

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: February 25, 1947

Released: February 28, 1947

VIKING AIR TRANSPORT COMPANY - RICHMOND, VIRGINIA, May 16, 1946The Accident

A Douglas DC-3, NC-53218, registered in the name of Viking Air Transport Company, a non-certificated air carrier,* crashed near Richmond, Virginia, at 0104 EST,** May 16, 1946, while attempting to locate Burd Field, Richmond, Virginia, for an emergency landing under extremely marginal weather conditions. The aircraft was demolished by impact and subsequent fire, and all 27 occupants were fatally injured.

History of the Flight

According to the operating policies of Viking Air Transport Company, the captain of each flight is authorized, in the absence of specific instructions from the home office of the company at Glendale, California and when away from the company headquarters, to contract with various travel agencies for the charter of the aircraft and to make such arrangements as necessary for the most economically advantageous operation. During a three-day stop-over at Newark Airport, Newark, New Jersey, Captain William D. Anderson had, therefore, chartered the DC-3 to the Coast To Coast Air Cargo Lines, a travel agency, for transport of passengers and baggage to various

*3r "non-certificated air carrier" this report refers to an air carrier which does not possess a Certificate of Public Convenience and Necessity as issued by the Civil Aeronautics Board in accordance with the provisions of the Civil Aeronautics Act of 1938, as amended. These carriers are commonly referred to as non-scheduled air carriers.

**All times referred to in this report are Eastern Standard and based on the 24-hour clock.

places in southern United States. With a crew of 2 and 29 passengers with personal baggage, the aircraft departed Newark airport at 1937, May 15, 1946, under a contact flight plan with its destination as Norfolk, Virginia.

At 2002, the flight reported over the Philadelphia radio range station and requested an instrument clearance from Air Traffic Control to cruise at 500-feet-on-top to Norfolk via Baltimore, Washington and Richmond. The request was approved by the New York ATC Center and the flight proceeded en route to Norfolk above the overcast, making normal position reports over Baltimore and Washington.

The flight called the Richmond radio range station at 2151 and requested the Richmond and Norfolk weather reports. Upon learning that the 2130 sequence report for Norfolk indicated a broken ceiling of 400 feet and 1 mile visibility, Captain Anderson decided to land at Richmond. The Richmond 2130 sequence report indicated an estimated ceiling of 2,500 feet and 7 miles visibility. The flight advised Richmond Radio of its intention to land at Richmond and also reported that it was experiencing "fuel trouble" at that time. Upon contacting the Richmond control tower for landing instructions, the flight advised the tower that the oil pressure gauge was "fluctuating." A normal approach was made to Byrd Field, and the flight landed at 2208.

The aircraft was taxied to the ramp and parked. The pilots advised Army ground crew personnel that no maintenance or service was required and then went to the operations building to check the weather in the area. Inasmuch as four passengers on the aircraft were en route to Norfolk and since the Norfolk weather showed no signs of improvement, arrangements were made for the transportation of these passengers to Norfolk by taxi. The captain and co-pilot spent the following two hours in checking the weather in order to determine the feasibility of continuing the flight toward Houston.

Captain Anderson studied the weather alone in the Army Air Forces weather office and, according to testimony of the AAF dispatcher at Base Operations, he stated that the weather "looked bad", and that he did not think he was going to take off that night. He then proceeded to the Eastern Airlines' station and discussed the weather further with his co-pilot, D. Miner and the Eastern station agent. The Eastern station agent stated that Captain Anderson did not wish to take off but that Miner wanted to continue with the flight immediately. After a discussion between the captain and the co-pilot for approximately 20 minutes, they agreed to file a flight plan for Atlanta, Georgia, and to check the weather at the destination while en route.

A flight plan was completed and an instrument clearance was obtained from the Washington Center of ATC to cruise 500-feet-on-top to Atlanta. The flight departed Richmond at 0007, May 16, 1946, with 25 passengers and the crew of 2. At 0034, the flight called Richmond Radio, reported its position as 40 miles southwest of Richmond at 500-feet-on-top, and stated that it was returning to Richmond because of a rough engine. Richmond Radio transmitted a new traffic clearance to the flight, clearing it to return to Richmond and to maintain an altitude of 3,000 feet en route. The flight reported over Richmond at 0044 and was cleared to the Richmond tower.

