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SA-330

File No. 1-0026

CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

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BRANIFF AIRWAYS, INC., DOUGLAS DC-7C, N 5904,
MIAMI, FLORIDA, MARCH 25, 1958

The Accident

Braniff Airways Flight 971, a Douglas DC-7C, crashed approximately three miles west-northwest of the Miami, Florida, International Airport, March 25, 1958, at 0006.1/ The accident occurred at night under VFR conditions less than two minutes after takeoff from runway 27R. There were 24 persons aboard, including 19 passengers and a flight crew of 5. All 5 flight crew members and 10 revenue passengers survived. Four Braniff Airways crew members, dead-heading to Panama to ferry a company aircraft to Dallas, Texas, and 5 of the other passengers died. The captain and first officer of Flight 971 were seriously injured; the second officer, a flight engineer, received a broken leg and other injuries. The aircraft, with an engine on fire in flight, was practically destroyed by subsequent impact and ground fire.

History of the Flight

Braniff International Flight 971 was originally scheduled to depart New York, New York, for Miami, Florida, on March 23, 1958, at 2355 but this leg of the flight was not made owing to shortage of equipment and scheduling difficulties on that date. N 5904 was ferried from Dallas, Texas, to Miami, arriving at 1915 on March 24 for use as Flight 971. The aircraft was serviced and made ready for the trip to Panama City, Panama, the first scheduled stop on the route to Rio de Janeiro, Brazil.

The crew consisted of Captain Thomas D. George, First Officer John C. Winthrop, Jr., Second Officer Charles F. Fink, Steward Alberto Zapatero, and Stewardess Madelon Campion.

The flight departed the Miami terminal at 2356, taxied to runway 27R where engine runup was made, after which a normal takeoff was accomplished. Shortly after takeoff, and in accordance with tower clearance, a climbing right turn was started. During the turn the No. 3 engine malfunctioned and a fire developed in that area. The airplane, still in a right turn, started to lose altitude rapidly. While traveling in a north-northeasterly direction it struck in an open marsh containing scattered trees and underbrush.

Rescue operations were immediately initiated but were seriously hampered by heavy ground traffic of sightseers attracted to the area. Several of the passengers and crew members were airlifted by U. S. Coast Guard helicopters

1/ All times herein are eastern standard based on the 24-hour clock.

direct to hospital grounds in Miami and the others were removed to nearby ambulances and taken to hospitals.

Investigation

Ground impact marks revealed that the aircraft struck the ground with approximately 25 degrees of right bank while descending at an angle of approximately five degrees. The right wing tip contacted the ground first and the aircraft broke up immediately thereafter when the inboard right wing structure, the engines, and the fuselage struck the soft ground.

The wreckage was strewn along a half-mile track^{2/} on a heading of 023 degrees. The fuselage structure broke into three major sections. After separating at station 600 the aft section, with the tail surfaces still attached, skidded and rolled almost the entire length of the main ground path. This portion came to rest on its left side about 100 yards to the left of the ground path on an easterly heading. The vertical and horizontal surfaces separated and were found nearby. The cockpit and forward portion of the fuselage, broken at station 440, was found in an upright position approximately 1,800 feet from the point of initial impact, on a heading of 285 degrees. The damage to the top of the forward fuselage section was relatively light. The lower forward part of this section was ground down and destroyed during the skid. The middle portion of the fuselage, a part of which remained attached to the wing center section, was found approximately 2,100 feet from the point of initial contact. This section, which was inverted during a portion of the ground skid, came to rest right side up. During the time it was inverted the entire upper portion of the fuselage down to the wing fillets was destroyed. The left-hand wing center section was consumed by an intense ground fire.

The nose gear and the right main landing gear were separated from the aircraft during the ground breakup. The nose gear assembly was found in a retracted position 1,550 feet from the point of initial impact. The right main gear came to rest 2,200 feet along the ground path. The left main gear remained attached to the wing center section and was subjected to intense fire. It was determined that all three gears were in the retracted position at impact.

The primary flight control systems, although damaged by the ground impact, were sufficiently intact to indicate that no control failure had occurred in flight. All components of the elevator and rudder systems were available for examination. Parts of the aileron system were completely burned out or buried in the solidified masses of metal which resulted from melting of the wing structure by the intense ground fire in the left wing center section. All failures of the individual systems components which were located and identified were examined and all appeared to have been the result of overloading during the structural breakup of the airplane.

In the right wing the aileron control system was not damaged by the inflight fire. Thus, while many of the parts of the control system were damaged or lost, nevertheless, sufficient parts remained which were in a

^{2/} See Attachment A.

condition that permitted an examination and a conclusion that the control system was functioning properly.

The right wing center section, including No. 3 and No. 4 nacelles, was reconstructed as fully as possible to determine inflight fire patterns and the extent of fire damage to this structure. The inflight fire damage was confined to the No. 3 nacelle and the upper and lower wing surfaces immediately inboard and aft of this nacelle. The visible fire damage was restricted to blistering and charring of the paint which protects the wing surfaces from corrosion. The air fire pattern also indicated that the wing flaps were in the retracted position when the fire occurred. All other heat damage outboard of the No. 3 nacelle was determined to be a result of fire after impact. The horizontal stabilizer directly behind the No. 3 nacelle was covered with heavy soot deposits. The entire tail section was subjected to a flash fire after impact which destroyed most of the fabric on the rudder and blistered the painted areas.

