approximately 4 knots.

First responders also reported that, at the time of the accident, visibility in the area of Antigun Pass was in excess of 10 miles with scattered clouds at approximately 12,000 feet and wind out of the northeast at 4 to 7 knots.

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Serious	**Latitude, Longitude:**	68.075553,-149.297225

Wreckage Examination

The airplane came to rest near mile marker 244.5 of the Dalton Highway, about 100 feet below the highway on a rocky 45 to 50-degree slope, between the highway and the Trans-Alaska Pipeline. The airplane sustained substantial impact, crush, and compression damage to the wings, fuselage, and empennage. The firewall was also damaged, and the engine was canted approximately 10 degrees down from its normal mounted position. The landing gear was in the up (retracted) position. The wing flaps switch was in the full down position, and the wing flaps were partially extended. The magneto switch was in the "BOTH" position. The throttle control was in the idle position and bent upward, and the propeller pitch control was in the high rpm position. The mixture was full rich, and the carburetor heat control was off.

Engine Examination

Examination of the engine revealed that both of the magnetos remained attached to their respective installation points and were undamaged. The right magneto was missing one of its magneto housing screws, and the housing was loose. Functional testing of both magnetos revealed that they were capable of producing spark when their input shafts were rotated.

The ignition harness remained attached to the magnetos and to each of the spark plugs and was undamaged. The twelve spark plugs remained installed in their respective cylinders and were undamaged. All of the spark plugs were removed and visually inspected. The bottom No.1, No.3, and No.5 spark plug electrodes were oil coated, which was consistent with the engine position at rest. All of the spark plugs displayed normal operating signatures when compared to Champion Aviation Service Manual AV6-R. The No.5 bottom, No.2 top, and No.4 top and bottom spark plugs were in a normal worn out condition when compared to Champion Aviation Service Manual AV6-R.

The fuel pump remained attached to its respective installation point and was undamaged. The fuel pump was removed, and its drive shaft remained intact and could be rotated by hand. The carburetor remained attached to the engine and to the airbox and displayed damage consistent with impact to the mixture control components. Examination of the fuel inlet screen revealed that it was contaminated with a significant amount of material consistent with rubber, and a significant amount of particulates were found in several of the carburetor chambers. Fuel was also present within several of the chambers of the carburetor.

The induction system remained attached to the engine and to the carburetor. The carburetor airbox sustained damage consistent with impact damage. The exhaust system also remained attached to the

engine and to the airframe and sustained damage consistent with impact damage in the form of bending.

The oil cooler remained attached to its respective installation point and was undamaged. The oil sump also remained attached to the engine and was undamaged. There were no anomalies noted with the oil sump. The oil pick-up tube and screen remained installed to its respective installation point and was undamaged. The screen was clear of contaminates.

The oil pump remained installed in its respective installation point and was capable of normal rotation. The oil pump was disassembled, and it was discovered that the oil pump housing displayed scoring consistent with hard particle passage. The oil pump gears also displayed small chips in several of the gear apexes consistent with hard particle passage. The oil filter was removed, and the filter housing was cut open for examination of the filter element. The filter element was found to contain several large flakes and small metallic particulates within the oil filter pleats. The oil filter pleats were then placed into solvent, and the solvent was poured through a paper filter where additional metallic particulates were discovered in the filter.

All six cylinders remained attached to the engine. There was no spot putty noted on any of the cylinder hold down nuts, and the bases of the push rod tubes were covered with large amounts of room temperature vulcanizing sealant.

The crankshaft was rotated, and it was noted that all cylinders had good thumb compression and suction. The cylinders were removed from the engine and visually inspected. The external and internal components of the cylinders displayed normal operating signatures, and their respective pistons displayed normal operating and combustion signatures. The piston rings were also intact and free in their grooves, and the valves remained installed in their respective cylinders and were undamaged. The intake and exhaust valve heads displayed normal operating and combustion signatures. During crankshaft rotation, the valves operated normally. All of the rocker arms also displayed normal operating signatures and operated normally during crankshaft rotation.

The crankcase remained intact, and there were no signs of impact damage. The engine was disassembled, and the internal portions of the crankcase were examined. During the examination, a small crack was discovered on both halves of the crankcase forward of the No.5 main bearing at the nose seal area. There was also wear noted on the No.2, No.3, and No.4 main bearing bosses consistent with the crankshaft contacting the crankcase.