At 0049, the flight contacted Richmond Tower and reported that it was leaving 2,500 feet and initiating an instrument approach to Byrd Field. The flight established visual contact at 400 feet at 0051 during its final approach and was sighted passing over the field at a very low altitude on a NNE heading. Inasmuch as it was not aligned with the runway at the completion of its approach, it continued beyond the field and immediately thereafter reported that it had lost sight of the airport and was returning to

the range station for a second approach. The control tower received a report from the flight at 0102, "over the cone at 1,500 feet", and, in acknowledgment, provided the flight with landing instructions. No further transmission was received from the flight.

Several Army personnel at the airport stated that they heard explosions and saw a bright flash resembling fire from an area six or seven miles south of the field. Several persons residing near the scene of the accident stated that they heard the aircraft pass in the vicinity of the range station at a low altitude and with at least one engine sounding "rough." Immediately prior to the sound of the crash a roar was heard indicating that full power had been applied in an attempt to avoid the crash. Fire broke out immediately following impact and all occupants of the aircraft were dead when the first observer reached the scene.

Investigation

The wreckage of the aircraft was located approximately 40 feet from the east bank of Fourmile Creek in a densely wooded section 5/8 of a mile SSE of the Richmond radio range station. Inspection of impact marks on the trees and on the ground indicated an angle of descent of approximately 55 degrees at the time of the crash. The relatively short swatch cut through the trees was oriented north and south and indicated a southerly heading of the aircraft at the moment of initial contact with the trees. Some parts of the aircraft had gouged the soft soil to a maximum depth of five feet while others had buried themselves deeply in the mud. The entire wreckage and the marks of impact were confined to an area 75 feet in radius demonstrating the steepness of the descent and the abruptness with which the aircraft came to a stop.

After glancing the tops of some tall trees at a height of more than 100 feet above the ground, the right wing was sheared off at a point 6 feet out-

board of the attack angles upon impact with a large pine tree. The outer wing panel fell almost vertically to the ground while the remainder of the aircraft whipped to the right. The left wing struck other trees and was sheared at three points before it contacted the ground. The fuselage came to rest on a heading of west, having turned approximately 90 degrees to the right while crashing through the trees. Both engines were torn loose, the right engine being thrown about 20 feet ahead of the wreckage and the left engine having uprooted two trees nearer the wreckage and lodged beneath them.

The considerable disintegration caused by contact with the ground and trees was further complicated by fire which broke out after impact and which consumed most of the forward portion of the fuselage. Practically all combustible material either on board the aircraft or a part of its structure, including the fabric covering of the control surfaces, was consumed by fire. Destruction of the instruments and cockpit controls was so complete as to render extremely difficult an accurate evaluation of their indications or settings at the time of the accident. The only reliable indication obtained from any of the instruments in the cockpit was the setting of one of the altimeters. The setting of 30.02 inches corresponded very closely to the altimeter setting recorded for Byrd Field at the time of take-off.

The investigation disclosed that the flaps were fully retracted and that the landing gear was fully extended at the time of impact. Inspection of the rudder trim tab indicated full application of left trim at the time of the crash. The radio dials were completely destroyed and no reliable indications as to their frequency setting prior to impact could be ascertained. Nothing was found to indicate failure of any part of the aircraft structure prior to the crash.

The right ignition switch was found in the "Off" position; the left ignition switch and the master switch were both in the "On" position. The control quadrant was found locked as a result of burning; the left mixture control was in the "On" position and the right mixture control was in the "Off" position. The position of these controls indicates conclusively that the right engine was inoperative prior to impact. Detailed inspection, however, failed to disclose any mechanical defects in the right engine which may have existed during flight. Inasmuch as this engine had rolled clear of the vicinity of the fuselage, it was not damaged by fire. It was apparent that the right propeller had not been feathered. The oil screen disclosed no evidence of metallic accumulation. All gears in both the reduction gear and accessory gear assemblies were intact. The remains of the ignition system were examined thoroughly for some indication of defective wiring, however, no such evidence was disclosed.

