

Aviation Investigation Final Report

Location:	SKAGWAY, Alaska		Accident Number:	ANC97FA097
Date & Time:	July 3, 1997, 17:30	Local	Registration:	N15199
Aircraft:	Piper	PA-32	Aircraft Damage:	Destroyed
Defining Event:			Injuries:	4 Fatal, 1 Minor, 1 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Sightseeing			

Analysis

The aircraft (acft) was on an air taxi/sightseeing flight (flt), which was an optional tour to a cruise liner trip. After viewing glaciers, flt was returning to land. Approach to airport (arpt) was along inlet shore, which had steep mountains descending to the water & infrequent areas of small beach. About 1,200' above water & 1-1/2 mi from arpt, engine lost power. Acft was ditched about 100' from shore near small cliffs. Passengers (pax) exited 1st into 39 deg water, but none exited with life vests. Plt threw one life vest out & exited as acft sank. With help from her husband, a pax donned the life vest that was thrown out; she partially inflated it using oral inflation tube, although it had CO2 cylinder for rapid inflation. Rescue helicopter arrived in about 10 min. Pax with life vest & plt were rescued; 2 pax drowned; other 2 pax were not found. Surviving pax did not recall briefing about location or use of life vests. Life vests were stored in seat-back pouches, but pouch openings were covered by slip-cover type seat covers. Exam of engine revealed left magneto impulse coupling had failed, stopping rotation of magneto drive gear. Several gear teeth on intermediate idler gear were damaged, disconnecting crankshaft from accessory gear train.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: jamming/failure of the left magneto impulse coupling, which stopped rotation of the magneto gear, and resulted in subsequent shearing of the accessory intermediate idler gear. Factors relating to the accident were: the lack of suitable terrain for a forced landing, which necessitated ditching of the aircraft; the passenger's lack of awareness concerning access to life vests, due to the pilot's inadequate briefing and the seat covers being installed over pouches that held the life vests; insufficient company standards/procedures regarding access to life vests.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF Phase of Operation: APPROACH

Findings 1. (C) IGNITION SYSTEM, MAGNETO - JAMMED 2. (C) ACCESSORY DRIVE ASSY, DRIVE GEAR - SHEARED

Occurrence #2: FORCED LANDING Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: DITCHING Phase of Operation: EMERGENCY LANDING

Findings

- 3. (F) TERRAIN CONDITION NONE SUITABLE
- 4. (F) TERRAIN CONDITION WATER

5. (F) PASSENGER BRIEFING - INADEQUATE - PILOT IN COMMAND

6. (F) MISC EQPT/FURNISHINGS, SURVIVAL EQUIPMENT - RESTRICTED

7. (F) EMERGENCY EQUIPMENT - NOT OBTAINED - PASSENGER

8. (F) INSUFFICIENT STANDARDS/REQUIREMENTS - COMPANY/OPERATOR MGMT

Factual Information

HISTORY OF FLIGHT

On July 3, 1997, about 1730 Alaska daylight time, a wheel equipped Piper PA-32 airplane, N15199, ditched in the ocean about 1 1/2 miles southwest of Skagway, Alaska. The airplane was being operated as a visual flight rules (VFR) sightseeing flight under Title 14 CFR Part 135 when the accident occurred. The airplane, registered to and operated by Haines Airways Inc., Haines, Alaska, sank after ditching. The certificated commercial pilot was not injured. One passenger sustained minor injuries. Two passengers received fatal injuries. Two additional passengers were not located, and are presumed to have received fatal injuries. Visual meteorological conditions prevailed. VFR company flight following procedures were in effect. The flight originated at the Haines Airport, at 1640.