The No.1, No.2, No.3, and No.4 main bearings remained installed within their respective bearing saddles, and there were no signs of bearing shift. The bearings displayed normal wear and lubrication signatures. The No. 5 main bearing also remained installed within its respective bearing saddle; there were no signs of bearing shift; and the bearing displayed normal lubrication signatures. However, this bearing displayed damage concentrated to the rear portion of the bearing, where several large, flat portions of the bearing had peeled away from the bearing. Several portions of this bearing and case material were also found in the crankcase.

The crankshaft remained intact, and there were no signs of damage. The crankshaft gear was secure, and the bolts were safety wired. The crankshaft spline shaft displayed normal operating signatures. The crankshaft main bearing journals displayed normal operating and lubrication signatures. All of the

connecting rods were capable of rotating freely around their respective connecting rod journals. The counterweights also remained installed in their respective locations and were undamaged, and both of the counterweights were capable of normal movement around the counterweight hangers.

All six connecting rods remained intact and were undamaged. The connecting rod bolts and nuts were secure. The connecting rods rotated around the crankshaft connecting rod journals freely.

The camshaft remained intact and was undamaged. The camshaft gear was secure, and the bolts were safety wired. The camshaft lobes and journals displayed normal operating signatures. All of the lifters were also intact and displayed normal operating signatures.

All of the accessory gears were secure and displayed normal operating signatures. It was noted that both of the magneto drive supports were secured with regular nuts instead of castellated nuts and cotter keys as specified in the E-225 Parts Catalog.

The starter, the alternator, the hydraulic pump, and the vacuum pump remained attached to their respective installation points and were undamaged.

The propeller actuator remained attached to its respective installation point, and the oil lines remained secured. The propeller governor remained attached to its respective installation point and was undamaged.

Propeller Examination

The propeller remained attached to the engine. The engine to propeller mounting was intact; however, the mounting nut was not torqued down and was removed with little effort. One propeller blade was missing and was not recovered. The other propeller blade was bent aft about 90-degrees at mid-span and was wedged into the engine cowling. The last 6 inches of the bent propeller's blade tip had separated, and the separated section was recovered at the accident site. The bent propeller blade exhibited rotational scoring, gouging, and scrapes. The propeller blade clamp of the bent propeller blade was intact; however, one of the propeller blade clamp bolts was loose.

There were large amounts of grease in the hub butt of the missing propeller blade, but there was no indication of the grease being thrown out of the hub butt in a centrifugal pattern. Two of the four bolts of the propeller blade clamp of the missing blade were broken, and the flange of one of the clamp halves was fractured. The bolt head of one of the broken propeller clamp bolts was lying inside the clamp bolt cup of the propeller clamp.

The low and high pitch stops, the piston, and the hydraulic bladder diaphragm were all intact and unremarkable. The cylinder was also intact; however, the guide for the arm was fractured. The propeller hub unit was impact damaged. Both propeller blade pilot tubes were impact damaged and fractured. Both the mounting flange and cylinder attachment were intact and unremarkable. A shiny crescent shaped contact mark indicative of aluminum transfer was visible on the hub butt of the missing blade, in the aft quadrant where the trailing edge of the blade would have been.

Propeller Governor Examination

The propeller governor was still attached to its T-drive assembly. Both the drive shaft of the T-drive and the governor drive gear could be freely rotated by hand, and there was no metal debris in the governor gasket screen. The control lever of the governor, which controls rpm setting, rotated freely by hand; the flyweights could rotate freely about their pivot point; and the metering spool would slide freely within the operating range of the spool. The propeller governor pump gears and shaft did not show any abnormal wear, nor did the wear surfaces of the governor base and body where it came into contact with the gears. There was no metal debris found in the pump cavity, and examination of the relief valve did not reveal any evidence of preimpact failure or malfunction that would have precluded normal operation of the propeller governor.

Flight recorders

The airplane was not equipped with a cockpit voice recorder or flight data recorder, nor was it required to be by federal regulations. Two still photo cameras and one video camera that belonged to the passengers and a Garmin GPSMAP 196 handheld Global Positioning System (GPS) receiver that belonged to the pilot were onboard the airplane.

