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CIVIL AERONAUTICS BOARD
AIRCRAFT ACCIDENT REPORT

ADOPTED: November 6, 1962

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NORTHWEST AIRLINES, INC., DOUGLAS DC-7C,
N 292, NEAR MANILA, PHILIPPINE ISLANDS,
JULY 14, 1960

SYNOPSIS

At approximately 0430 Manila Time, July 14, 1960 (2030 g.m.t. July 13, 1960), a Northwest Airlines DC-7C, N 292, operating as Flight 1-11, en route from Okinawa to Manila, Philippine Islands, ditched in the Pacific Ocean, approximately 67 nautical miles northeast of the Manila Airport, after reporting fire in the left wing and loss of the No. 2 propeller. All 58 occupants, including the 7 crew members, successfully evacuated the aircraft. Of these, 44 suffered minor injuries and one woman passenger died.

While the flight was en route between Okinawa and the Philippine Islands, the No. 2 engine experienced an appreciable power loss followed by overspeeding of the propeller. The crew instituted emergency procedures but was unable to control or feather the propeller. The propeller separated from the engine with a resulting nose section fire. Attempts to extinguish the fire failed, and the crew elected to ditch the aircraft. The ditching was accomplished at night during a rainstorm and while under instrument conditions.

The Board determines that the probable cause of this accident was the internal failure of No. 2 engine, resulting in oil contamination, loss of oil supply, subsequent loss of the No. 2 propeller assembly, and fire-in-flight, which necessitated a ditching.

Investigation

Northwest Airlines Flight 1-11, a scheduled passenger flight, originated at Idlewild Airport, New York, on July 11, 1960; its destination was Manila, Philippine Islands. After departure from Seattle, Washington, however, the flight was diverted from schedule and landed at Anchorage and Cold Bay, Alaska, because of weather conditions farther along the route. The flight arrived at Tokyo, Japan, at 1015^{1/2}, July 13, 7 hours and 20 minutes behind schedule.

A scheduled crew change was made at Tokyo. The new crew consisted of Captain David G. Rall, First Officer Travis E. Everett, Flight Engineer Melvin P. English, Navigator Theodore A. Wright, Purser Edmond E. Zan, Flight Service Attendant Antonio R. Suarez, and Stewardess **Yuriko Fuchigami**.

^{1/2} All times herein are Greenwich Mean based on the 24-hour clock.

An Instrument Flight Rules (IFR) flight plan was prepared and filed by Captain Rall at Tokyo. The weather briefing prior to the Tokyo departure was conducted by a Northwest Airlines dispatcher and a meteorologist of the Japanese Meteorological Agency. The proposed IFR flight plan for the Tokyo-Okinawa segment of the flight was via Airway Green 8 at 18,000 feet; true airspeed 285 knots; estimated time en route 3:10 hours; alternate Clark Air Force Base, P.I. The flight arrived at Okinawa at 1625, July 13, 1960.

Flight 1-11 departed the Okinawa Terminal at 1700 at a gross weight of 115,429 pounds, 6,101 pounds less than permissible for this takeoff. Captain Rall occupied the right seat and First Officer Everett the left seat. All four engines performed satisfactorily on runup and the flight was off the ground at 1712.

Radio communication was maintained with a radio telephone facility at Okinawa until 1907, when communication was established with Manila Radio.

At approximately 1915, a considerable loss of power occurred as indicated by a drop in Brake Mean Effective Pressure (BMEP) and manifold pressure in the No. 2 engine. This suggested carburetor icing to the crew and caused them to apply alcohol to the carburetor, retard the throttle, place the mixture in auto-rich, and apply carburetor heat. The engine ignition analyzer indicated nothing of an unusual nature. The oil quantity indicator for No. 2 engine at this time showed only 30 gallons, which was 22 gallons less than at departure from Okinawa.

The captain then noticed the oil-out temperature for No. 2 engine was rising, and the engine ignition analyzer showed irregular patterns on 5 or 7 cylinders. The captain and flight engineer concurred in feathering the propeller, but when the feather button was actuated the propeller failed to feather and the engine r.p.m. increased from 2,350 to 2,900. At this time the oil quantity indicator for No. 2 engine registered empty.