The flight was one of several airplanes utilized to provide sightseeing flights for cruise liner passengers. The passenger's cruise ship was docked in Skagway, and the accident flight was the second portion of an eagle viewing/glacier tour from Skagway to Haines, and return. Following the departure from Haines, the flight proceeded to overfly several glaciers, and then flew north into the Taiya Inlet. The terrain in the inlet is comprised of steep mountains that descend to the water with infrequent areas of small beach. Voluntary traffic flow procedures for airplanes operating into, and out of Skagway, have been established by agreement with the Federal Aviation Administration (FAA), and operators in the area. In-bound airplanes to Skagway fly northbound along the west shoreline of the Taiya Inlet. Position reports are usually made by arriving pilots at Taiya Point, Long Falls, and Burrow Creek.

The pilot reported she was proceeding northbound along the west side of the Taiya Inlet about 1,500 feet mean sea level. She was slowly descending for landing with the airplane positioned between 1/4 to 1/2 mile from the shore. As the flight was approaching Burro Creek, a VFR reporting point that is about 2 miles southwest of Skagway, the engine began to lose fuel pressure, and then stopped. At that time, the airplane was about 1,200 feet msl. Emergency procedures failed to restore engine power.

The pilot transmitted several radio calls for assistance, stating among other calls, "I need help" several times. Other company pilots heard the radio calls from the accident airplane, and attempted to offer suggestions over the radio. The pilot initially made a right turn in a northeast direction, toward runway 01 at Skagway. The pilot determined the airplane lacked sufficient altitude to glide across the inlet to the Skagway Airport, and made a left turn toward the west shore of the Taiya Inlet. The pilot selected full flaps, and ditched the airplane about 100 feet from the west shoreline of the inlet.

Following water contact, the pilot indicated the front seat and middle seat occupants exited

the airplane through the right front door. The rear seat occupants exited through the left rear door. All occupants successfully evacuated the airplane into the water. The water temperature was estimated at 39 degrees F. Following water impact, the pilot of the accident airplane was heard over the radio to yell, "get out" several times.

A tour helicopter based in Skagway was following the accident airplane into Skagway, and was about 1 mile behind the airplane. The pilot of the helicopter observed the airplane in the water and orbited over the scene. The helicopter pilot reported observing five persons near the sinking airplane. The occupants of the helicopter threw several life vests into the water in an attempt to aid the survivors. The helicopter pilot requested additional help, and a second helicopter responded to the scene within 10 minutes. The two survivors were pulled from the water by the crew of the second helicopter, and air-lifted to Skagway.

The accident occurred during the hours of daylight at latitude 59 degrees, 26.98 minutes north, and longitude 135 degrees, 21.76 minutes west.

CREW INFORMATION

The pilot holds a commercial pilot certificate with airplane single-engine land, single-engine sea, multiengine land, and instrument airplane ratings. In addition, the pilot holds a flight instructor certificate with airplane single-engine, and instrument airplane ratings. The most recent first-class medical certificate was issued to the pilot on September 10, 1996, and contained no limitations.

The pilot completed her basic indoctrination training on April 15, 1997. She received her Part 135 pilot check-flight on April 21, 1997, and her route check flights on April 24, 1997.

According to the operator, the pilot's total aeronautical experience consists of about 1,815 hours, of which 200 hours were accrued in the accident airplane make and model. In the preceding 90 and 30 days prior to the accident, the pilot accrued a total of 189 and 106 hours respectively.

A review of the pilot's flight and duty records revealed that on June 30, 1997, the pilot worked from 0500 to 1430, and accrued 3.17 flight hours. On July 1 and July 2, 1997, the pilot worked from 0500 to 1830. The flight hours accrued on those days were not noted. The pilot began work at 0500 on the day of the accident.

AIRCRAFT INFORMATION

The airplane had accumulated a total time in service of 4,688.9 hours. Examination of the maintenance records revealed the most recent annual inspection was accomplished on October 14, 1996, 747.8 hours before the accident. In addition, a 100-hour inspection was completed on June 26, 1997, 47.5 hours before the accident.