All four engines, found approximately 2,000 feet from point of first impact, were removed from the swamp and examined by the Powerplant Group. A piston and a cylinder were found 1,350 and 1,550 feet, respectively, along the flight path. It was positively determined that these were the No. 11 cylinder and piston of the No. 3 engine. Investigation further disclosed that the other three engines were operating normally and developing considerable power at impact.

Inspection of the No. 11 cylinder of the No. 3 engine revealed that it had failed from fatigue approximately 1-1/2 inches above the cylinder mounting flange on the thrust side. The cylinder flange attaching cap screws were intact. The cylinder wall contained evidence of scuffing and ladder cracking was in evidence. The No. 11 connecting rod had failed approximately six inches outboard of its knuckle pin. All knuckle pins, including No. 11, were free from indications of maloperation at the master rod end. Cylinder wall scuffing was also found on No. 2 cylinder of the No. 3 engine.

All major portions of the four propeller assemblies were recovered. Most blades were shattered by contact with the ground. The No. 3 propeller was feathered. The propeller dome settings and shim plate impact marks on Nos. 1, 2, and 4 were examined and found to be positioned for a blade angle of approximately 43 degrees, which is 15-1/2 degrees above the low pitch stop and indicative that considerable power was being developed. Further, the Nos. 1, 2, 3, and 4 propeller governors were recovered. Subsequent bench tests revealed that they were positioned at 2,500 r. p. m. (climb power settings). Test also revealed that the governors were capable of normal operation.

The flight instrument panels were recovered from the wreckage. Impact forces had caused some external damage to the panels and to certain of the instruments. The flight instruments were removed from the panels and tested. All were found to be operable.

As previously stated N 5904, the ferry flight, arrived from Dallas at 1915 on March 24, 45 minutes after official sunset. As the flight approached for landing the airport tower controller asked the flight "904 your No. 3 engine smoking a little bit?" to which the flight replied "Well I hope not."

Another message from the controller stated, "Checking your position with the glasses, it seems to be leaving a very faint trail." The flight acknowledged these messages and landed without incident. When the crew reported in to company operations no mention was made of the smoking engine advisory from the tower. The captain reported the aircraft ready for Flight 971. He previously had signed the flight log which indicated no aircraft discrepancies. The company station agent also stated that during the period that N 5904 was on the ground at Miami he personally checked the aircraft log and found no entries therein. The ferry flight crew were "deadheading" on Flight 971 of March 25 and were fatally injured.

The aircraft was manufactured on March 29, 1957, and had accumulated a total time of 3,307:46 hours at the time of the accident. The last three maintenance checks and the last service check were reviewed and found to be completed and signed off by the mechanics and inspectors. The nonroutine work sheets indicated nothing significant pertaining to the engines, airframe, or electrical systems. The last No. 3 check was accomplished at Dallas on March 20, 1958, at which time the aircraft had accumulated a total time of 3,250:04 hours. The last service check was performed at Idlewild on March 24, 1958, at which time the aircraft had accumulated a total time of 3,298:31 hours.

A review of carryover reports revealed that they concerned cabin interior and upholstery items. One item concerning a cracked, nonstructural former in the right fuselage fillet had been carried through the last three maintenance checks since February 13, 1958, and was still outstanding at the time of the accident.

The aircraft flight logs and flight engineer logs since January 1, 1958, were reviewed and they indicated that the engines had been operated according to the instructions recommended by the manufacturer. Although consistent with company policy, certain maintenance items contained in the flight logs had been "deferred" for correction at Dallas, it was determined that none of these items were of such a nature as to affect adversely the airworthiness of the aircraft.

The flight crew scheduled for Flight 971 arrived at the operations office about 2250, March 24, and began their routine duties prior to flight. Captain George examined the weather reports over the route thoroughly, signed the customs general declaration, and signed his clearance. First Officer Winthrop prepared the flight plan and upon completion handed it to the station agent for routine handling. Gross weight of the aircraft was calculated to be 114,938 pounds at takeoff (gross weight 143,000 maximum allowable). Second Officer Fink arrived at operations before the others and went immediately to the aircraft to conduct the preflight inspection. The engines were started and taxi clearance was received.

Flight 971 taxied from the Miami International terminal ramp at 2356. Air Route Traffic Control (ARTC) clearance was delivered on ground frequency at 0002, March 25, 1958. The flight changed to tower frequency and was cleared onto the active runway, 27R, to make a right turn after takeoff, climbing on an eastbound heading 090 degrees until reaching 2,500 feet before proceeding on course. The flight departed without incident at 0004.

Tower personnel stated that the aircraft made a climbing right turn shortly after takeoff. When it had reached an altitude of approximately 900 feet a bright orange glow was observed on the right side of the aircraft. The aircraft was further observed to enter a descent, contacting the ground at 0006. Immediately prior to impact, tower personnel heard a call, "Braniff 971." No other messages were received from the flight following takeoff.

