CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: September 23, 1952 Released: September 29, 1952

BRANIFF AIRWAYS, INC., NEAR HUGOTON, KANSAS, MARCH 26, 1952

The Accident

A Douglas DC-4 aircraft, N 65143, owned and operated by Braniff Airways, Inc., made an emergency landing because of an engine fire in flight on HAP Airport near Hugoton, Kansas, at approximately 1730,1/ March 26, 1952. Of the 45 passengers and crew of four, one passenger received a minor injury. The aircraft was substantially damaged by fire.

History of the Flight

Braniff Airways' Flight 65 departed Denver, Colorado, at 1535 on March 26, 1952, for Dallas, Texas, with intermediate stops scheduled at Colorado Springs, Colorado, and Oklahoma City, Oklahoma. The crew consisted of Captain J. W. Stanford, First Officer J. P. Beakley, and Hostesses Dorothy Currey and Betty Murphy. The flight arrived at Colorado Springs after a routine trip and departed there at 1620. On departure it was cleared IFR (Instrument Flight Rules) direct to LaJunta, Colorado, and then by Red Airway 35 to Garden City, Kansas, and Red Airway 59 to Oklahoma City; to cruise at 8,000 feet to LaJunta, and to descend and maintain 7,000 feet from LaJunta to Oklahoma City. According to company records, the gross weight of the aircraft was within approved limits and the load was properly distributed.

At 1653 the flight reported over LaJunta at 8,000 feet, descending to 7,000. Four minutes later, at 1657, the flight canceled its IFR flight plan and advised that it was proceeding VFR (Visual Flight Rules) direct to Oklahoma City via Liberal, Kansas. When in the vicinity of Hugoton, Kansas, at approximately 6,000 feet MSL, (3000 feet above the ground), one of the hostesses advised the crew that the right wing was on fire. This was the first indication the crew had that anything was wrong, as the fire-warning signal devices had not functioned and all engines appeared to be operating in a normal manner.

The captain immediately looked through the small window in the forward cargo loading door on the right and saw a brilliant red reflection on the inboard surface of the No. 4 engine nacelle. Because of the brilliance of the reflection and the fact that it covered the entire visible portion of this nacelle, he believed the fire was of considerable proportion. He immediately asked the copilot where the fire was and was advised that he thought it was No. 3.

1/ All times referred to herein are Central Standard and based on the 24-hour clock.

The captain then decided to land as quickly as possible on a small airport near Hugoton, which he had seen only a few seconds before the hostess came to the cockpit. Accordingly, the hostess was told to advise the passengers that an emergency landing was to be made, and the "Fasten seat belt" and "No smoking" signs were turned on. The captain then disengaged the autopilot, closed the throttle of the No. 3 engine, put the mixture control at idle cutoff, closed the fuel selector valve, and set the propeller control at the full high pitch position. Following this, he dived the aircraft in an attempt to extinguish the fire and to lose altitude. At this time the copilot asked the captain if he wanted the No. 3 engine's propeller feathered, and the captain said, "No."

When an air speed of approximately 230 miles per hour was reached, power was reduced on the remaining three engines. During the dive the aircraft was heading in a southeasterly direction, and after a short time the dive was decreased and a steep left turn was made to a westerly heading. When the air speed decreased to approximately 200 miles per hour, the captain pulled the No. 3 fire extinguisher selector valve control handle (this also operates the fire wall shutoff valves), and then pulled the discharge handle of the left CO_2 bottle. When this bottle was discharged, the reflection on the No. 4 engine nacelle was observed to diminish appreciably. The captain said that at this time he thought he asked the copilot to discharge the right CO_2 bottle; however, this bottle was not discharged. The landing gear was lowered, and power was resumed on the three remaining engines. About this time the fire warning light in the cockpit came on, and the bell rang. These warning signals continued to operate intermittently. As soon as the gear was down, the descent was steepened and a series of steep slipping "S" turns were made toward the north while approaching the airport.

At an altitude of approximately 200 to 300 feet above the ground, a pronounced buffeting (similar to that which accompanies a near stalling attitude) was experienced. This buffeting was so pronounced it was difficult to control the aircraft; however, it soon stopped and normal control was again resumed. When the buffeting occurred, the indicated air speed was approximately 150 mph. It is believed that the No. 3 engine fell from the aircraft at this time. The captain next called for full flaps. Although the copilot immediately executed this command, no apparent effect of the flaps being lowered was noticed by the crew, and a few seconds later, the aircraft touched down in the middle of the airport. The captain applied brake pressure immediately, but the aircraft did not decelerate. Approaching the north boundary of the field, the captain tried to turn left to avoid crossing a road which was adjacent to the airport, but the nose steering wheel was inoperative. Left rudder was immediately applied; however, the aircraft responded so quickly to this action that right rudder had to be applied at once to keep the aircraft from groundlooping. After the aircraft was again rolling straight, the captain pulled back on the wheel, causing the nose wheel to lift from the ground, and the aircraft rolled beyond the airport boundary across a highway, through two fences and a ditch, and came to rest in a wheat field. All of the occupants were evacuated in an orderly manner, some through the forward compartment and main cabin doors by using descent ropes and a few by means of an emergency exit located on the left side of the aircraft.