The airplane was equipped with a Lycoming, IO-540-K1A5, engine. The engine was purchased from West Star Aviation Inc., Grand Junction, Colorado on September 25, 1996, as an exchanged, "0" time engine. West Star Aviation certified the engine as a: "Gold Star zero time equivalent engine per Lycoming manual 60294-7-4. Engine and accessories were remanufactured to factory new tolerances." The previous total time on the engine was 3,742.2 hours.

According to West Star personnel, the engine crankcase was cracked adjacent to the number 4 cylinder. The crankcase was sent to Div Co, Inc., Tulsa, Oklahoma, for welding and machining. Div Co personnel reported the crankcase was repaired on September 5, 1996. The repair included machining of the case-half mating surfaces, and welding and reboring of the magneto bearing bore holes, located at the aft end of the crankcase.

Since the engine was installed in the accident airplane on October 14, 1996, the engine had accrued 747.8 hours. The engine annual and 100 hour inspections, coincided with the airframe inspections.

The engine is equipped with Slick magnetos, part number 6351 for the left magneto, and part number 6350 for the right. The left magneto is equipped with an impulse coupling, part number M3333. The magnetos are subject to a recurring 500 hour inspection. That inspection was conducted by the operator on May 16, 1997, at 500.7 hours of service.

During normal operation, the engine accessory gears are turned either by the starter (during engine start), or by normal engine operation. When viewed from the aft end of the engine, looking forward, the crankshaft gear rotates clockwise. The crankshaft gear drives two intermediate idler gears in a counterclockwise direction. The idler gears drive the left and right engine magneto drive gears clockwise. The magneto drive gear mates to a rotating bearing installed in a bearing bore hole. The bearing bore is drilled into the aft end of the engine crankcase.

An impulse coupling is utilized to delay magneto spark during engine starting until the engine pistons have reached top dead center. The coupling consists of a hub assembly mounted on the magneto shaft. The hub assembly is comprised of a heel plate, on which two impulse pawls are attached by rivets. The rivets serve as an axle for the pawl, and are welded to the bearing plate. The rivet is used to secure the pawl plate assembly together by compressing the pawl plate, and the bearing plate together.

The impulse pawls pivot on the rivets during starting to engage a stop pin located on the magneto frame. When stationary, two thin wire impulse pawl retracting springs, installed between the impulse pawls and the pawl plate, serve to position the latching end of each pawl outward toward the stop pin during engine start. A coil spring is installed between the impulse coupling and the impulse shell. The shell covers the spring and hub assembly. The shell has two drive lugs on its outer surface that mate to the magneto drive gear. Two rubber cushions are installed around the impulse shell lugs, between the drive gear edge and the impulse shell

drive lugs. The shell also has two impulse trip lugs located on the outer skirt of the shell that releases the impulse pawls as the shell rotates past the stop pin.

During engine start, usually below about 200 RPM, the impulse coupling pawls rotate outward. The latching end of the pawl engages the stop pin, which momentarily holds the magneto shaft from turning. As the magneto shaft is being held stationary, the impulse shell continues to be turned by the magneto drive gear, winding up the impulse coupling spring. As the impulse coupling shell rotates, its trip lugs contact the outer edge of the stationary impulse coupling pawl, and the pawl is disengaged from the stop pin. When the pawl is released, the energy stored in the coupling spring is released, briskly rotating the magneto rotor shaft. This momentary engagement/disengagement cycle occurs during every engine start sequence. Above about 350 RPM, centrifugal force acts on the counterweighted impulse coupling pawls to cause them to retract away from the stop pin.

The pilot and surviving passenger indicated the airplane engine was hard to start when the flight initially departed Skagway. The engine start required between 5 to 7 minutes. The engine start in Haines, on the accident flight, was uneventful.