Passenger Photographs

Photographs taken during the flight were recovered by the FAA from one of the still photo cameras. Examination of these photographs indicated that, during the accident flight, the airplane was flown in close proximity to the ground and obstructions (including a highway bridge and the Trans-Alaska Pipeline) and at altitudes below the tops of the surrounding mountains.

Pilot's GPSMAP 196

The global navigation satellite system, known as the GPS, provides geolocation and time information to GPS receivers where there is an unobstructed line of sight to four or more of the satellites in the network of 24 satellites placed into orbit by the U.S. Department of Defense. Review of FAA documents titled "Global Positioning System (GPS) Standard Positioning Service (SPS) Performance Analysis Report #87" and the "Civil Report Card on GPS Performance August 2014" indicated that the GPS was functioning normally on the day of the accident.

Data from the pilot's handheld GPS receiver was downloaded in the NTSB Vehicle Recorders Laboratory. The device contained data for 10 flights with the accident flight being the last flight recorded on the device. Review of the data for the 9 previous flights indicated that the device departed from and arrived at known, geographically surveyed airports on each flight. The data for the accident flight indicated that the device departed from PABT, and the last recorded position corresponded with the GPS-surveyed location of the accident site. Review of the data indicated that the device was recording positions within its specified tolerance of 49 feet, and there were no indications that the device was indicating or recording positions that were inaccurate or inconsistent with surveyed points such as runways and taxiways.

According to the data for the accident flight, the airplane departed from PABT about 1201:15 and made one circle around the town of Evansville immediately after takeoff while climbing to a calculated altitude of 500 feet agl. The airplane's track then generally followed the Koyukuk River to the northeast, while maintaining about 500 feet agl. About 1248, the airplane made four circles at the point where the Koyukuk joined the Dietrich River. While circling, the calculated altitude reached a low of 139 feet agl. The track then continued north along the Dietrich River and climbed back to a calculated altitude of about 500 feet agl. About 1302, the airplane passed 5CD heading north towards Atigun Pass following the Dalton Highway.

During the final 10 minutes of the flight, the airplane was climbing. However, the airplane's height above the surveyed terrain began to decrease as the ground elevation rose faster than the airplane was climbing. In the final 2.5 minutes of the flight, ground speed decayed from 105 knots to 41 knots, and, during the final minute of the flight, calculated height above ground level decreased from 682 feet to 36 feet. The last recorded data point, at 1304:52, indicated the airplane was at 4,564 feet GPS altitude (a calculated altitude of about 36 feet agl) in a shallow climb with a ground speed of 41 knots.

Passenger Video Camera

Two video files were recovered from a video camera belonging to one of the passengers. Examination of the files revealed that the camera's lens was obscured rendering the images from the files unusable. However, the audio portion of each file was extracted, and the two audio tracks were joined to form a single 29 minute 59 second (29:59) track. Insufficient information was available for a time correlation to be created for either of the two video files so elapsed video time was used for event identification purposes. The recording started at some unknown time after the airplane came to rest as first responders were heard assisting the occupants of the airplane at the accident site. From the onset of the recording until approximately 20:40, a female passenger located near the camera's microphone was heard speaking in an unknown language. Her voice made it difficult to hear the conversations between the first responders and the airplane's occupants in the background of the recording. However, as the recording progressed, the first responders were heard moving from passenger to passenger to assist in their extrication.

Around 22:00, the first responders had begun to focus on extricating the right front seat passenger. Later, around 22:37, a first responder was heard in the background of the recording making a statement to an unknown party that "everybody's conscious."

Around 23:03, a first responder was heard saying to an unknown party, "the pilot's (like) * * belly, belly landed on a rock. * * *the pilot said that uh, he felt the first draft, downdraft, at (which/that) time (it's a) * * " The rest of the comment became inaudible as a conversation began to take place between a first responder and a passenger in closer proximity to the camera's microphone.

At 23:46, a first responder stated in reference to the right front seat passenger, "he's got his seatbelt and * * other shoulder harness," and another responder was heard saying, "oh your seatbelts on right here? K' hold on lemme get ya." The first responders continued giving instructions on how the front right seat passenger should move his body as they worked on extricating him from the airplane wreckage. The recording ended at 29:59 as the first responders were still attempting to extricate the right front seat passenger.