Investigation

Weather was not a factor in this accident. At the time of the accident the ceiling was 12,000 feet, visibility 15 miles, and wind from the north approximately 10 miles per hour.

HAP Airport is located 1½ miles southwest of Hugoton at an elevation of 3,107 feet MSL. It has several turf runways, the longest of which is 2,600 feet.

Passengers on board the aircraft said that when they first observed the fire, flames were extending slightly beyond the trailing edge of the wing and as the fire increased in intensity, the flames lengthened. One passenger, who was also a pilot, said that the flames were light yellow or amber and that they appeared to be coming from beneath the wing behind the No. 3 engine nacelle. The fire was first observed by ground witnesses when the aircraft was approximately 11½ miles from HAP Airport on a bearing of 288 degrees true.

Other witnesses said that when the aircraft was approaching the airport at an altitude estimated to be about 300 feet above the ground, they saw the burning No. 3 engine fall from the aircraft. This engine was found approximately one mile southeast of the airport. Related parts to this engine, its nacelle, and a portion of the skin on the underside of the right flap were also found back along the flight path for a distance of 2½ miles.2/

Investigation revealed that the aircraft was not badly damaged during the landing. According to ground witnesses, the fire was confined to the No. 3 engine nacelle and the adjacent wing area when the aircraft stopped and did not appear to be burning intensely. It gained impetus, however, and destroyed a large portion of the aircraft.

The fuselage was destroyed by fire from Station 64 (located immediately forward of the pilot's cockpit) rearward to the empennage. Examination of the burned cockpit showed the landing gear and flap controls in the down position and the carburetor mixture controls of all engines at idle cutoff. The intense fire in this area made further readings impossible.

The undersurface of the left wing showed evidence of having been subjected to considerable heat; the wing structure had buckled slightly from the forward junction of the wing with the fuselage diagonally outboard and rearward to the trailing edge of the No. 2 engine nacelle. The upper surface of all other portions of the wing was undamaged. The left aileron and controls were not damaged. The flap and flap controls were not seriously damaged by the fire and could be manually operated.

The right wing was not damaged outboard of the No. 4 engine nacelle; however, between the nacelle and the fuselage, this wing was badly damaged by fire after landing. The right aileron was intact except for a section of its inside covering which was burned off. The right flap was badly burned.

2/ See Appendix A.

Both fuel tanks in the left wing were undamaged. The inboard fuel tank in the right wing was completely burned out, the outboard fuel tank had holes in its structure, apparently caused by heat. Considerable fuel remained in the outer end of this tank after the fire subsided.

Nos. 1 and 2 engine nacelles were undamaged. The No. 3 engine nacelle was missing forward of the front spar. The lower portion of the No. 4 engine nacelle was dented by contact with the ground when the right wing buckled sometime after the aircraft had stopped. This nacelle was also slightly damaged by fire.

The landing gear was in the down position and locked. The nose gear was not damaged. The air bottle which actuates the emergency brakes and is located in the nose-wheel well was discharged, but it was determined from the damaged condition of its valve that heat had caused the discharge of this bottle. The captain said that the emergency brakes were not used during the landing roll. The main landing gear was severely damaged and the wheels and tires were consumed by fire.

Most parts of the No. 3 engine assembly and its nacelle were recovered. These parts, together with this engine, were sent to Dallas, Texas, for further examination and analysis. At Dallas a reconstruction was made of the No. 3 engine nacelle, using all parts which were recovered and identifiable, in an effort to determine the fire pattern. A study of this assembly revealed no evidence of fire in Zone 1.