The airplane's front and middle row of seats, were equipped with a pouch installed on the aft facing side of the upright, seat-back portion of each seat. The pilot's seat pouch, equipped with a zipper for closure, was positioned about 2/3 the way up the back of the seat. The passenger seat pouches, equipped with an elastic closure, were positioned about mid-height on the seat backs. Each seat pouch contained an airplane briefing card. The pouch also contained an inflatable life vest that is encased in plastic wrap. The seat assemblies had acrylic/sheep-skin type seat covers installed that slipped over the top of the seat-back, and also over the bottom cushion of the seat. The aft, bottom edge of the seat back portion of each seat cover, as installed, slipped down over the opening of the seat back pouches. The life vests for the front seat occupants were stored in pouches located at the lower portion of each side of the cockpit, below the instrument panel, and forward of the seats. The airplane's seat cushions are not designed for, nor are they required to be, a floatation device.

The briefing card contained in the airplane was produced by the Piper Aircraft Corporation for PA-32 and PA-34 series airplanes. It is designed as a supplement to the pilot's passenger briefing. The card contains text, and visual descriptions about adjusting the seats, a no-smoking caution, the use of seat belts, the use of oxygen, the operation of the cabin doors, and the use of the doors as emergency exits.

METEOROLOGICAL INFORMATION

The closest official weather observation station is Skagway, which is located 1.5 nautical miles northeast of the accident site. On July 3, 1997, at 1653, an automated aviation weather observation system, aviation routine weather report (METAR) was reporting, in part: Wind, 100 degrees (true) at 14 knots, wind varies between 080 and 220 degrees; visibility, 10 statute miles; clouds, 5,500 feet overcast; temperature, 65 degrees F; dew point, 52 degrees F;

altimeter, 30.10 inHg.

COMMUNICATIONS

During the emergency, the pilot transmitted a radio call for help on the common traffic control frequency (CTAF) of 122.9 MHz. CTAF communications are not recorded in the Skagway area.

AERODROME AND GROUND FACILITIES

The Skagway airport is equipped with a single hard-surfaced runway on a 010 to 190 degree magnetic orientation. Runway 01 is 3,750 feet long by 75 feet wide.

WRECKAGE AND IMPACT INFORMATION

The airplane was ditched and sank, about 100 feet from an area of near vertical rocks. The wreckage was located by recovery divers at a depth of about 153 feet. The wreckage was recovered in the presence of the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) on the night of July 9, 1997, by hoisting the airplane vertically out of the water by a cable attached to the propeller assembly. The wreckage was examined at Skagway, Alaska, on July 10, 1997, by all parties to the investigation, except the representative from Unison Industries.

All of the airplane's major components were found at the main wreckage area. The right wing exhibited upward and aft crushing on the underside of the leading edge, about 12 inches outboard from the wing root. The underside of the wing exhibited upward crushing in the area of the inboard fuel cap. The right main landing gear strut housing was bent aft about 45 degrees. The upper end of the strut housing was displaced upward through the upper surface of the wing. The interior strut sleeve and the right main wheel were missing.

The left wing was separated, torn and crushed in an aft direction, about 2 feet outboard from the wing root. The vertical face of the forward spar web exhibited a 90 degree twist and separation, with the bottom edge of the spar rolled forward, and the upper edge of the spar rolled aft. The wing exhibited upward bending about midspan, and upward and inward crushing to the underside of the wing at the point of separation. During the recovery of the airplane, the left wing twisted 180 degrees with the left main landing gear oriented upward.

The right stabilator exhibited minor wrinkling, and slight downward crushing of the upper surface. The left stabilator displayed minor damage to the outboard end of the fairing.

The left rear door of the airplane was unlatched. The upper door latch was unlocked.

The flight control surfaces remained connected to their respective attach points, and flight control system cable continuity was established throughout the airplane.

The manual flaps were found retracted. The elevator trim tab actuator was found extended three threads. According to the airplane manufacturer, the extended trim tab actuator threads do not correspond to an exact degree setting. Known points of measurement on the accident airplane make and model are as follows: zero threads extended equates to 5 degree tab up, (nose down) setting. Five threads extended equates to a neutral, or zero tab setting.