Following the accident First Officer Winthrop and Second Officer Fink were interviewed regarding the circumstances leading to the accident. Both stated that preflight preparations were routine and that no discrepancies were noted during the pretakeoff engine check. The first officer stated that Captain George made the takeoff from the left seat. He further stated that takeoff power was applied and that he adjusted the throttles to maintain a boost of 59-1/2 inches of manifold pressure.

First Officer Winthrop said that the takeoff was extremely smooth and that the aircraft was off the ground shortly after reaching V₂. The captain ordered the landing gear retracted, which Second Officer Fink accomplished. The flaps were then raised. First Officer Winthrop further stated that just about the time the flaps reached the full up position he felt a thud and immediately noticed a flash of light. He turned to his right, looked out his window and saw fire. He said the fire seemed to him to disappear so he looked back to the engine instruments to determine if they indicated an engine failure. At that time, he said, he recalls Captain George saying, "Feather 3." He also remembered Captain George telling him to call the tower and report that 971 was returning. He said he picked up the microphone but did not recall making any transmission.

First Officer Winthrop stated he noted no propeller overspeed or engine vibration and he could not remember performing any of the emergency procedures involved in feathering. He said he vaguely recalled hearing the fire warning alarm bell but did not recall actuating the Freon fire extinguisher.

Second Officer Fink was also questioned concerning the operation of Flight 971. He said, "We applied power and started the takeoff. All four engines developed about 250 to 255 RMEP (brake mean effective pressure) which is normal for the temperature condition existing at that time. We broke ground and the captain gave the order to pull up the gear and flaps and ordered METO power (maximum continuous power). The copilot reduced the manifold pressure and I reduced the r. p. m. Everything was normal at that time. Then the captain called for climb power and decreased the manifold pressure and r. p. m. Things seemed normal and we went ahead with the takeoff." The climb checklist was then accomplished. The bypass system was placed in the off position and the gear handle neutral; the "Fasten Seat Belt" and "No Smoking" signs were turned off and the turbine switch was turned to the off position.

Second Officer Fink also said that he waited a moment and then reached around and picked up his second officer's log to record the takeoff RMEP and fuel flow, and at this time the copilot said that No. 3 engine had failed and had a fire. Fink immediately turned back around and then the captain ordered No. 3 propeller feathered. Fink said, "I pulled back the No. 3 throttle and put the No. 3 in auto-lean-idle cutoff and feathered the No. 3 engine. The copilot pulled the firewall shutoff and pulled the Freon discharge from the

right bank and the fire seemed to diminish somewhat at this time." Fink further said that as he was reaching up to turn off the No. 3 magneto he noted a bright flash. He could see a glow against the night but did not know whether this was the fire recurring or if it was an explosion. He had the seat belt loose and was able to reach the necessary controls. At this time the airplane started downward and Fink said he was thrown against the glare shield. At about the same time he heard the captain exclaim "Jesus Christ." Second Officer Fink was still in this position facing the captain when the crash occurred. He said, "Everything happened so fast that -- actually there wasn't any time for anything to be said. Normally, you reach up and turn off the mag switch in a matter of a split second. I didn't even get that done." He stated that the engine fire was extremely intense. Asked if he had an opportunity to note any of the engine instruments prior to the warning by the copilot that No. 3 was on fire, he said, "Everything was normal--oil pressure, fuel pressure--everything normal operation at that time." He further indicated that takeoff power used was 59-1/2 inches, 2,800 r. p. m., and that they reduced power to 40 inches for climb r. p. m. He confirmed the copilot's statement that the captain was in the left seat, copilot in the right seat, and he was at the flight engineer's station. No one was on the rear jump seat, and no one else was on the flight deck. When the aircraft broke ground, he said, the airspeed was 120 knots but he did not remember any other speed readings. Mr. Fink further said that after No. 3 was feathered they did not increase power on the remaining engines. When asked about the attitude of the aircraft following the takeoff, he said he thought it was going out straight and that no turns were perceptible to him prior to the accident. However, he stated that he did not have his headset on and did not hear any conversation with the tower when the flight was given its flight clearance to execute a climbing right turn to 090 degrees following the takeoff.

In the course of the investigation statements were obtained from a number of passengers who were aboard Flight 971. Those who were seated in the rear of the cabin stated they had seen a flash of light and fire coming from the area of the inboard engine on the right side of the aircraft. They said the flames, which were yellowish-orange in color, were streaming back to the trailing edge of the wing or slightly beyond. Two of the passengers seated in the rear felt a severe vibration at the same instant. Those who were seated in the forward cabin directly behind the flight deck stated that after takeoff they noticed a flare of firelight reflecting in the cabin windows. Although the door to the flight deck was closed, two of these passengers said they heard a bell ringing prior to the impact but they were unable to determine its source. Other passengers also said that, following the flash of light, the aircraft nosed down abruptly as if in a dive, forcing them against their seats or belts. One passenger who had unfastened his seat belt after the seat belt light went out was thrown from the seat by the abrupt maneuver.