At 1925 the flight advised Manila Radio, "We have our No. 2 engine runaway unable to feather requesting lower altitude." Clearance to descend from cruising altitude of 18,000 feet to 10,000 feet was transmitted to the flight at 1930, about two hours before sunrise. The flight engineer tried to transfer oil from the reserve tank in an additional attempt to feather the propeller; however, it did not feather. After reducing the airspeed the No. 2 engine r.p.m. fluctuated between 2,150 to 2,350. It was also noted at this time that the No. 2 engine would not come out of high blower.

The captain and first officer then exchanged seats and the descent to 10,000 feet was begun at an indicated airspeed of 130 knots with landing gear and flaps extended. The captain alerted the cabin attendants to prepare for ditching and to evacuate the hazardous area in line with the No. 2 propeller. The cabin attendants immediately began to secure the cabin for ditching. Lifevests were donned, emergency lights on the vests and in the cabin were turned on, and two of the four liferafts were positioned, one at the main cabin door and one at the emergency door on the right side of the aft compartment. Loose articles were secured. The captain and purser, through the use of the loudspeaker system, directed the passengers to remove their shoes, ties, glasses, and other pertinent objects. Because of the evacuation of the cabin area in line with the propellers, some passengers were directed to sit with their backs to the compartment walls.

At 1940 Captain Rall declared an emergency and gave his 1920 position as 180 miles northeast of Jomalig Island on Amber 2 Airway, and requested an intercept by rescue aircraft. At 1944 Manila Radio was given the 1933 position as 140 miles northeast of Jomalig Island and estimated arrival there at 2023. A Loran fix at 1950 established the position as 100 miles northeast of Jomalig Island. This position was also transmitted to Manila Radio with advice that the flight was proceeding to the coastline due east of Manila. At this time the aircraft was at 9,000 feet and maintaining 130 knots.

Shortly thereafter, the engineer noted sparks and white smoke coming from the No. 2 engine. However, no flames were visible and no evidence of oil was present on the wing or the engine nacelle. The captain and engineer concurred in an attempt to stop the engine rotation by actuating the firewall shutoff valve, thereby depriving the engine of lubricant. Sparks came from the engine, loud thumping noises were heard, and activation of the fire warning system occurred. Accordingly, the fire extinguishing system was used, but without effect. At this time the propeller wrenched free of the engine striking the fuselage about in line with its plane of rotation slashing a hole some 15 inches in diameter above the overhead rack at the first seat forward of the left restroom. A red glow was noted on the front casing and changed rapidly into a white glow. There was a continuous fire warning light from the No. 2 engine and the fire extinguisher was again used but was ineffectual.

At 2020 the flight reported to Manila Radio that there was fire on the wing, that the propeller was gone, and a decision had been made to ditch. There was no further radio contact.

The captain then began a 3,000-feet-per-minute descent from 9,000 feet on a heading of 225 degrees at an airspeed of from 100 to 115 knots with the gear and flaps down. The navigator and the engineer were ordered to proceed to their emergency stations in the cabin.

The descent was made on instruments and in darkness. Moderate rain showers increased the intensity of the magnesium fire in the No. 2 engine. At 1,000 feet indicated altitude, power was applied, the gear retracted, and the flaps were raised to the approach setting of 30 degrees. An airspeed of approximately 100 knots and a descent rate of 100 to 200 feet per minute were maintained. The first officer was directed to watch for the water and when he saw it he shouted, "There's the water! Pull up! Pull up!" The captain immediately started the flaps up, the first officer then started them down again, at which time the captain pulled the control wheel all the way back. Seconds later the aircraft struck the water.