The nose gear assembly remained attached to the airplane, but was folded aft and upward against the bottom of the fuselage.

The propeller assembly remained connected to the engine crankshaft, and both blades were loose in the hub. One propeller blade exhibited minor aft bending about midspan. The second blade exhibited about 45 degrees of aft bending about midspan, and very slight torsional twisting.

The crankshaft could be rotated by the propeller. Hand rotation of the crankshaft did not produce any accessory gear or valve train movement.

The right magneto did not exhibit any damage, and was free to rotate by hand. The left magneto exhibited the presence of metal slivers and shavings around the magneto flange. The impulse coupling shell was cracked, and unable to be rotated by hand. The magneto pawls were observed extending beyond the impulse coupling shell. The left magneto accessory drive gear exhibited a broken gear tooth.

The electric engine boost pump operated when electrical power was attached to the pump.

Seat number 2B was found loose from its seat track attachment. No damage was observed to the seat latching mechanism.

Search personnel recovered floating wreckage from the accident site. These items included three un-inflated Air Mate life vests, personal items, and an airplane antenna. The airplane's right main wheel and strut was recovered. The wheel strut was bent slightly about midspan. In addition, an Eastern Aero Marine life vest inspection tag, was found floating in the water. The inspection tag indicated an EAM, GA-12 life vest had been inspected on October 9, 1996. The inspection tag was signed by a mechanic from the operator's maintenance department.

MEDICAL AND PATHOLOGICAL INFORMATION

Medical personnel at the Skagway Medical Clinic reported the surviving occupants exhibited symptoms of mild hypothermia. The deceased passengers did not exhibit any obvious signs of trauma. Postmortem examinations were not conducted.

SURVIVAL ASPECTS

Federal Aviation Regulation (FAR) 14 CFR Part 135.117, 'Briefing of Passengers Before Flight',

includes language that requires the pilot or crew member to orally brief the passengers on topics of smoking; the use of seat belts; the placement of seat backs in an upright position; the location and means for opening the passenger door and emergency exits; the location of survival equipment; ditching procedures and the use of floatation equipment, if the flight involves extended over-water operation; the use of oxygen; the location and operation of fire extinguishers; and evacuation procedures for persons needing assistance from another person. The oral briefing shall be supplemented by printed cards carried in the airplane, in locations convenient for the use by each passenger. The printed cards must be appropriate for the aircraft in use, contain a diagram and method for operating the emergency exits, and contain instructions necessary for the use of emergency equipment on board the aircraft.

During the accident flight briefing, the pilot stated she provided the passengers with the location of the life vests (in the seat back pouch). The pilot is not required to demonstrate the use of a life vest, nor was such a demonstration provided.

The surviving passenger recalled the accident flight briefing consisted of the location of the fire extinguisher, and the location of a briefing card (in the seat back pouch). The passenger noted the briefing card was not visible, and it was hard to locate the pouch containing the card. The back of the seat, including the pouch, was covered by the seat cover. The passenger recalled the pilot included a joking reminder that passengers were not to run up and down the isles, no drinks would be served, and passengers were not to throw popcorn. The passenger did not recall any briefing about the location or use of the life vests, or door opening procedures.

Following water impact, all of the passengers egressed from the sinking airplane. The pilot indicated she pulled a life vest from the lower right front pouch of the airplane, located adjacent to the right front door, and threw it out of the airplane, into the water.

The surviving passenger reported her husband located the life vest that was thrown from the airplane by the pilot, and placed the life vest over her head after they were both in the water. The passenger indicated she was not aware the vest had an inflation cylinder. At one point, while in the water, the passenger noticed the mouth inflation tube on the life vest when it bumped into her face. She indicated she attempted to blow air into the tube, and partially inflated the vest. No other life vests were taken from the accident airplane. With the exception of the life vest on the surviving passenger, all of the accident airplane life vests were located in the airplane.