The left engine was extensively damaged as a result of fire on the ground, rendering an accurate evaluation of its condition prior to impact extremely difficult. Although all but six of the cylinders were found broken off the engine, it was observed that the inner surface of only the No. 5 cylinder had contained marks of contact with an apparently broken intake valve. It could not be determined at this time whether these marks were the result of impact, however, since this was the only cylinder which bore such abrasions, a careful inspection was made of the remaining assembly. The lockbox had broken loose from the cylinder head, the fracture running across the intake along a line approximately 1/2 inch above the valve seat. Peening or scuffing was noticed on the inner surfaces of the fracture of both these segments and it was observed that the scuffing was of such a nature as to indicate that the failure must have occurred prior to the crash and that these

surfaces had been rubbing against each other for a considerable period of time. A deep dent was observed on the side of the rocker box, the most extensive distortion in which had occurred at the fracture. The indentation was of such a nature that, had the rocker box and cylinder head been intact at impact, a similar distortion of the surface of the cylinder head should have occurred at approximately the same location. However, when the two parts were mated it was clearly noticed that the cylinder head had not been subjected to the same blow which dented the rocker box. It was apparent, therefore, that this blow was not responsible for the fracture and that the fracture had occurred prior to the concussion which caused that indentation. The above findings indicate, therefore, that, although the left engine was operating until the moment of impact, it was operating with the No. 6 cylinder defective.

In order to check thoroughly every possible evidence of malfunctioning in the No. 6 cylinder of the left engine, this cylinder was sent to the National Bureau of Standards for further study. The study by that agency disclosed the presence of a dark carbonaceous material coating parts of the inner surfaces of the fracture on both the rocker box and the cylinder head which appeared to be the product of engine combustion. However, inasmuch as the failure was located in the intake port, it is probable that the discoloration was the residue of gasoline seepage through the crack plus dust and oil which may have been drawn in from external sources when the powerplant was being operated at manifold pressures less than atmospheric pressures. The intensiveness of the discoloration strongly indicated that the initial failure had occurred considerably prior to impact. Similar fractures on the same as well as other cylinders bore no evidence of such a coating. This study demonstrated, furthermore, that, in view of the localized character of the coating and because of the absence of any indications

on the cylinder of a severe fire from an external source, it can be concluded that the fracture had been progressively enlarging for some time prior to the accident.

In addition to the foregoing, the Bureau of Standards confirmed the findings of the Board's technical staff that the rocker arm sockets and valve tips, as well as the cam follower sockets and the ball ends of the push rods, of the No. 6 cylinder possessed a polished and worn appearance which indicated that they had been loose for some time prior to the crash and that this condition may have been caused by a failure in the cylinder head casting.

The testimony of two AAF maintenance personnel disclosed that some difficulty was observed in the operation of the right engine while the aircraft was at Byrd Field and that considerable difficulty was encountered in starting this engine shortly before departing for Atlanta. Both of the above witnesses testified that the right engine "sounded rough" and explained that it appeared to be "missing." The left engine, however, appeared to be functioning normally. At no time did either of the pilots request any service from the AAF maintenance crew. However, according to the testimony of an AAF mechanic, at this time one of the pilots commented that he had observed some defect in the ignition system of one engine.

An analysis of the weather synopsis concerning this region indicated the location of an extensive high pressure area off the Atlantic Seaboard centered approximately 100 miles off the coast of Virginia. The circulation about this high pressure area resulted in a long trajectory over the ocean and a flow of warm, moist air from the Atlantic into the southern Seaboard States causing low ceilings and poor visibility throughout the period. Marginal and below minimum weather conditions were being reported in the extreme south Atlantic coastal area during the evening of May 15.

and these conditions were gradually spreading inland and northward during the very early morning of the following day.

During the flight from Newark to Richmond, the crew were aware that weather conditions had gradually worsened throughout the south Atlantic states. While the pilots were checking the weather situation at Richmond from 2200 to 2400, the ceiling at Richmond decreased from 2,500 feet overcast to 400 feet overcast and the visibility decreased from 7 miles to 4 miles. Ceiling and visibility continued to decrease after the departure of the aircraft at 0007. At 0034, when the aircraft was already returning to Richmond, the Richmond weather report was indicating "Ceiling, 400 feet, overcast; visibility, 2 miles." By 0056, shortly after the aircraft missed its first approach, the visibility had decreased to $1\frac{1}{2}$ miles. Within the following hour the weather conditions were being reported as: "Ceiling zero, visibility zero."

The histories of the crew revealed that the captain had recently left the employ of a scheduled air carrier in whose service he had been flying as a co-pilot for approximately $3\frac{1}{2}$ years. Having failed on several occasions to pass satisfactorily the flight test required by that air carrier for promotion to captain, Anderson was informed that he was "not considered captain material", whereupon he resigned. A review of the company flight check records indicates that in each instance he was unable to maintain adequate control of the aircraft under emergency situations. Shortly after having resigned from the scheduled air carrier he passed satisfactorily a flight check given by a CAA Air Carrier Inspector and thereby obtained an Airline Transport Pilot Rating. This certificate was effective at the time of the accident. Having been employed by Viking Air Transport for only a week, a flight from Glendale, California, to Newark and from Newark until the
Y accident at Richmond constituted his only experience in command of an air

carrier aircraft. Until the time of the accident the captain had accumulated a total of 2,556 hours' flying time, the greater portion of which had been obtained as a co-pilot in DC-3 aircraft. The co-pilot, D. Miner, had obtained most of his total of 500 hours' flying time in small, single-engine training aircraft while serving in the AAF glider training program and, since having joined the company, had obtained approximately 100 hours as co-pilot in DC-3 equipment. Investigation disclosed that Miner was one of the original organizers of Viking and was a stockholder in the company.