There was considerable evidence of fire in Zone 2, with the intense fire area being confined to the lower right rear portion of this zone. Evidence of fire was noticeable to a lesser degree in the lower left rear portion of this zone and also forward and immediately below the rear accessory case. The vacuum pump housing was broken above the inlet boss, and the lower portion of the housing, including the steel sleeve, rotor and vanes, was missing. The section of the vacuum pump housing which includes the fusible plug was attached to the engine rear case pad; the fusible alloy in the plug was missing. The inlet line to the vacuum pump was torn and frayed near one end. Examination of the remaining three engines showed that the vacuum pump inlet line was installed so that it passed extremely close to the air exit opening of the generator housing. The vacuum pump oil separator, which is located on the upper right forward side of the fire wall, was missing, and all vacuum pump lines were badly burned. The generator, normally mounted on the rear of the engine directly above the vacuum pump, was missing. The generator housing was recovered, and its lower right side showed considerable evidence of fire. Several turns of the blast tube former wire were wrapped around the housing. The terminal block and brush assembly were missing. The armature, minus its pencil drive shaft, was recovered. The front and rear inner ball bearing races of the armature were attached to the shaft, and these had been subjected to intense heat. The front and rear outer bearing races were missing. Marks on the armature throughout 180 degrees of its circumference indicated that it had whipped and rubbed against the pole shoes.

The motor section of the starter was missing, the gear section remained attached to the engine. The external right side of the starter case, which is mounted immediately above the generator, had been subjected to heat.

All of Zone 3 was badly burned. The rear portion of the oil tank was missing. The electrical junction box located on the rear side of the fire wall was destroyed. Although there was considerable evidence of fire throughout this entire area, the landing gear tires were not badly damaged during flight. This was evidenced by tire markings on the ground made during the landing roll.

The No. 3 engine was subsequently disassembled and examined. The drive shafts of the vacuum, fuel, and hydraulic pumps were discolored by heat. The rear portion of the generator drive shaft was scored, and it showed evidence of having rotated unevenly before the generator broke from its mount, the staking pin was loose. Although the engine was severely damaged by impact with the ground, no evidence was found to indicate that it failed in flight.

The fire-detection system consisted of three circuits: the detector circuit, the fire warning circuit, and the test circuit. Two detector circuits were employed, one protecting Zone 1 and one protecting Zones 2 and 3. Twenty-six detector units were used in the protection of each engine. When the engine fell from the aircraft, the circuits were torn and so damaged by fire that it was impossible to determine why the system failed to operate. The captain stated that the fire warning signals operated a short time before the aircraft landed and that these signals continued to operate intermittently even during the landing roll.

A polarity check of the fire-detection system of No. 1 engine revealed that the two leads which formed the ends of a portion of the Zone 2 and 3 detector current and which were connected to the fire wall connector plug, had been connected in reverse at the first detector box. This resulted in reverse polarity being produced at the fire wall connector plug pins. With these wires reversed, the test circuit light would function normally if checked by the crew, but the system should not operate properly in the event of a fire.

Portions of the No. 3 engine fire-detection circuit wiring were sent to Washington, D. C., for additional study. Nothing was found to indicate that this engine's fire-detection system was wired incorrectly, nor was it learned why this system failed to function properly.

The company's Operations Manual, under "Emergency Procedures," specifies the following: "WING FIRE. If A wing fire exists, shut off fuel, tank selector, cross-feed valves and booster pumps and LAND AS QUICKLY AS POSSIBLE." Under "Engine Fires," the manual lists the following procedure to be followed: "Gear up; flaps, as required; throttle, closed; propeller control, lowest RPM, mixture, idle cutoff; feather, check button for snap out; increased power, as required; fire wall shutoff, pull; fuel selector

and cross-feed, off; vacuum, check; booster pump, off, generator, off; cowl flaps and mixtures, as required; ignition, off; fire extinguisher, as needed." The pilot's check list does not include any emergency procedures.

The captain said that when he was informed the wing was on fire, and saw the brilliant reflection on the No. 4 nacelle, he did not definitely know whether it was the wing or the No. 3 engine which was burning. He therefore decided to land as quickly as possible and this landing was accomplished in less than four minutes.

A review of the records of Captain Stanford's DC-4 flight training, together with his route and instrument checks, indicated his flying ability to be above average. These records also showed that he had satisfactorily completed DC-4 emergency procedure and evacuation training.

Analysis

A study of past in-flight engine fires has shown that the majority of fires originating in Zone 3 have not progressed forward into Zone 2. In this instance it is possible that the flexible bus, which extends from the junction box on the rear of the fire wall in Zone 3, through the fire wall along the inside of the leading edge of the wing, could have short-circuited at or near the junction box and created a fire. This would have occurred if the insulated copper cable of the bus had chafed against the inside wall of its aluminum conduit, which is grounded to the aircraft frame. However, the cable did not reveal any evidence of electrical arcing despite the fact that the conduit and cable insulation were destroyed.