The accident airplane life vests, model EAM GA-12, were manufactured by Eastern Aero Marine, part number PO201-105. The life vest is a horse collar type of device which is placed over the head, and is secured by straps that are tied around the waist. The life vest has one CO2 cylinder, and an oral inflation tube utilized to inflate the vest.

14 CFR Part 135.183, 'Performance Requirements: Land Aircraft Operated Over Water', states, in part: "No person may operate a land aircraft carrying passengers over water unless - (a) It is

operated at an altitude that allows it to reach land in the case of engine failure. (b) It is necessary for takeoff and landing... (d) It is a helicopter equipped with helicopter floatation devices."

United States Coast Guard data indicates that typical survival times in water having a temperature of 32.5 to 40 degrees F, without any floatation device, is between 15 to 30 minutes. The survival time for a person wearing a life vest is between 50 to 90 minutes.

The pilot of the first helicopter to arrive at the scene, estimated the accident airplane was completely submerged in about 60 seconds.

SEARCH AND RESCUE

During the emergency landing, the pilot was providing her location to any, and all aircraft, and the airplane was observed by several other aircraft. A helicopter, operated by Temsco Helicopters, Skagway, was following the accident airplane into Skagway, and was the first aircraft over the crash scene. Passengers from the helicopter dropped life vests into the water.

A second Temsco helicopter, departed their facility at Skagway with a pilot and a ramp agent to respond to the accident scene. The crew estimated they were on-scene in 10 minutes. Upon arrival, they noted two surviving occupants, and two occupants floating face-down. The missing passengers were not observed. The helicopter pilot inflated the emergency floats, and landed on the water. The ramp agent pulled the survivors into the helicopter, and landed at Skagway, where medical personnel were assembled. Several boats from the Skagway harbor also responded to the scene, and recovered the two observed deceased passengers. The search vessels also recovered three life vests that belonged to Temsco.

TESTS AND RESEARCH

An examination of the engine was conducted on October 15, 1997, at the Textron Lycoming facility in Williamsport, Pennsylvania. All of the parties to the investigation, except a representative from The New Piper Aircraft Inc., attended the examination. Removal of the engine sump revealed four broken gear teeth from the left intermediate idler gear, one broken gear tooth from the left magneto drive gear, metal shavings, and one impulse pawl retracting spring. The sump screen contained several flakes of metal, and a second impulse pawl retracting spring. Metal flakes and slivers were found in the engine oil filter element. The engine sump baffle exhibited loose rivets that retain two slosh baffle fins. Two missing intermediate idler gear teeth were not located.

Removal of the accessory gear cover revealed the left magneto drive gear was missing one gear tooth. The left intermediate idler gear has two rows of gear teeth. The outer row of teeth that mate to the magneto drive gear, was missing six teeth. The circumferential pattern of missing idler gear teeth was three successive missing teeth, one intact tooth, then three

additional missing teeth. The crankshaft gear dowel pin was sheared. The crankshaft gear retaining bolt was lose. The head of the bolt was gouged and peened. An attempt to remove the bolt resulted in a shearing of the bolt. The shaft of the bolt appeared to have received damage prior to the attempt to remove it.

An examination of the crankshaft drive gear revealed three cracked teeth located just to the right (clockwise) from the dowel pin hole. The cracks are located at the base of the driving side of the gear teeth.

A closer examination of the left magneto drive gear revealed an indentation on the driven side of the gear tooth, preceding the broken tooth. The broken tooth exhibited an indentation, also on the driven side of the tooth. The driven side of the gear tooth following the broken tooth, exhibited a small indentation.

The left magneto drive gear bearing exhibited a fracture along the edge of the inner bearing race. The left magneto bearing bore exhibited gouging of the inboard edge of the bore hole, adjacent to the intermediate idler gear.