Testimony indicated cloudy, windy weather with showers at the scene of the ditching. The crew of a Coast Guard amphibious aircraft, first to arrive at the scene approximately two hours after the ditching, reported in part that the surface wind was from the northwest 12 to 15 knots, a sky condition of 3,000 feet scattered to broken clouds with rain, visibility unlimited except in rain, and a squall line slightly to the north of the rafts. The squall line subsequently passed over the rafts. The crew of the Coast Guard aircraft reported the following sea conditions: primary swell from the east, 4 feet high, 210 feet between crests with a period of 7 seconds; a secondary swell from the northwest, 4 feet high, 75 feet between crests with a period of 4 seconds, and a wind-driven chop of 2 feet.

Upon final contact with the water, the aft end of the fuselage broke free at the rear of the pressure bulkhead and sank immediately. At the same time the right wing was torn free at the fuselage and its two engines were torn out and sank. This wing floated for about three hours, temporarily serving as a liferaft for several passengers. The trailing edge of this wing was torn and jagged. The remainder of the fuselage, with the left wing attached, sank some 8 or 10 minutes after impact.

The ditching was at 2030, approximately 5 miles northeast of the nearest point of Polillo Island and in water 2,100 feet deep. The last occupant was out of the aircraft within five minutes. The U. S. Coast Guard amphibian and a U. S. Navy aircraft landed in the rough sea four and six hours, respectively, after the ditching. These two aircraft took aboard all survivors, and a fatality, and taxied 10-12 miles to the shelter of a harbor at Polillo Island.

The events which transpired immediately before and after the ditching were described by the purser as follows:

" . . . the propeller sheared off, which I witnessed by being in the tourist compartment, checking lifevests and seat belts. As soon as the propeller sheared and went thru the forward passenger compartment, I ran to the cockpit to see if the crew was all right. They were very busy and okay, so I returned to the cabin and give ditching instructions over the public address. At no time did we have any hysteria or panic among our passengers. They were a tremendous group and followed our instructions to the letter. While this was being done, the stewardess stowed all the loose equipment in the galley area and Mr. Suarez secured the drop door on our carrier holders. They both then proceeded to work thru each cabin. I then asked for swimmers and placed able-bodied men in positions to handle rafts. We assigned the passengers to the rafts in their area. We had positioned two rafts in the tourist compartment along the overwing exits. Another by the main cabin door and another by the window exit on the righthand side of the aft compartment. All rafts were secured with their lanyards. We then instructed the passengers as to their ditching position. . ."

" . . . I think the ship bounced several times and finally slued to the left and came to a stop. All lights except the emergency lights went out and the cabin started to fill with smoke. Also burning gas seeped in along the righthand wall of the main cabin. We were afraid to open the overwing exits because of the fire on both sides of the cabin. Passengers were directed to the main cabin door from the tourist and forward first-class compartments. At this time, I heard Captain Rall call from up near the cockpit that if we couldn't get out to come forward. I hollered that we were all getting out in the back. I then noticed that the fire had gone out on the right wing side of the cabin and I tried to get the raft that had been prepositioned there out, but it was jammed on the floor between the seat.

"The cabin was now heavy with smoke and filling with water. I then opened the window exit on the lefthand side where I had been sitting and got the other raft out on the wing and launched it. I then looked back in the forward first-class and the tourists compartments, and I determined that there were no passengers left in the compartments. The water was then about knee-high in the aisle and the ship in a deep slanted attitude. I went out the window exit and got into the raft which was not fully inflated and had three people in it. I could see the tail lifting (I should say the area where the tail had been) out of the water. I asked one of the

men in the raft for a knife which I cut the mooring raft line that was attached to the ship and we started paddling away with our hands. I heard the engineer hollering in the next raft and yelled at him to throw us a line, which he did. He had just drifted away from the ship when the aft end went straight in the air and the ship sank.

"Everyone was pretty exhausted and I could hear people hollering. We could see some of the passengers in the water and some on a piece of the wing that had broken off and was floating. We started to paddle towards the passengers. They were easy to see because of the lights on their vests. At this time we heard the captain shouting to these passengers and he and the copilot paddled their 10-man raft over and picked up these people. We then drew close to the engineer's raft and took some of his people off, as his raft was overloaded. I believe the lower station on my raft was ruptured by the jagged wing in the launching. The lower station was ripped and a small leak was found in the floor. The survival pack was taken out of the center section of the raft and the gear distributed. We patched the leak and then began using the bailing bucket and the sponges to clear our raft. Again, we had no panic or hysteria. As daylight began to break, a rain squall came up. We put up our canopy and collected some rain water in the plastic bags. Most of our people in the raft were ill at various times. We then waited for the Air Sea Rescue people. After hearing, sighting the plane, we fired our smoke flares. Everyone was greatly relieved and then we waited to be rescued."