It is believed more likely that the fire originated in Zone 2. This could have occurred in several ways. If the flexible oil pressure gauge line rubbed against the positive terminal of the generator and wore a hole through the cable to the metal braid, arcing would have resulted which would eventually ignite the escaping oil. A nacelle fire from such a cause had occurred only a few weeks prior to this accident, on this same aircraft. However, the company was alerted to such a possibility, and had taken the necessary corrective action.

Another possibility is that the generator failed mechanically, causing intense frictional heat to be transferred to the vacuum pump inlet line which was installed in close proximity to the generator. The temperature of the air which flows through this line would then be increased to such an extent by the action of the pump that it would melt the fusible plug which is designed as a safety factor to melt at a temperature lower than that of combustion. Oil vapor would then be released into the nacelle, and this vapor could be ignited by sparks from the failing generator. Since the alloy of the fusible plug did melt, this possibility cannot be discounted. This could also have occurred if there had been a restriction in the pressure discharge line of the vacuum pump.

Captain Stanford stated that when the emergency occurred he did not know whether the right wing or the No. 3 engine was on fire and that his

prime consideration was the saving of life by landing as quickly as possible. While the emergency procedures set forth in the company's Operations Manual were not followed in their entirety, in this instance it does not appear that the failure to do so resulted in any way in making the situation worse. In fact, had the oil line to the feathering mechanism been weakened or burned through by the fire, an attempt to feather the No. 3 propeller would have sprayed hot oil throughout Zone 2 of the nacelle, greatly intensifying the fire.

The captain also said that the emergency air brakes were not used during the landing roll because in his judgment the application of these brakes would have forced the nose wheel immediately to the ground and with the high speed of the aircraft at that time serious damage might have resulted by the gear striking an obstruction. Since the aircraft did roll across a highway and through two fences and a ditch before stopping, it appears that the captain exercised good judgment in not using these brakes.

Findings

On the basis of all available evidence, the Board finds that:

1. The carrier, the crew, and the aircraft were properly certificated.

2. Weather was not a factor in this accident.

3. A fire in the No. 3 engine nacelle, which necessitated an immediate landing, was observed when the aircraft was in the vicinity of Hugoton, Kansas.

4. When the aircraft was approximately 300 feet above the ground the No. 3 engine fell from the aircraft.

5. The fire-detection system did not function properly.

6. A safe landing was made on a small airport which was unsuitable for DC-4 aircraft.

Probable Cause

The Board determines that the probable cause of this accident was an uncontrollable engine fire of unknown origin which necessitated an immediate landing.

BY THE CIVIL AERONAUTICS BOARD:

/s/ DONALD W. NYROP

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board received notification at 2000, March 26, 1952, from the Kansas City office of the Civil Aeronautics Administration, that an accident had occurred near Hugoton, Kansas, at approximately 1725, involving an aircraft owned by Braniff Airways, Inc. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. A public hearing in connection with this accident was held in Dallas, Texas, on April 24 and 25, 1952.

Air Carrier

Braniff Airways, Inc., is an Oklahoma corporation, with its principal offices in Dallas, Texas. The company operates as an air carrier under a certificate of public convenience and necessity, and an air carrier operating certificate issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorize the carrier to engage in air transportation between various points in the United States, South America, and Mexico.

Flight Personnel

Captain J. W. Stanford, age 40, was employed by Braniff Airways, Inc., on February 16, 1941. He held a valid airman certificate with an air transport rating. Captain Stanford had a total of 10,271 flying hours, of which 389 were in DC-4 equipment. His last instrument and route checks were accomplished on February 8, 1952. He received his last CAA physical examination on September 26, 1951.

First Officer J. P. Beakley, age 29, was employed by the company on July 31, 1950. He held a valid airman certificate with an airline transport rating. He had a total of 2,797 flying hours, of which 95 were in DC-4 equipment. His last instrument and route checks were accomplished February 26, 1952, and his last CAA physical examination on January 11, 1952.

Hostess Dorothy Currey was employed by the company on November 20, 1950.

Hostess Betty Murphy was employed by the company in April 1951.

The Aircraft

N 65143, a Douglas Model C-54A, was owned and operated by Braniff Airways, and was currently certificated by the Civil Aeronautics Administration. It had a total of 11,679 hours, and was equipped with Pratt & Whitney R-2000 engines and Hamilton Standard 23E50 propellers. The engines had been operated since overhaul as follows:
No. 1, 722 hrs. 52 min.; No. 2, 6 hrs. 2 min.; No. 3, 378 hrs. 29 min.; No. 4, 627 hrs. 28 min.

PROBABLE FLIGHT PATH AND LOCATION OF FALLEN PARTS — BRANIFF AIRWAYS ACCIDENT

HUGOTON, KANSAS — MARCH 26, 1952