



National Transportation Safety Board Aviation Accident Final Report

Location:	RUSSIAN MISSION, AK	Accident Number:	ANC96FA102
Date & Time:	07/20/1996, 1506 AKD	Registration:	N313RS
Aircraft:	Douglas DC-6A	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	4 Fatal
Flight Conducted Under:	Part 121: Air Carrier - Non-scheduled		

Analysis

The cargo flight was en route, when a fire erupted in or near the #3 engine. During subsequent emergency procedures, the flight crew pulled the fire handle first. Later, they feathered the #3 engine. The fire did not extinguish. During an attempt to land at a rural, intermediate airstrip, while the airplane was in the traffic pattern, witnesses saw fire coming from the area of the #3 engine. They stated the right wing buckled upward, and the airplane crashed. Examination of the wreckage revealed a failure of the master rod in the front bank of cylinders of the #3 engine. Metallurgical tests revealed a crack in the top of the master rod head, which had resulted from corrosion pits. The side of the master rod head was measured and found to be out of round. The master rod shank also fractured due to fatigue. The operator's training procedures and the Douglas Aircraft emergency checklist procedures, required that the engine's propeller be feathered first, and then the fire extinguishing system to be activated. According to information derived from the airplane's cockpit voice recorder, the flight crew reversed that order. The effectiveness of the fire suppression system is diminished if the propeller is not feathered first.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: fatigue failure of the master connecting rod, which originated from corrosion pitting, subsequently compromised the engine crankcase, and resulted in a fire; and failure of the flight crew to follow emergency procedures by pulling the fire handle before feathering the propeller, which diminished the effectiveness of the fire suppression system.

Findings

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

Findings

1. (C) ENGINE ASSEMBLY,MASTER ROD - CORRODED
2. (C) ENGINE ASSEMBLY,MASTER ROD - FATIGUE
3. (C) ENGINE ASSEMBLY,MASTER ROD - FAILURE,TOTAL

Occurrence #2: FIRE

Phase of Operation: APPROACH - VFR PATTERN - DOWNWIND

Findings

4. (C) EMERGENCY PROCEDURE - NOT FOLLOWED - FLIGHTCREW
5. (C) ENGINE COMPARTMENT - FIRE
6. (C) WING - FIRE

Occurrence #3: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION

Phase of Operation: APPROACH - VFR PATTERN - BASE LEG/BASE TO FINAL

Findings

7. WING - FAILURE

Factual Information

HISTORY OF FLIGHT

On July 20, 1996, at 1506 Alaska daylight time, a wheel equipped Douglas DC-6A airplane, N313RS, registered to and operated by Northern Air Cargo as Flight 33, had an in-flight fire and subsequent failure of the right wing while in the traffic pattern at the Russian Mission Airport, Russian Mission, Alaska. The cargo flight, operating under 14 CFR Part 121, departed Emmonak, Alaska, at 1410, and the destination was Aniak, Alaska. A visual rules flight plan was filed and visual meteorological conditions prevailed. The certificated airline transport pilot-in-command, the copilot, the flight engineer, and the jump seat rider, were fatally injured. The airplane was destroyed by impact and fire.

According to witnesses from the village of Russian Mission, they saw the DC-6 pass over the airport from west to east at an altitude of 300 to 400 feet above the ground. Witnesses stated that a fire engulfed the inboard engine on the right side of the airplane. The airplane flew across the Yukon River and made a turn onto the downwind leg. Witnesses reported smoking pieces from the airplane were falling to the ground while the airplane flew the downwind leg. The airplane turned base leg and continued the turn to final. During this turn, the right wing folded upward and the airplane rolled to the right and nosed into the ground approximately 3/4 of a mile short of runway 35.

WITNESSES

During an interview with Mr. Jack Hopstad, he stated that he heard a large plane. He did not see the first pass, only the second pass. He looked up and saw a DC-6 cross the airport at midfield. He noticed that the right inboard engine was on fire or missing. The airplane turned downwind, then base leg. During the base leg, while the airplane was turning, Mr. Hopstad stated that the wing buckled upward on the side that was on fire. He could not tell if the landing gear was up or down. He stated he saw the airplane for less than 1.5 minutes. He viewed the entire flight from his house which is situated on a hill overlooking the runway. He estimated the airplane's altitude at 350 to 400 feet above ground level (agl).