Discussion

In reconstructing the flight several significant facts are apparent which strongly indicate inadequacy of company policies with respect to operations of this nature as well as the incompetency of the pilot personnel involved. A series of extremely adverse conditions combined to involve this operation in an exceptionally unfortunate situation with which the flight crew were not competent to cope. The entire operation was characterized by indecision and confusion on the part of the crew, and it is apparent that the manifold responsibilities of the captain coupled with his own awareness of the hazards of the particular flight affected his ability to reach a sound decision on the basis of which the safety of the operation might have been assured.

From the testimony obtained during the investigation of this accident it is apparent that the crew had some doubts concerning the satisfactory functioning of the aircraft. At various times during the night of May 16 the pilots commented on "fuel trouble", a fluctuating oil pressure gauge, and a loss of power in an engine when operating on only one magneto for that engine. Yet no request was made for any maintenance service at Richmond. These comments by the crew disclose an element of doubt as to the airworthiness

ness of the aircraft but do not indicate with any degree of conclusiveness that the flight crew were aware of the seriousness of the defects in the aircraft.

It is apparent that, although the crew indicated that the reason for landing at Richmond was mechanical trouble, their intent was primarily to deplane passengers bound for Norfolk. It is further evident that the captain was apprehensive of the weather situation farther south and that he desired to make an additional check at Richmond of the weather before continuing the flight.

Neither of the pilots had much experience in command of aircraft with the responsibility for reaching appropriate decisions under difficult circumstances as well as the responsibility for control of aircraft under emergency flight situations. Captain Anderson was apparently very reluctant to continue the flight under the conditions existing at the time and had evidently decided against taking off at Richmond. However, the testimony of personnel at Byrd Field indicates strongly that the captain permitted his much less experienced co-pilot to persuade him to attempt the flight against his judgment. All the data available to the crew disclosed a rapid worsening of weather conditions throughout the area but, despite a seemingly comprehensive study of the weather, the captain, after consulting with the co-pilot, modified his earlier decision and agreed to continue the flight.

The evidence disclosed that the right engine had been operating somewhat roughly prior to departure from Richmond. It is possible that this condition was the result of ignition difficulty due to moisture which caused occasional missing. This fact, in addition to the difficulty encountered in starting the right engine at Richmond, may have led the crew to conclude that this engine required particular attention. Unknown to the crew, however, a crack

had been developing in the No. 6 cylinder head of the left engine and, shortly after departing from Byrd Field, the cylinder head evidently fractured completely. This failure would have resulted in abnormally rough operation of the left engine, however, it would have been difficult for the pilot to determine which engine was operating roughly without particular attention to instrument indications.

There is little doubt that this roughness in operation of the left engine convinced the crew that a landing should be made without delay and they elected to return to Richmond where the weather conditions, meanwhile, were worsening. It appears, however, that the crew believed that the source of the vibration was in the right engine instead of the left. The extent of the roughness in the left engine during the descent to Richmond would not have been as noticeable to the crew as it would had full power been developed at that engine. In view of this fact and because the radio contacts with the flight indicated that it was returning to Richmond with a "rough engine," it is apparent that both engines were operating until the completion of the attempted instrument approach.

An instrument approach was attempted by the flight with the landing gear extended. However, when the aircraft had established visual contact with Byrd Field, it was not in position for a landing and the captain chose to attempt a second approach. In doing so the captain neglected to retract the landing gear. At this time it became necessary for the pilot to apply take-off power to both engines in order to complete the go-around. It is evident that a considerably greater roughness of the left engine was then experienced and the pilot apparently became convinced that it would be necessary to shut down the rough engine. This decision must have been reached within two minutes after the aircraft had passed over Byrd Field.

on its first low approach.