When the aircraft came to rest the fuselage was in three distinct and separated portions. Thus, evacuation as such presented no problem. Occupants who were ambulatory got out without help; the scene was well lighted by the ground fire, according to witnesses.

Statements were also obtained from many persons on the ground who had seen the aircraft on fire in flight. Almost all of these witnesses were in

agreement as to the probable flight path the aircraft followed. Most of the witnesses stated that their attention was attracted to a bright flash, immediately followed by fire, in the sky west of the airport. Some described their observations as being a "ball of fire" traveling in a northerly direction. All of them realized that the fire was coming from an airplane. To most of them who were not able to discern the aircraft form, the ball of fire appeared to proceed horizontally for a brief moment and then abruptly descend at an angle of approximately 20 to 40 degrees, striking the ground with a tremendous explosion. A few of the witnesses who were closer to the flight path of the aircraft were able to locate the fire as being on the right side of the aircraft. They said the fire appeared to come from the area of the right inboard engine and the flames extended aft to the trailing edge of the right wing.

One witness, an aircraft mechanic, located near the west end of runway 27R, stated he saw a small flame on the aircraft shortly after takeoff. He said the aircraft started a normal climbing right turn. He further said, "As the aircraft approached a northerly heading there was a bright white-orange flash which lit up the full right side of the aircraft. Immediately after this first flash or explosion the aircraft started going down very fast but holding level or a slight right-wing-down attitude." He also stated that it appeared to be under control but settling as if it had a great loss of power. Some of the witnesses described the fire as decreasing in intensity as the aircraft approached the ground. Others seemed to believe that the intensity did not decrease. Most of them were in agreement that the color was yellowish-orange and that this did not change. Various witnesses described the visibility conditions in the vicinity of the accident as being good but with patches of fog. The 2352 airport observation was: ceiling 7,500 feet; visibility 5 miles; temperature 64; dewpoint 63; barometer 2989; relative humidity 99 percent.

The radiosonde observations at Miami at 0000Z and 1200Z on the 25th showed a low level temperature inversion of 4 to 5 degrees in the first few hundred feet above the surface. This lowest few hundred feet was laden with moisture and a moist layer existed aloft between 9,000 and 11,000 feet at 0000Z and between 5,000 and 10,000 feet at 1200Z.

An examination of the hourly surface observations at Miami International Airport reveals that patchy shallow ground fog started forming after 2200 on the 24th. The 2328 observation showed clear skies and calm surface winds with a surface visibility of 4 miles in ground fog and a tower visibility of 8 miles. By 2343, a thin broken deck of clouds had developed at 7,500 feet and the surface visibility had improved to 5 miles. Surface winds were still calm and the tower visibility had remained 8 miles. A special observation was taken at 0012, six minutes following the accident. This observation indicated a measured ceiling of 7,500 feet (broken) with visibility 5 miles in ground fog and the surface winds calm.

The area aviation weather forecast called for variable patchy cloudiness above 3,000 feet m.s.l., while the winds aloft forecast for Miami called for southwesterly winds below 5,000 feet.

The terminal forecast for Miami, issued about 1700, called for a broken ceiling above 10,000 feet and no restriction to visibility between 2400 and 0600 on the 25th. The terminal forecast which came out about 2300 on the 24th indicated clear skies and 3 miles in ground fog from 2400 to 0700 at Miami, with conditions occasionally lowering to thin obscuration and 3/4-mile in ground fog. At 2312 on the 24th, however, an amendment to this Miami terminal forecast called for clear skies and 5 miles in ground fog between 2400 and 0200.

During the course of the investigation a test flight was conducted under the supervision of a Board investigator to determine whether any unusual flight attitude or maneuver would be required to place the aircraft in line with the wreckage path. Using the prescribed Braniff operating procedures, a DC-7C was flown from runway 27R to a point over the accident site and on a heading approximately that of the ground swath. This was easily accomplished with a right bank not exceeding 20 degrees. The test aircraft, which was approximately 8,400 pounds lighter than N 5904, reached an altitude of 1,000 feet over this point in less than two minutes from start of takeoff roll.

All Braniff crew training is conducted at the company headquarters in Dallas, Texas. A study of the school curriculum for DC-7C indicates that training is complete and comprehensive. The ground school course, which is given to both captains and first officers, consists of 36 hours of study of aircraft systems, aircraft performance and operation, and emergency procedures. Each pilot is provided with a manual of the course which he is required to study. Also, each pilot is required to pass an examination on the aircraft. Company records indicate that both Captain George and First Officer Winthrop successfully completed this course.