Another witness interviewed at Russian Mission stated he was standing on the airport parking ramp. He saw the airplane fly the downwind leg, make the turn from downwind to base, and as the airplane was turning during the base leg he saw the right wing fold up. The airplane rolled over and nosed into the ground. He stated there were no children or other people on the runway. He was the only one on the airport and he was standing on the parking ramp. There were children on the beach about 1/4 mile beyond the end of runway 35.

INJURIES TO PERSONS

All occupants were fatally injured.

DAMAGE TO AIRCRAFT

The airplane was destroyed by fire and impact forces.

PERSONNEL INFORMATION

The captain was the holder of an airline transport pilot certificate with type ratings in the DC-6 and DC-7 airplanes. He also held a flight engineer certificate for reciprocating engine powered airplanes. According to company records, the pilot had a total flight time of 14,200

hours; 7,200 hours in make and model. He received a biennial flight review in the form of a company pilot proficiency check in the DC-6 airplane on April 20, 1996. He was issued a Federal Aviation Administration (FAA) Class 1 Medical Certificate dated May 21, 1996, and he was required to wear corrective lenses.

According to company records, the captain was trained as a flight engineer and copilot in the DC-6 airplane in April of 1988. The records show that he successfully passed a Captain's proficiency check in the DC-6 airplane on October 30, 1995. The records show the Captain attended a Crew Resource Management class on November 18-19, 1990.

The first officer was the holder of a commercial pilot certificate. He was not type rated in the DC-6 airplane. He also held a flight engineer certificate for reciprocating engine powered airplanes. The company records show he had a total flight time of 9,000 hours, with 4,500 in the DC-6 airplane. He received a biennial flight review, in the form of a flight check in the DC-6 airplane, on May 27, 1996. He was issued an FAA class 2 medical certificate on August 31, 1996 which required him to possess corrective lenses.

Company training records show that the first officer received an initial flight engineer flight check on June 5, 1989. He then received his initial flight check as a first officer on May 23, 1994. He attended a Cockpit Resource Management class on November 18-19, 1990.

The flight engineer was the holder of a commercial pilot certificate. He did not have a DC-6 type rating. He was also the holder of a flight engineer certificate with a reciprocating engine powered airplane rating. He was the holder of an airframe and powerplant mechanic certificate. The flight engineer was issued an FAA second class medical certificate, dated February 29, 1996, that required him to wear corrective lenses for distant vision, and possess lenses that corrected for near vision.

Company records show that the flight engineer received his initial flight check as a flight engineer on December 7, 1994. He last received recurrent ground training on January 19-20, 1996, and a proficiency check, as a flight engineer, on June 29, 1996.

AIRCRAFT INFORMATION

N313RS, a DC-6A airplane, serial number 44663, gross weight of 103,800 pounds, was equipped with four Pratt and Whitney R2800-Cb3 engines rated at 2,400 horsepower each. The table below lists the total time and time since inspection for each engine.

Engine times:	total time	time since inspected	1	690
109	2	1,199	3	3
109	4	1,022	109	2,354

The aircraft was on a continuous airworthiness inspection system and was last inspected on April 4, 1996. The airplane had flown 109 hours since that inspection.

The company records show that the number 3 engine was overhauled by Precision Airmotive of Everett, Washington.

AERODROME INFORMATION

The Russian Mission Airport, the airport on which the airplane was intending to land, has a gravel runway which is 2,700 feet long, and 50 feet wide. The runway aligns with 350 and 170 degrees. The field elevation is 70 feet above mean sea level. The approach path to runway 35 is over the Yukon River, an island, a slough, and then the runway.

Examination of the airport showed there are two large metal fuel storage tanks situated approximately 200 feet beyond the departure end of runway 35. Beyond the storage tanks the villagers park their boats on the beach. There were people and kids standing and playing around the boats on the beach.

The aircraft parking ramp is located on the west side of the runway, at the north end (departure end) of runway 35.

There is no control tower or services available at the Russian Mission Airport. The airport is located in class "G" airspace.

FLIGHT RECORDERS

The airplane was not equipped with a flight data recorder. The airplane was equipped with a cockpit voice recorder (CVR). The CVR was sent to and analyzed at the NTSB Flight Recorder Laboratory in Washington, D.C. .