The position of the left magneto drive bearing bore was measured by Lycoming personnel on October 22, 1997. An FAA inspector from the Harrisburg FSDO, New Cumberland, Pennsylvania, was in attendance for the measurement. The manufacturer's specification for the center of the bore, measured from the center of a master disk positioned in the crankshaft bore, is 3.860 to 3.862 inches. The position of the magneto bearing bore was found to be 3.873 inches.

The magneto drive gear, and the intermediate idler gear, along with the separated portions of gear teeth, were sent to the NTSB's Materials Laboratory. An examination revealed overload signatures on all of the gear teeth.

An examination of the engine magnetos was conducted on November 12, 1997, at the Unison Industries facility in Rockford, Illinois. Safety Board personnel from the North Central Regional Office, Chicago, Illinois, directed the examination. All the parties to the investigation were in attendance, except a representative from Haines Airways Inc. An examination of the left magneto, serial number 9608353, revealed about a 3 inch long portion of the magneto flange, and inner pilot flange, was broken away from the magneto case, adjacent to the stop pin. One of the impulse shell trip lugs exhibited impact damage on the leading edge of the lug in the direction of rotation. Just forward of the damaged trip lug, the impulse shell was fractured vertically from the spring eyelet anchor point in the shell shirt. The fracture continued horizontally across the face of the shell to the center hole of the shell. At the aft edge of the opposite trip lug, the impulse shell skirt exhibited a vertical crack. The shell exhibited about a 30 degrees bend, transverse through the center of the shell.

Removal of the pawl plate revealed gouging and shaving of metal on the magneto frame beneath the pawl plate. An impulse pawl rivet was broken about midspan. The inner portion of the broken rivet, about which the impulse pawl rotates, was found driven into the magneto frame. The outer portion of the rivet, normally welded to the bearing plate, was retained within the pawl plate and bearing plate assembly. The rivet weld was partially pulled through the bearing plate, loosening the bearing and pawl plate assembly.

The impulse pawl, normally mounted on the broken rivet, was detached and displaced opposite the direction of rotation. It was wedged under the latching end of the remaining attached pawl and pawl plate, and between the impulse coupling and the magneto pilot flange. The heel of the detached impulse pawl was positioned along the outer edge of the magneto pilot flange, forward in the path of rotation of the impact damaged shell lug, and extended outboard from the impulse shell skirt. The heel exhibited shiny impact marks. The face of the latching end of the detached pawl exhibited a flattening impact mark. The face of the remaining attached pawl exhibited similar damage, including flaring of the latching end.

The rivet hole of the detached impulse pawl exhibited elongation. The remaining attached impulse pawl exhibited radial movement around its retaining rivet.

Indentations on the magneto shaft were noted adjacent to the heel of the impulse pawls. The indentations measured .025 inches. The manufacturer's maximum allowable depth for indentations is .006 inches.

The separated rivets from the magneto coupling were sent to the NTSB's Materials Laboratory. The examination revealed features typical of overstress separations under direct shear loading conditions.

An examination of the right magneto, serial number 90081443, did not reveal any mechanical malfunction.

ADDITIONAL INFORMATION

Skagway Air Service, Skagway, reported an engine power loss involving a Lycoming IO-540-K1G5 engine that occurred on September 15, 1995. The engine had part number 6351 Slick magnetos with an M3333 impulse coupling installed. The coupling was found with the impulse pawls jammed, and sheared teeth on the magneto drive gear at 364.3 hours of service. West Star Aviation personnel reported they received the engine from Skagway Air Service on April 23, 1996, for overhaul. When it was received by West Star, the engine had accrued 4,268.7 hours, and 1,973.2 hours since being overhauled by Textron Lycoming. During the overhaul inspection by West Star personnel, they noted several magneto idler gear teeth were missing. The crankshaft gear was cracked, and the crankshaft dowel pin was sheared. Portions of the idler gear teeth, and portions of the impulse coupling were found in the engine sump.