When in the vicinity of the Richmond range station, the pilot, in the belief that the right engine was not functioning properly, either ordered the co-pilot or took the necessary action himself to shut down the right engine. The right ignition switch was turned to the "off" position and the aircraft was trimmed fully to the left to compensate for the resultant loss in power from the right engine. The left engine, however, remained in operation with one defective cylinder and at a fairly high manifold pressure. Such a condition would have resulted in considerable vibration from that engine and full power could not have been developed. In this confusion the landing gear was left in the down position. Airspeed and altitude could not possibly be maintained under these conditions and the manner in which the impact occurred indicates conclusively that the aircraft was stalled shortly thereafter, following which it fell to the ground and burned.

Findings

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

1. Some doubt existed in the minds of the crew as to the airworthiness of the aircraft prior to departure from Richmond, Virginia.
2. The captain permitted himself to be persuaded by the less experienced co-pilot to undertake a flight under adverse weather conditions the forecast for which predicted worsening weather both at the point of departure and the destination.
3. The aircraft departed Byrd Field, Richmond, Virginia, at 0007 for Atlanta, Georgia.
4. Unknown to the flight crew, a crack was developing in the No. 6 cylinder head of the left engine during that portion of the flight immediately after take-off.

5. Shortly after departure, while en route to Atlanta, the rocker box fractured completely.
6. The crew elected to return to Richmond for an emergency landing.
7. Having obtained the proper Air Traffic Control clearance, the flight returned to Richmond and attempted an instrument approach to Byrd Field.
8. Visual contact was established at an altitude of 400 feet above the ground, however, the aircraft was not oriented with respect to the landing runway and a go-around was initiated with the landing gear left in the extended position.
9. The aircraft returned to the range station in order to begin a second approach.
10. In the vicinity of the range station the right engine was shut down and the crew attempted to sustain flight with only the left engine operating and with the landing gear extended.
11. The right propeller was not feathered.
12. The aircraft was not able to maintain airspeed or altitude.
13. The aircraft stalled and fell to the ground nose first and was demolished by impact and fire.

Probable Cause

On the basis of the foregoing the Board determines that the probable cause of this accident was the inability of the pilot to maintain adequate control of the aircraft to effect an emergency single-engine instrument approach under adverse weather conditions. Contributing factors were: The decision of the pilot to continue the flight into weather conditions which he considered unsafe; the negligence of the pilot in failing to

have an inspection of the aircraft engines made prior to departure from Richmond, the action of the pilot in shutting down the wrong engine when experiencing excessive vibration from a power plant; and the pilot's neglect in failing to retract the landing gear during an emergency go-around.

BY THE CIVIL AERONAUTICS BOARD:

/s/ J. W. LANDIS

/s/ OSWALD RYAN

/s/ HAROLD BRANCH

/s/ JOSH LEE

/s/ CLARENCE M. YOUNG

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board received notification of the accident at 0315, May 16, 1946, and immediately initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Air Safety Investigators of the Board arrived at the scene of the accident at 0830 that day and were later assisted in the investigation by other members of the Safety Bureau staff.

Air Carrier

Viking Air Transport Company, incorporated under the laws of California, January 23, 1946, maintains its offices at Grand Central Airport, Glendale, California. Since that date the company has engaged in air transport service, of a non-scheduled nature, carrying passengers and freight within the United States.

Flight Personnel

William D. Anderson, age 27, pilot of the aircraft, had been in the employ of Viking for approximately a week preceding the accident. He had served in the capacity of co-pilot with Western Air Lines since October 12, 1942, terminating his service with that air carrier April 1, 1946. Since leaving Western Air Lines he had obtained an Airline Transport Pilot Rating which was effective at the time of the accident. At the time of his employ by Viking, Anderson had logged a total of 2,566 hours of which 2,325 hours were as co-pilot in twin engine aircraft for Western Air Lines. David H. Miner, age 29, co-pilot of the aircraft, possessed a Commercial Pilot Certificate and had accumulated a total of 500 hours, 100 hours of which were as co-pilot in DC-3 aircraft.

Aircraft

NC-53218, a Douglas DC-3C, was manufactured in 1944 for the AAF and was purchased by Viking on February 1, 1946, from the War Assets Corporation. Conversion of the aircraft for CAA certification was accomplished by the Grand Central Airport Company during February and March, 1946. At the time of the accident it had accumulated a total of 1,180 hours. It was equipped with two Pratt and Whitney engines, model R-1830-92 with Hamilton Standard hydromatic propellers. The total times logged for the left and right engines, respectively, were 970 hours and 1030 hours with 442 hours since last Army overhaul for both engines.