The following text/paraphrase was excerpted from the information obtained from the cockpit voice recorder. At 1455:13, the cockpit area microphone picked up the sound of a shudder. The captain asks, "which one is it?" at the same time the sound of the fire bell starts. The captain states "number 3", and the first officer states, "number four." At 1455:25, the flight engineer says "firewall selector." The captain repeats the statement and the first officer says, "selector." At 1455:28, the sound of the fire bell stops and one second later the flight engineer says, "pull." The first officer says the number 3 engine is still burning. The captain directs the discharge of the right hand bank. At 1455:37, the first officer asks, "are we feathered?" An unidentified voice says no, and the captain directs someone to "feather it." At 1455:47, the flight engineer and the first officer identify and attempt to feather propeller number 3. At 1455:54, the sound of the landing gear warning horn starts and the engineer states, "okay there he goes."

At 1456:06, the first officer still sees a fire. At 1456:17, the flight engineer states: "she's windin'up run away." The first officer says that the propeller on number three is still not completely feathered, and he refers to the, "speed going down too." The captain called for METO power. The captain takes control of the airplane at 1457:11, and calls for the before landing check. At 1457:43, the captain asks if number 3 is feathered. The first officer replies, "still not feathered-feather three." At 1457:48, the flight engineer feathers number 3 once again and states, "there it goes, three is feathering." The first officer confirms that number 3 actually feathered, but said they were still indicating a fire. The captain indicates at this time that he is going to land at Holy Cross.

The nearest airport, and the airport over which this event took place, was Russian Mission.

While the captain was preparing the airplane for landing the first officer stated that the fire is starting to go out. He then confirmed that they are not indicating a fire anymore. The captain asked for METO power. The flight engineer applied METO power and the first officer exclaimed, "whoop I saw another...flicker." The captain remarked that if the fire is out he would rather not land "here." At 1459:01, the sound of the fire bell starts. The captain stated that he is going to go for a downwind for this runway. At 1459:18, the flight engineer stated that he was smelling something. At 1459:56, the flight engineer indicated there was smoke in the cockpit.

The CVR transcript shows that the flight crew was preparing the airplane for landing. The flight engineer referenced the airspeed and called out "115" a number of times. At 1459:50, the first officer confirmed that he could still see the fire burning. The first officer indicated that they needed to get the airplane down. The flight engineer turned the "water on" and the captain continued the approach. There was a discussion in the cockpit about the turn being too tight. The captain swung the airplane a little wider and then began a turn back toward the runway. The airspeed was called out by the flight engineer and he said, "115." At 1501:41, the sound of the fire bell started. The flight engineer stated that they were getting hot on all the other engines.

At 1501:49, there was a sound described by the NTSB Electrical Engineer as a sound similar to increasing engine speed. The Northern Air Cargo Company member to the CVR group stated that it sounded more like a high speed fan spooling up and then a few seconds later it spooled down. The spooling down sound occurred at 1201:55. One second later the flight engineer said: "keep her goin' " The first officer echoed the statement.

Review of the CVR tape indicated an exclamation of "whoa" , from the voice identified as the flight engineer, just prior to the end of the recording at 1501:59.

WRECKAGE AND IMPACT INFORMATION

The wreckage was located on a small island in the Yukon River, just south of the Russian Mission Airport, approximately 3/4 of a mile from the approach end of runway 35. The accident site was located on a 160 degree magnetic bearing from the runway. The wreckage path was aligned with 247 degrees and was approximately 550 feet long. Early in the wreckage path there were two distinct debris trails which converged approximately 300 feet from the main wreckage.

According to witnesses on the ground, they described the fire as extending from the engine on the right wing to a point approximately midway to the tail. They stated that as the airplane flew along the Yukon River (the downwind leg), there were parts falling into the river and streaming fire falling from the airplane. Examination of the terrain near the downwind leg showed that a forest fire was burning and was being extinguished by BLM fire fighters. No parts of the airplane were located there.

Two parts of the airplane were not recovered and could not be found. One part was a piece of stainless steel cowling from the outboard side of the number 3 engine which would normally be located between the upper and lower exhaust chutes. This piece of cowling was on the same plane as the leading edge of the right wing. The other component missing was a section of flap normally located behind the number 3 engine.

The foremost path through the trees was made by the right wing. Viewing the swath along the direction of travel of 247 degrees, showed an angle perpendicular to the crash path. The swath started from the ground and rose to the right at a measured 41.5 degree angle. The forward descent angle of the swath was measured at 20 degrees. The debris in this path consisted of the right wing tip, number 4 engine propeller and blades, large sections of the upper and lower, outer wing skins, and a portion of the right flap. The right wing was located along this debris trail and was resting inverted. The wing root was pointing toward the main wreckage and the wingtip was pointing toward 067 degrees. The leading edge was facing toward the southeast. The wing came to rest approximately 86 feet beyond the first swath found in the trees.