According to Braniff's chief pilot the company has no flight simulator training and none is required. He stated that, in addition to Link training, cockpit procedure training is done in the aircraft itself, either on the ground or in the air. All four-engine flight training is accomplished at Dallas, the carrier's main maintenance and overhaul base. A captain is required to fly DC-4 equipment for a period of six months prior to becoming eligible to qualify as captain on DC-6/DC-7C-type equipment. He receives a cockpit check and airplane familiarization in the same aircraft. Qualification on DC-6/DC-7C requires a minimum of 20 hours en route transition. Normally during this period he is scheduled as copilot. However, he may be scheduled as observer for any portion of the 20 hours, at the discretion of the chief pilot. Each captain receives a minimum of eight hours local flight transition, followed by a proficiency flight check and equipment type rating conducted by a qualified check pilot. Captain George qualified in this course during May 1957 and successfully passed his DC-7 line check on May 25, 1957. His last instrument check was accomplished January 11, 1958, in DC-6 equipment.

Candidates for DC-6/DC-7C First Officer Flight Transition Course initially receive a minimum of three hours airplane and cockpit familiarization, followed by 35 hours of en route transition on scheduled or nonscheduled point-to-point flights and then receive 2-1/2 hours of local flight transition. The 35 hours of en route transition may be reduced to 20 hours at the discretion of the chief pilot. In cases where the en route transition time has been reduced to 20 hours the local flight transition time shall be increased to 5 hours. First Officer Winthrop completed and qualified in the transition course.

The ground school curriculum for second officers (flight engineers) is equally comprehensive. Each second officer is provided with a manual containing all pertinent information necessary for his training. During the 289-hour course of instruction the subject matters covered consist of flight engineer duties, theory of flight and aerodynamics, maintenance of aircraft and engines, aircraft and engine performance computations, aircraft systems, trouble shooting, and emergency procedures. Each second officer is required to pass an examination covering all these subjects. In addition, for the DC-7C the flight engineer is given an additional 40 hours of instruction prior to his checkout. Company records indicate Second Officer Fink successfully completed these courses prior to assignment to this type of equipment.

Captain George has been a captain for Braniff for over 18 years. His total flying time is over 20,000 hours. According to company records 241 of this has been in DC-7 aircraft and 117:55 hours were acquired in the 90 days prior to the accident. The remaining 123 hours were accumulated during the previous nine months. Captain George had approximately 200 hours of scheduled operation in DC-7 equipment. He has also accumulated several thousand hours in other four-engine type aircraft.

A review of company pilot checks of Captain George for a period of almost 10 years disclosed that he had been given more than the minimum required number of such checks. In several instances it was necessary for him to be rechecked by company check pilots because of his initial failure to receive passing grades. Some instrument flight checks reflected inability to maintain altitude during turns; however, he did pass rechecks and remained on flying status.

Analysis

During the investigation of the accident the possibility was advanced that the captain intended to make an immediate off-airport landing because of damage to the airframe by the fire.

The Board is aware that fire in flight is extremely serious and unless quickly checked can affect the integrity of the structure. There is no doubt that a fire in flight existed; however, it was so confined within the No. 1 zone of No. 3 engine that the aircraft structure was not affected. Actually, only blistering of the paint was evident to the rear of No. 3 nacelle, which substantiates the small area and duration of the fire. Unfortunately, the crew could not be certain that the fire was under complete control. Regardless of the effectiveness of the fire control procedure, an immediate return to the airport was proper.

The evidence is clear that Captain George did not intend to make a landing at the time or point of impact. His order to the first officer to advise the tower that they were returning to the airport precludes any thought of landing at a place other than the airport. The first officer was only able to start his radio transmission ("Braniff 971") before the accident occurred.

Well qualified witnesses estimated the highest altitude of the aircraft during the flight to be approximately 800 feet. This estimate is consistent with the known performance of the aircraft under the conditions of power and

configuration employed until the moment of engine failure. It is evident, therefore, that the aircraft descended rapidly from this altitude. Testimony of the flight engineer and statements of passengers show conclusively that there was a sudden descent and an abrupt change in aircraft attitude. They said the aircraft pitched down abruptly.

The captain took positive action to break the climb attitude and establish a shallow descent toward the airport. Nevertheless, the Board must conclude that he did not use proper technique and allowed the aircraft to descend to the ground. His injuries blocked all recollection of the flight despite his sincere desire to testify regarding his actions during the emergency. The first officer, also seriously injured, was able to recall some of his own actions during the flight. However, his recollections of detail and times were not as clear as those of the second officer. Second Officer Fink, although injured, did not lose consciousness in the accident and was able to describe events of the flight in more detail and better sequence when interviewed in the hospital several days after the accident.

Soon after passing the boundary of the airport on a heading of 270 degrees a right turn was started and the ground impact was on a heading of 23 degrees. It is obvious that the rapid descent occurred during this turn of 113 degrees. Ground marks indicated that the right wing tip was the first part of the aircraft to strike the ground. This impact occurred while the aircraft was in a right bank of approximately 25 degrees and descending at an angle of approximately five degrees below horizontal. The banked attitude and high airspeed at impact (178 knots - computed from propeller slash marks) offer further proof that an off-airport landing was not intended.