Medical and Pathological Information

On September 28, 2014, 35 days after the accident, the right front seat passenger died. According to the Office of the Chief Coroner, Province of New Brunswick, Canada, the passenger's cause of death was a pulmonary artery embolism as a result of the injuries he sustained during the accident.

Tests and Research

American Testing Services, Ltd., examined the missing propeller blade's cracked clamp half and the two fractured propeller blade pilot tubes at the request of Hartzell Propeller. The metallurgical examinations found no evidence of fatigue cracking and determined that the crack in the clamp half and the fractures of the pilot tubes were the result of overload.

Organizational and Management Information

Kirst Aviation, FAA designator code K70A, was owned by the pilot and based at PAFA. The pilot provided flight instruction, aircraft rental, on-demand charters, and other specialized services.

On December 27, 2009, the pilot submitted an application for a single-pilot 14 CFR Part 135 Air Taxi certificate to the FAA. On August 29, 2012, the FAA issued an Air Carrier Certificate to the pilot.

FAA records on the pilot, including Program Tracking and Reporting Subsystem (PTRS) records that were released by the FAA in response to a Freedom of Information Act (FOIA) request by an attorney representing the pilot and documents provided by the FAA to the NTSB regarding the certification of Kirst Aviation, were reviewed; these records included the following information:

• On February 7, 2008, as a result of the pilot's December 26, 2007, accident, the FAA sent a letter of reexamination to the pilot to evaluate if he was qualified to hold a flight instructor certificate. The reexamination consisted of the pilot's knowledge of the Piper PA-22's systems and his judgement in selecting safe landing areas before attempting to land. On February 27, 2008, an oral reexamination of the pilot was conducted, and the results were satisfactory.

• On November 16, 2009, as a result of the pilot's November 14, 2008, accident, the FAA proposed a

120-day suspension of the pilot's certificates. The final duration of the suspension was 60 days.

• On April 24, 2011, the pilot was acting as pilot-in-command on an instructional flight when the landing gear on the accident airplane failed to fully extend. During landing roll, the propeller contacted the runway, and the airplane then veered off the runway and struck a snow bank. As a result of this incident, on June 23, 2011, the pilot was reexamined by an FAA inspector for his commercial pilot single engine privileges. During the reexamination, the pilot received both an oral and flight evaluation, and special emphasis was given in the areas of emergency landing procedures, hydraulic failure emergencies, engine out procedures, approach to stall, and aeronautical decision-making. The results of the reexamination were satisfactory.

• A memorandum dated December 6, 2011, sent from the Certification Manager of the Fairbanks FSDO to the Alaska Region Division Manager (AAL-200), recommended termination of the certification process for Kirst Aviation. The memorandum stated, "[the pilot] has demonstrated poor judgment, a lack of knowledge, and failure to comply with the Federal Aviation regulations on multiple occasions and his record demonstrates an inability to conduct safe operations under Part 135."

• A second memorandum dated December 20, 2011, sent from a Technical Operations Specialist (AAL-232) to the Alaska Region Division Manager (AAL-200), supported the recommendation made in the December 6, 2011, memorandum "to deny the certification request submitted by [the pilot] for Kirst Aviation." The memorandum cited 14 CFR Part 119.39(b)(1), which states that "an application for a certificate may be denied if the administrator finds the applicant is not properly or adequately equipped or is not able to conduct safe operations." The memorandum stated, "it is clear, based on [the pilot's] history of accidents and lack of ability to comply with Air Traffic Control (ATC) instructions, that he has not exemplified the characteristics of someone who could adequately conduct safe operations as is required by the above listed regulation."

• On July 17, 2012, during a 14 CFR Part 135.293(a) checkride in the accident airplane, the pilot failed to perform steep turns within commercial pilot test standards. After the failure, the pilot elected to continue the checkride. During the next maneuver, which was an approach to landing stall, the "GEAR UNSAFE" light remained on when the landing gear was selected to the down position. The checkride was then discontinued, and the pilot landed the airplane without incident.

• PTRS entries indicated that, during a 14 CFR 135.293 checkride, the accident airplane began to leak engine oil. There were PTRS entries regarding this checkride dated August 10, 2012, and August 24, 2012, and the exact date of the checkride could not be determined from the available records. When the oil leak occurred, the pilot turned towards PAFA and started a descent. The FAA inspector administering the checkride advised the pilot to maintain altitude until within gliding distance of the airport in case the engine seized, and the pilot complied.