The second crash path through the trees started approximately 108 feet beyond the first swath, and was displaced 33 feet laterally toward the right while viewing along the debris path of 247 degrees. This second swath had a debris trail that aligned with 230 degrees. This swath was made by the airplane's left wing. Viewing the swath along the 230 degree debris trail, the swath had a descending angle, left to right of a measured 30 degrees. The forward descent angle of the swath was measured to be 23 degrees. Both crash paths converged with a final crash path which aligned with 247 degrees magnetic. This debris path terminated at the main wreckage. A portion of the left outboard wing section was found near the confluence of the two crash paths.

The main wreckage consisted of the tail section with a portion of the vertical fin. The top of the vertical fin and rudder had separated, but were located in the wreckage. The left horizontal stabilizer remained attached to the empennage. The left wingtip was pointing toward 067 degrees. The left main landing gear was identified and was in its proximate correct position. The structure surrounding the left main gear had burned away and the gear was resting on the wreckage in the prone position. The right main gear remained attached to its structure and was extended in the down and locked position. The remains of the wire in the tires were co-located with the axles. The rims from the left main gear burned away and their magnesium residue was located at the spot where they had burned. The right main gear rims were located on the right main gear. The inner rim had burned away, and the burned away rim residue was located directly beneath the extended landing gear.

All the propellers and/or blades were located. The number 3 propeller was complete with portions of the gear box attached. The blades were found in the feathered position. The other propeller blades from the other engines were either not in the feathered position, or had separated from their respective hubs.

The firewall shutoff valves were examined on the right wing. The number three fuel shutoff valve was partially closed. The fuel selector was in the closed position. The number 4 engine fuel shutoff valve was open.

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examinations of the three flight crew members were conducted by the State of Alaska, Office of the Medical Examiner, 5700 East Tudor Road, Anchorage, Alaska. Toxicological specimens, where obtainable, were sent to the FAA Civil Aero Medical Institute, Oklahoma City, Oklahoma, for analysis. No specimens were forwarded for the captain, Mr. Bell.

FIRE

Examination of the wreckage showed fire patterns on the right wing, right flap sections, and right side of the center fuselage, that differed from those of the post impact fire. The sooting areas were streamed and there was very little sooting downwind of rivet heads and other imperfections in the skin. There was no visible fire damage to the main spar immediately behind the number 3 firewall. The spar just outboard of number 3 engine nacelle was burned and melted. The upper and lower spar caps showed bending upward and rearward. The upper skin surface of the right wing between the number 3 and 4 nacelles was bowed upward. The wet wing fuel cell of the right wing was compromised in numerous places in the vicinity of the area between the number 3 and 4 engine nacelles. The inside of the right wingtip was sooted. Further examination of the interior of the right wing's fuel cell showed that all portions of the

inside of the right wing were sooted. Pieces of the right wing located in the early part of the crash path, and which were not involved in the post impact fire, were sooted on the inside.

The number 4 engine had fire damage consistent with a post impact fire, and was located resting close to the right wing. It was located approximately 175 feet from the beginning of the right wing's initial impact and swath.

Engines 1, 2, and 3, were located with the main wreckage. Engines 2 and 3 were sitting next to each other and were fire damaged. Number 3 had more fire damage to more cylinders, and the entire rear power accessory section, including the carburetor, starter generator, intake distributor and impeller, were missing. Engine number 1 was located close to the cockpit, approximately 50 feet before engines 2 and 3, and it did not have any fire damage.

Post impact fire consumed the main fuselage and left wing. The airplane's right side of the center section was fire damaged but identifiable.

TEST AND RESEARCH

The number 3 engine was removed from the wreckage scene and transported to Anchorage where it was disassembled. During the disassembly of the engine, the crankcase of the forward bank of cylinders was found to be broken in the lower right hand quarter of the engine (as viewed from the rear of the engine) between the number 6 and 8 cylinders.

The disassembly disclosed that the master rod was severed and all the link rods were severed. Visual examination of the master rod shank showed visible striations.