The captain was under considerable stress during the emergency and despite his 20,000 hours of flight experience it is probable that this situation brought out his former difficulties in maintaining altitude and control during turns. The aircraft was not heavily loaded and there should have been little difficulty in returning to the airport with three normal operating engines and the fourth, an inboard engine, feathered. Power was not advanced from the climb setting existing but, according to the DC-7 operations manual, more power was not required to maintain level flight and altitude. In fact, this aircraft, loaded as it was, and under the existing atmospheric conditions, should have been capable of climbing with one propeller feathered at a rate of about 470 ft./min. The rapid and premature descent indicates that the captain displayed poor piloting technique by allowing his attention to be diverted from his flight instruments by the engine fire, objects on the ground, and the emergency procedures being taken by the other crew members. Investigation determined that the Nos. 1, 2, and 4 engines were operating normally. Also, there was no failure of the airframe prior to impact and the flight instrument systems operated normally when tested after the accident. The flight control systems, as hereinbefore indicated, appear to have been operating normally up to the impact. Had any control difficulty been experienced the crew could have been expected to take emergency flight control measures, but no indication of such measures having been taken was found. In any case, other crew members would have been aware of the control difficulties.

Visibility in the airport area was reported as eight miles by the tower. Since the scene of the accident was approximately three miles from the airport,

patches of ground fog at the accident area would not have interfered with the return of the flight.

As N 5904 arrived on a ferry flight from Dallas, Texas, March 24, a Miami tower controller observed smoke trailing from the No. 3 engine. The crew, although informed by the tower that smoke was observed trailing from the No. 3 engine, did not enter this information on the flight log. It is possible that had this been done an inspection would most likely have detected the defective cylinder. It is difficult to understand why this was not entered as it would have required an inspection at Miami. Because of the fatal injuries to the crew of the ferry flight, the Board is unable to determine the reason for this incident not being written up in the aircraft log.

The problem of cylinder wall scuffing in the turbo compound engines has been industry-wide. The Civil Aeronautics Board and the Civil Aeronautics Administration are studying the problems related to this model engine. The Civil Aeronautics Administration, on June 30, 1958, issued Airworthiness Directive 58-13-5. Part I of this Directive calls for the mandatory replacement of the second chrome-plated compression ring with a cast-iron ring at first overhaul after August 1, 1958, but no later than March 1, 1959.

Prior to the accident, Braniff Airways was in the process of replacing this chrome-plated piston ring on all of its engines as they reached overhaul. The No. 3 engine involved in this flight did not have the cast-iron piston ring installed as the engine had not reached its overhaul period. Since the accident, all Braniff engines have been modified to replace the second chrome-plated compression ring with the cast-iron ring in accordance with the Airworthiness Directive of June 30, 1958.

New procedures in the cylinder wall refinishing process, in the form of crosshatching, are being incorporated to improve cylinder barrel lubrication, as recommended by the manufacturer's service bulletin dated December 31, 1957.

In addition to compliance with the Airworthiness Directive of June 30, Braniff is boroscoping all cylinders which indicate combustion chamber difficulties as shown by the ignition analyzer. Also, all cylinders are being boroscoped during line maintenance inspections as the engines reach 600 hours operating time. Since the institution of these procedures following the accident, the carrier has not experienced a single instance of cylinder barrel failure.

As a part of this accident investigation, the Board has examined closely the qualification requirements and procedures of the carrier and its ground and flight training curriculum and facilities. We are unable to find any basic deficiency which we would consider contributory to this accident. The preoccupation of the captain under the conditions of emergency with which he was confronted is recognized as a matter extremely difficult, if not impossible, to anticipate. It is recognized, however, that the increased size of aircraft, the increasing cost of operation, the pressures of communities in the vicinity of airports which tend to discourage simulated engine failures during takeoff, and increasing traffic problems, especially at high-density airports, tend to discourage training operations at air carrier terminals. The Board is of the view that these factors, as well as the vastly improved quality of aircraft simulation in recent years, add emphasis to the need for

maximum exploitation by air carriers of training devices, such as aircraft simulators.

Findings

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

1. The aircraft, crew, and carrier were currently certificated.
2. The gross load of the aircraft was well under maximum allowable weight and was properly distributed.
3. Weather was not a factor in the accident.
4. The flight was properly planned and dispatched.
5. Smoke from No. 3 engine on the prior flight was reported to the ferry crew by the Miami tower and the crew should have written up this item in the aircraft log.
6. Shortly after a routine takeoff No. 11 cylinder of the No. 3 engine failed, resulting in a fire in flight.
7. Emergency measures (i.e., propeller feathering, extinguisher, fuel (shutoff) were promptly taken by the crew.
8. Full power was available from the other three engines and there was no impairment of structure or control of the airplane.
9. The captain made a decision to return to the airport and, in attempting to do so, altitude was not maintained and the aircraft struck the ground.

Probable Cause

The Board determines that the probable cause of this accident was the failure of the captain to maintain altitude during an emergency return to the airport due to his undue preoccupation with an engine fire following takeoff.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ G. JOSEPH MINETTI

/s/ LOUIS J. HECTOR

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

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident at 0015, March 25, 1958. 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 was ordered by the Board and was held in Miami Beach, Florida, on May 7 and 8, 1958.