The statements of the other crew members were in accord with that of the purser especially in praise of the lighted lifevests.

A review of the overhaul records for the No. 2 engine indicated that the last overhaul was routine. The test stand run-in after overhaul, the inspection records, airplane flight logs, and in-flight check reports gave no indications that the No. 2 engine was operating in other than a normal manner up to the time of its failure.

Examination of the records pertaining to the No. 2 propeller also reflected no abnormal operation or condition prior to the accident. An examination of the propeller governor history failed to reflect any indication of prior operating difficulties.

Analysis

Since nothing of an unusual nature was disclosed from the past history of the engine and propeller, and investigation could not be made of the aircraft wreckage, the probable cause of engine failure must be based upon the testimony of the flight crew as well as on other established facts.

Based on the crew's testimony as to the sequence of events in the failure of No. 2 engine, it is probable that the initial failure occurred to components in the two-speed impeller drive system. Failures in this assembly result in an appreciable power loss and sudden drop in manifold pressure. When a failure of this type occurs, most of the supercharging effect is lost. The manifold pressure will drop momentarily and will then return to atmospheric pressure.

A failure of this type requires immediate feathering of the propeller. If this is not done, numerous metal particles are circulated throughout the engine causing

contamination and failure of the bearings and bushings. Since the oil flow rate of the engine is approximately 50 gallons per minute, it is evident that metal contamination to other parts can occur very rapidly. The failure was not immediately diagnosed by the flight crew. Believing their difficulty was carburetor ice, they spent a period of time trying to restore power by use of remedial action associated with icing. It was not apparent to the crew that an internal failure was in progress until the oil-out temperature started to rise. This rise in oil-out temperature is associated with master-rod bearing failures. When the bearings fail the master rods begin to overtravel and cause disintegration of the reciprocating assemblies. This fact is further substantiated by the second check of the ignition analyzer which showed extended patterns and a change in combustion in several cylinders of both rows.

It appears that the increase in engine r.p.m. was due to contamination of the propeller governor. It is most likely that the pilot valve became stuck in the "up" position due to metal contamination, which would result in an overspeed. In addition, the other valves in the governor, including the feathering by-pass valve, could fail to function properly if the metal particles were restricting their movements.

The probability also exists of damage to the oil transfer bearing and seals as a result of contamination. If the oil transfer bearing assembly were in a state of failure, propeller oil pressure would be lost to the propeller due to high internal leakage, and the oil would collect in the nose case rather than flow to the propeller. A failure of this type would preclude feathering and cause propeller overspeed.

The propellers installed on the aircraft were equipped with the r.p.m.-sensitive pitch lock assembly. This device prevents a propeller from uncontrolled overspeeding. The pitch lock becomes effective when an overspeed exceeds approximately 3,200 r.p.m. On the basis of the crew's testimony, it is evident that the pitch lock assembly prevented a severe overspeed which could have been as high as 4,500 r.p.m. at the time of the initial trouble. It was testified that 2,900 r.p.m. was the highest speed observed, and after reducing airspeed the r.p.m. remained between 2,100 and 2,350 r.p.m.

Later in the sequence of events of engine difficulty, the crew stated that the oil quantity dropped to zero. The loss of oil quantity can be attributed to two most likely causes. As the failures in the engine progressed, some oil would be pumped overboard as a result of failures in the reciprocating assemblies. In addition, the metal contamination in the oil probably caused failure of the scavenger pump bushings and drives, and much of the oil was never returned to the oil tank. When the tachometer, fuel pressure, and oil pressure dropped to zero, it was evident that the internal failure progressed to a point where the pump drives and bushings seized and became disconnected from the rest of the engine.