The master rod, associated cylinder, and piston with master rod head attached were sent to the NTSB's Metallurgical Laboratory for examination. The metallurgical report is attached. The report revealed a crack on the top of the rod head. Examination showed two areas of fatigue fracture. The side of the rod head was out of round. The examination also showed that the shank failed due to fatigue on the opposite side from the fatigue crack in the rod head. The metallurgical report states that the fracture origins of the fracture, which is located in the top of the rod head, were due to corrosion pits.

A records search by Precision Airmotive revealed that the total number of hours or cycles on the master rod were undetermined. The master rod does not have a specified hours or cycles life limit.

ADDITIONAL INFORMATION

According to the DC-6 emergency checklist, the proper procedure for an engine fire is to ensure the engine is feathered first before pulling the fire extinguishing handle. The checklist notes the effectiveness of the fire extinguisher system is greater after the engine rotation has stopped. A letter submitted to the NTSB by the Operator, says, in part: " 1. Engine rotation may be the source of the engine fire. Feathering, stopping engine rotation, may remove that source. 2. The reason feathering and checking for feather and fire before pulling the engine firewall selector is-pulling the engine firewall selector shuts all fluids off at the firewall. This includes the oil supply which controls the prop governor. Severing oil supply and pressure to the prop governor allows the prop to go towards flat pitch (low pitch stops) resulting in a very high RPM. At a very high RPM, moments build on the prop that makes it very difficult to feather. In some cases an attempt to feather at very high Rpm's results in a feather pump failure or continuous tripping of the feather pump circuit breaker. An uncontrollable, high RPM, and non-feathering prop can be catastrophic."

Northern Air Cargo's training program coincides with the airplane's checklist.

A review of the metallurgical report shows that the report refers to the number 3 cylinder. The actual cylinder that contained the master connecting rod section was the number 8 cylinder. The number 8 cylinder was the cylinder submitted to and examined by the NTSB laboratory.

The FAA and Northern Cargo representatives were parties to the accident investigation.

Pilot Information

Certificate:	Airline Transport; Flight Engineer	Age:	53, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last FAA Medical Exam:	04/20/1996
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	14200 hours (Total, all aircraft), 7200 hours (Total, this make and model), 3000 hours (Pilot In Command, all aircraft), 204 hours (Last 90 days, all aircraft), 79 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Douglas	Registration:	N313RS
Model/Series:	DC-6A DC-6A	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	44663
Landing Gear Type:	Retractable - Tricycle	Seats:	5
Date/Type of Last Inspection:	04/04/1996, Continuous Airworthiness	Certified Max Gross Wt.:	103800 lbs
Time Since Last Inspection:	109 Hours	Engines:	4 Reciprocating
Airframe Total Time:	38248 Hours	Engine Manufacturer:	P&W
ELT:	Installed, not activated	Engine Model/Series:	R-2800-CB3
Registered Owner:	NORTHERN AIR CARGO	Rated Power:	2400 hp
Operator:	NORTHERN AIR CARGO	Operating Certificate(s) Held:	Commuter Air Carrier (135); Flag carrier (121); Supplemental
Operator Does Business As:		Operator Designator Code:	NACA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	, 0 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	0000	Direction from Accident Site:	0°
Lowest Cloud Condition:	Clear / 0 ft agl	Visibility	50 Miles
Lowest Ceiling:	None / 0 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	Light and Variable /	Turbulence Type Forecast/Actual:	/
Wind Direction:	Variable	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	20° C
Precipitation and Obscuration:			
Departure Point:	EMMONAK, AK (ENM)	Type of Flight Plan Filed:	VFR
Destination:	ANIAK, AK (ANI)	Type of Clearance:	None
Departure Time:	1410 ADT	Type of Airspace:	Class G

Airport Information

Airport:	RUSSIAN MISSION (RSH)	Runway Surface Type:	Gravel
Airport Elevation:	70 ft	Runway Surface Condition:	Dry
Runway Used:	35	IFR Approach:	None
Runway Length/Width:	2700 ft / 50 ft	VFR Approach/Landing:	Forced Landing

Wreckage and Impact Information

Crew Injuries:	3 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	1 Fatal	Aircraft Fire:	In-Flight
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	4 Fatal	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	GEORGE KOBELNYK	Report Date:	10/14/1997
Additional Participating Persons:	MIKE DOLSEN; ANCHORAGE, AK DAVE CAMPBELL; ANCHORAGE, AK BRYAN ANDERSON; ANCHORAGE, AK ADAM SOLTON; ANCHORAGE, AK		
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.nts.gov/pubdms/ .		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).