Air Carrier

Braniff Airways, Inc., is an Oklahoma corporation with its principal offices located in Dallas, Texas. The company is engaged in the transportation by air of persons, property, and mail under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. The company conducts scheduled operations over the international route involved and over routes within the United States.

Flight Personnel

Captain Thomas D. George, age 50, was employed as a pilot of Braniff Airways October 18, 1935, and was rated as a captain on May 1, 1939. He held a valid airman certificate with an airline transport rating and type ratings on DC-3, DC-4, DC-6, and DC-7 aircraft. Captain George had, according to company records, a total of 20,672 pilot hours, of which 241 were acquired in DC-7 equipment. His last physical examination was successfully passed on October 31, 1957, first-class, with a limitation that glasses shall be worn while flying aircraft. The dates of his last instrument proficiency and line checks (on DC-6 aircraft) were January 11, 1958, and January 13, 1958, respectively.

First Officer John C. Winthrop, Jr., age 37 (copilot on Flight 971), was employed by Braniff Airways as a pilot on July 8, 1946. He held a valid airman certificate with an airline transport rating and type ratings on DC-4, DC-6, and DC-7 aircraft. First Officer Winthrop had, according to company records, a total of 13,250 hours, of which 257 hours were acquired in DC-7 equipment. His last physical examination was successfully passed on February 20, 1958, first-class, no waivers. His last competency (line) check was on November 8, 1957. His DC-7 copilot qualification was on March 10, 1957.

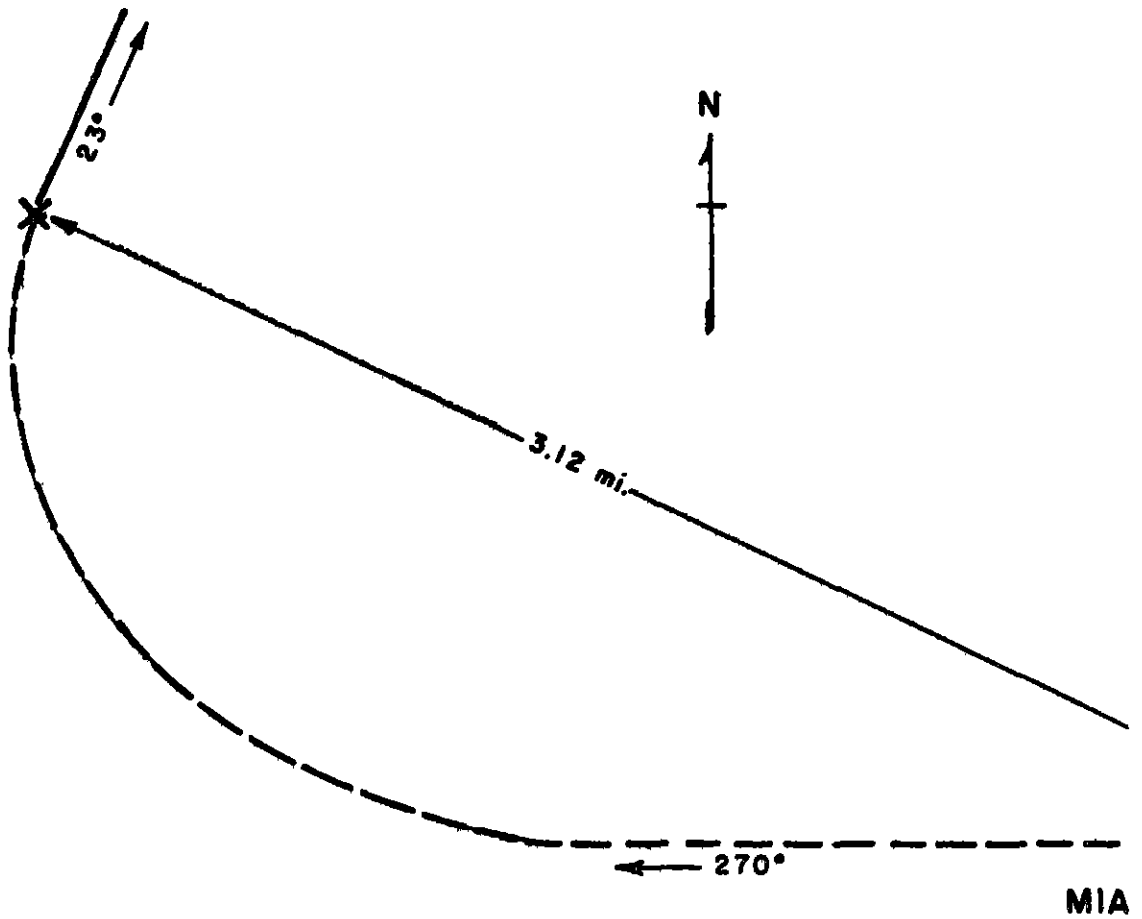
Second Officer (Flight Engineer) Charles F. Fink, age 23, was employed by Braniff Airways as a second officer (flight engineer) April 30, 1956. He held a valid airman certificate with ratings of commercial pilot, multi-engine land, instrument and flight engineer. His latest physical examination was on March 3, 1958. He received a flight engineer proficiency check on October 8, 1957. His total time on DC-7 equipment was 705 hours.