LAB Flying Service, Juneau, Alaska, reported an engine power loss involving a Lycoming IO-540-K1G5 engine that occurred on September 13, 1997. An examination of the left magneto, part number 6351, and impulse coupling M34333, revealed a damaged impulse coupling, and broken gear teeth on the magneto drive gear. The coupling had accrued 1,286.73 hours.

In September, 1997, Skagway Air Service noted two incidents of severely worn M3333 impulse couplings from two different Piper PA-32 airplanes. One coupling had accrued 432 hours. The second had accrued 473 hours.

Haines Airways was purchased by Mountain Aviation, Sitka, Alaska, on March 1, 1997. A new president assumed a management role at that time. On May 18, 1997, a new Chief Pilot, Check Airman, and a new Director of Maintenance, were selected from existing company personnel. On May 19, 1997, a new Chief Executive Officer for Haines Airways was selected from Mountain Aviation.

The operator placed the accident airplane in service on July 10, 1996. The seat covers found in the airplane were installed prior to the operator taking delivery of the airplane, and were not removed.

Following the accident, a review was conducted of the FAA's Juneau Flight Standards District Office (FSDO) records covering the operator, including Program Tracking and Reporting System (PTRS) data for the accident airplane. The review indicated 13 different inspections between August 20, 1996, and June 30, 1997, including ramp inspections, en route inspections, and airplane record reviews of the accident airplane.

One inspection specifically included a review of the airplane's seat configuration log. An FAA inspector noted that even though the log referred to the seats being removed, the seats were still installed in the airplane.

Additional parties in the investigation were:

Harry Fenton Unison Industries 530 Blackhawk Park Ave. Rockford, IL 61104

WRECKAGE RELEASE

The Safety Board released the wreckage, located at Skagway, to the owner's representatives on July 10, 1997. The engine was retained by the Safety Board for examination until its release on March 23, 1998.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	42,Female
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medicalno waivers/lim.	Last FAA Medical Exam:	September 10, 1996
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	1815 hours (Total, all aircraft), 200 hours (Total, this make and model), 189 hours (Last 90 days, all aircraft), 106 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	Registration:	N15199
Model/Series:	PA-32 PA-32	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	32-7340021
Landing Gear Type:	Tricycle	Seats:	6
Date/Type of Last Inspection:	June 26, 1997 100 hour	Certified Max Gross Wt.:	3400 lbs
Time Since Last Inspection:	48 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	4689 Hrs	Engine Manufacturer:	Lycoming
ELT:	Installed, not activated	Engine Model/Series:	IO-540-K1A5
Registered Owner:	HAINES AIRWAYS INC.	Rated Power:	300 Horsepower
Operator:		Operating Certificate(s) Held:	Commuter air carrier (135), On-demand air taxi (135)
Operator Does Business As:		Operator Designator Code:	FGHA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	SGY ,44 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	16:53 Local	Direction from Accident Site:	41°
Lowest Cloud Condition:	Unknown	Visibility	10 miles
Lowest Ceiling:	Overcast / 5500 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	14 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:	73°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	18°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	HAINES (HNS)	Type of Flight Plan Filed:	Company VFR
Destination:	(SGY)	Type of Clearance:	None
Departure Time:	16:40 Local	Type of Airspace:	Class G

Airport Information

Airport:	SKAGWAY SGY	Runway Surface Type:	
Airport Elevation:	44 ft msl	Runway Surface Condition:	
Runway Used:	0	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Destroyed
Passenger Injuries:	4 Fatal, 1 Minor	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	4 Fatal, 1 Minor, 1 None	Latitude, Longitude:	59.570816,-135.349029(est)

Administrative Information

Investigator In Charge (IIC):	Erickson, Scott
Additional Participating Persons:	PATRICIA MATTISON; JUNEAU , AK CHARLES R LITTLE; CHINO HILLS , CA MICHAEL LOVERINK; HAINES , AK GERALD R JAMES; DALLAS , TX
Original Publish Date:	July 13, 1998
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=2937

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