The landing at PAFA was uneventful. During post flight inspection, the oil filler cap was found hanging from its chain. The pilot stated that he was not sure how the cap came off. The FAA inspector put the cap back on, checked it for tightness, and determined that the cap could not have come loose if it was securely put on.

• A PTRS entry dated August 10, 2012, stated that a recheck was done, and the pilot completed all of the

required elements from the checking module within minimum standards. The entry also stated that the pilot was "reevaluated on emergency engine out procedures (not descending too soon during an engine issue)" with satisfactory completion. The PTRS entry did not specify the date of the recheck.

• A PTRS entry dated August 29, 2012, stated that an FAA inspector "administered a continuation of a 14 CFR 135.293(a) checkride after the first attempt was unsatisfactory followed by an illuminated gear unsafe light." The PTRS entry did not specify the date of the checkride. During this checkride, the pilot was asked to demonstrate a normal landing and had to "add a significant power increase on final to make the runway." When asked to demonstrate a short field landing, the pilot again had to "add significant power to make the runway." When asked to demonstrate a simulated engine failure to a landing, it became evident to the FAA inspector that the airplane would not make the runway, and he instructed the pilot to go around. The checkride was discontinued with the emergency landing being unsatisfactory. During the postflight debriefing, the pilot stated that he could have made the runway area.

At the request of the NTSB investigator-in-charge, the FAA's Office of Accident Investigation (AVP-100) reviewed certain documents deemed privileged by the FAA and made inquiries within the FAA in an effort to provide NTSB with additional information regarding the issuance of the commercial air carrier certificate for the operator. A letter dated June 17, 2016, from the Manager of AVP-100 to the NTSB investigator-in-charge stated, in part:

"As you are aware from the documents that were provided to you as part of your request submitted to my office, several FAA employees raised concerns about the approval of the operator's application for an air carrier certificate that was granted two years prior to the accident. My review and inquiries have revealed that FAA personnel debated internally regarding these concerns. Some of the deliberations were mentioned in the draft documents and emails that were provided to you. Those records – which should not be construed as final agency decisions – mostly indicate that FAA inspectors were seeking legal and managerial advice regarding the disposition of the operator's Part 119 application for a Part 135 commercial air carrier certificate.

Aside from the contents of these documents, my review indicates that the majority of the deliberations regarding these concerns occurred verbally – either in person or over the telephone – and I found no additional records that documented these discussions. Also, I found that these deliberations occurred sporadically over an 8-month period – from December 2011 through August 2012 – and involved several FAA inspectors, managers, attorneys and other staff who held positions in the Office of Flight Standards (AFS) and the Office of Chief Counsel (AGC) located at FAA Headquarters in Washington, DC, the Alaska Regional Office in Anchorage, and the Flight Standards District Office (FSDO) in Fairbanks.

Ultimately, in late August 2012, the aircraft operator completed the Part 119 process and was issued a certificate by the Fairbanks FSDO to conduct commercial air transportation pursuant to Part 135. Implicit in the decision to grant this authorization is the Agency's judgment that the operator met the minimum requirements of Part 119.

In the specific case of the referenced aircraft operator, the FAA evaluated the strength and weaknesses of the documented evidence presented by the applicant for the certification, as well as the documented

evidence from those AFS individuals that were concerned about the certification. As a result of these evaluations, the Agency determined that an adequate basis to summarily deny the applicant the opportunity to obtain a Part 135 certificate did not exist.

According to staff in FAA's Office of Chief Counsel, applicants for an air carrier certificate are not denied solely on the basis of a single violation or a previous accident. The Agency has a legal obligation to utilize its authority for certification that is based on substantiated facts, not individual inspector opinions and innuendo. The FAA strives to ensure its actions of granting and denying certificates are not arbitrary and capricious."

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Jason Major; FAA/FSDO; Fairbanks, AK Kurt Gibson; Continental Motors Incorporated; Mobile, AL Frederick K Distad; Arctic Aviation Incorporated; Fairbanks, AK Jason Kobi; TSBC; Vancouver Jim McMenemy; Transport Canada; Ottawa Les Doud; Hartzell Propeller Inc.; Piqua, OH
Original Publish Date:	March 8, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89947