Steward Alberto Zapatero, age 21, was employed by Braniff Airways on October 17, 1957. He was qualified on DC-7 equipment and had received his last emergency training procedure in October 1957.

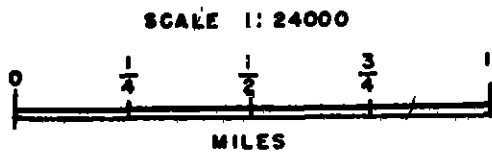
Stewardess Madelon Campion, age 25, was employed by Braniff Airways March 1, 1953. She was checked out on DC-7 equipment and had received her latest emergency training procedures on March 14, 1958.

The Aircraft

Douglas DC-7C, serial number 45072, N 5904, was manufactured March 29, 1957. Total time on the airframe was approximately 3,306 hours, with 57:42 hours since last maintenance operation. The aircraft was equipped with four Wright 988TC18EAL engines and four Hamilton Standard model 34E60-355 propellers with 7019-2 blades. Total time on the engines ranged from 2,944 hours to 3,242 hours, with last overhaul times between 2,086 hours and 2,764 hours. Time on the propellers ranged from 2,504 hours to 3,618 hours, with the last overhaul times between 2,083 and 2,159 hours.



----- Take off and probable flight path
————— Wreckage path

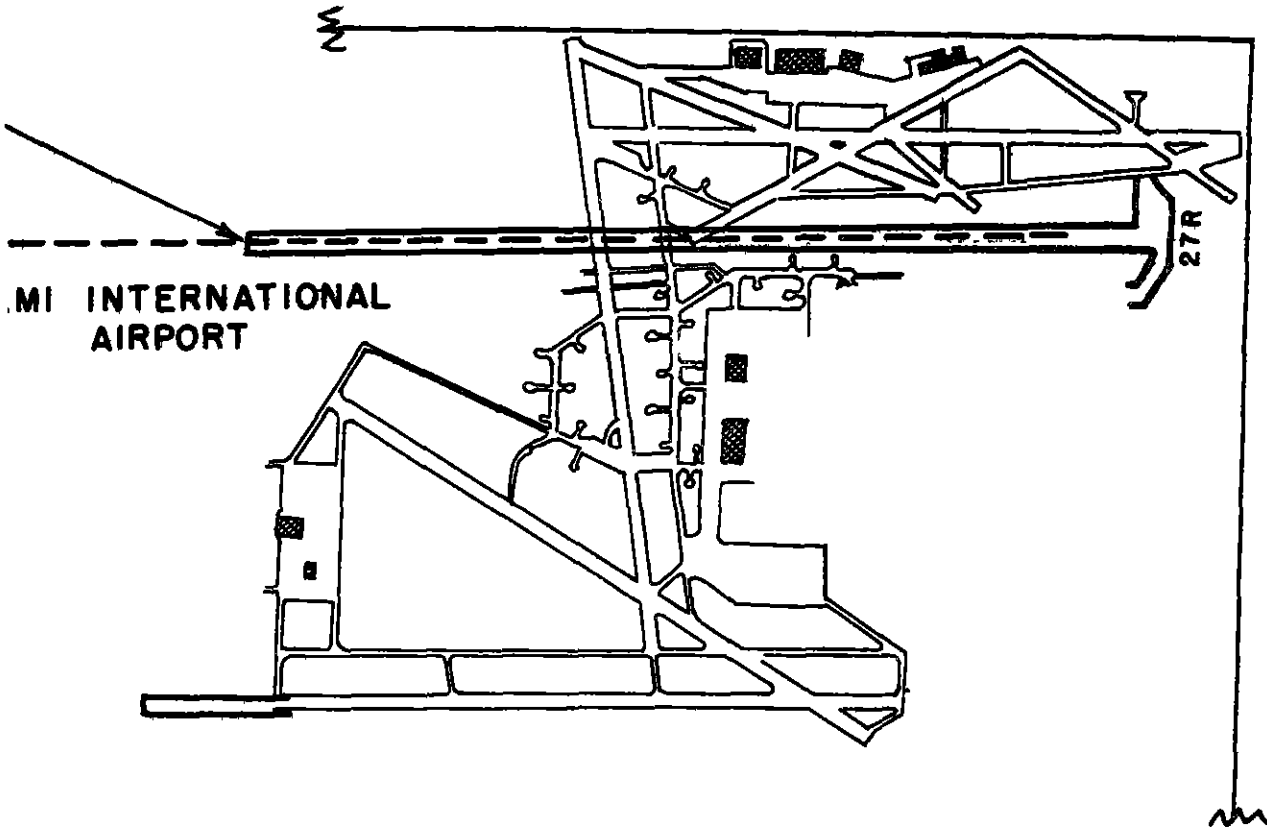


ATTACHMENT A.

BRANIFF AIRWAYS-DC-7C-N5904

MIAMI, FLORIDA

MARCH 25, 1958



MIAMI INTERNATIONAL
AIRPORT

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