Subsequently, heavy vibration developed, the propeller windmilled faster, and then separated from the engine. The separation of the propeller resulted from the lack of lubrication precipitated by the initial failure in the engine.

Conclusions

The Board concludes that the No. 2 engine lost power because of a failure in the two-speed impeller drive system. This failure was allowed to progress until

complete internal disintegration of the engine's parts occurred. Attempts to feather the No. 2 propeller failed because of metal contamination within the propeller governor and the engine. Friction heat at the propeller thrust bearing and reduction gear assemblies caused a magnesium fire in the nose case of No. 2 engine.

The crew decided to ditch the aircraft since the possibility of a structural failure of the wing existed because of the fire in No. 2 engine, Emergency evacuation operations by the crew were accomplished efficiently.

It was noted that the illumination by a one-cell flashlight permanently attached to the lifevests of survivors materially aided the occupants in the liferafts in locating survivors in the sea during hours of darkness. Although Northwest Airlines had lifevests with one-cell flashlights aboard this flight, the Board notes that such flashlight-equipped lifevests are not a standard requirement for overseas flight of U. S. air carriers.

Probable Cause

The Board determines that the probable cause of this accident was the internal failure of No. 2 engine, resulting in oil contamination, loss of oil supply, subsequent loss of the No. 2 propeller assembly, and fire-in-flight, which necessitated a ditching.

BY THE CIVIL AERONAUTICS BOARD.

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

CHAN GURNEY, Member, did not take part in the adoption of this report.

S U P P L E M E N T A L D A T A

Investigation and Depositions

The Civil Aeronautics Board was notified of this accident at 0700 EDST, July 14, 1960. An investigation was immediately initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958. Depositions ordered by the Board were taken at Seattle, Washington, on August 18, 1960, and at Washington, D. C., on November 9, 1960.

The Aircraft

Douglas DC-7C, N 292, serial No. 45462, was manufactured January 3, 1958. Total time on the aircraft was 9,233:28 hours with 25.34 since the overseas check, and 71:02 hours since the last No. 3 check. The aircraft was equipped with four Wright model 988TC18EA series engines and four Hamilton Standard model 34E60/7019B propellers. No. 1 engine had 1,135:17 hours since last overhaul, No. 2 engine had 71 02 hours since last overhaul; No. 3 engine had 996 48 hours since last overhaul; and No. 4 engine had 373 27 hours since last overhaul. The total time since overhaul on each propeller was as follows: No. 1 - 71.02 hours; No. 2 - 1,428:12 hours, No. 3 - 519 38 hours, and No. 4 - 1,066.27 hours.

Flight Personnel

Captain David G. Rall, age 53, held an airman certificate with airline transport rating and type ratings in DC-3, DC-4, DC-6, DC-7, and Martin 202 aircraft. He had a total of 17,780 flying hours, of which 1,071 were in DC-7 aircraft. His last proficiency check was accomplished on April 20, 1960, and his last refresher course on air-sea rescue and ditching was given July 17, 1959.

First Officer Travis E. Everett, age 36, held an airman certificate with airline transport rating and type ratings in DC-4, DC-6, and DC-7 aircraft. He had a total of 2,964 flying hours, of which 1,190 were in DC-7 aircraft. His last instrument check was accomplished on March 28, 1960, and his last refresher course on air-sea rescue and ditching was given July 21, 1959.

Flight Engineer Melvin P. English, age 42, held a flight engineer's certificate with ratings on DC-6, DC-7, Lockheed 1049G, and Boeing 377. He had a total of 9,017 flying hours, of which 2,217 were in DC-7 aircraft. His last proficiency check was accomplished on February 4, 1960. He accomplished a refresher course on air-sea rescue and ditching on July 17, 1959.

Navigator Theodore A. Wright, age 50, held a flight navigator certificate. He had a total of 13,272 flying hours and had accomplished a refresher course on air-sea rescue and emergency procedures July 13, 1960.

The three remaining crew members, purser, flight attendant, and stewardess had accomplished emergency procedure refresher courses within the last month prior to the accident.