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CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: May 10, 1956

Released: May 14, 1956

UNITED AIR LINES, INC., DOUGLAS DC-6B, N 37559, NEAR
LONGMONT, COLORADO, NOVEMBER 1, 1955

Foreword

The Board delayed the release of this aircraft accident report at the request of the State's Attorney for Colorado, the request being prompted by the criminal aspects involved in the accident. Deemed reasonable and in the public interest, the delay was granted in accordance with the provisions of the Civil Aeronautics Act of 1938, as amended.

The Accident

On November 1, 1955, at approximately 1903, ^{1/} a midair explosion of disintegrating force occurred aboard United Air Lines Flight 629 and the aircraft, a DC-6B, N 37559, crashed near Longmont, Colorado. The crew of five and 39 passengers were fatally injured. The aircraft was destroyed.

History of the Flight

United Air Lines Flight 629 is scheduled daily between LaGuardia Field, New York, and Seattle, Washington. There are scheduled stops over the route at Chicago, Illinois; Denver, Colorado; and Portland, Oregon, with crew changes at Chicago and Denver. On November 1, 1955, this operation was routine to Denver where the flight landed at 1811, 11 minutes late because of several brief ground delays. At Denver the aircraft was refueled to 3,400 gallons of fuel and was checked for the continued flight. There was no maintenance work required or performed on the aircraft.

The Denver crew assigned for the remainder of the operation consisted of Captain Lee H. Hall, First Officer Donald A. White, Flight Engineer Samuel F. Arthur, and Stewardesses Peggy L. Peddicord and Jacqueline L. Hinds.

Captain Hall and First Officer White arrived at the airport well before flight time. Preparations for the flight were made in a normal and routine manner, and the pilots were briefed and furnished the latest weather reports and forecasts for the route. The reported weather conditions for Denver were: Ceiling measured 9,500 feet, overcast; visibility 10 miles; temperature 36; dewpoint 30; wind southwest 5 knots; altimeter 29.84. The weather conditions forecast were of little consequence but indicated the flight, as planned, would be in accordance with instrument flight rules (IFR).

^{1/} All times herein are mountain standard and based on the 24-hour clock. Headings are magnetic and altitudes are mean sea level.

When the flight arrived at Denver, the rear cargo pit (No. 4), containing cargo, luggage, and mail scheduled for Denver, was emptied and thereafter loaded with mail, freight, and passenger luggage, all of which originated at Denver. According to company records when loaded for departure the gross weight of the aircraft was 91,746 pounds which was 1,954 pounds less than the permissible gross takeoff weight. The load was properly distributed.

After a routine radio ramp check, Flight 629 taxied to runway 8R (80 degrees, right) and at 1844 the flight was in runup position where it was given ATC clearance for the flight to Portland, the first intended landing. The clearance, in part, included compulsory radio reports from the flight upon passing the Denver Omni and when climbing through 18,000 feet to its assigned flight altitude, 21,000 feet. Following takeoff the flight reported its "off time" to the company as 1852 and thereafter reported passing the Denver Omni at 1856. The latter communication was the last from the flight.

Investigation

About 1903 the Denver tower controllers saw two white lights, one brighter than the other, appear in the sky north-northwest of the airport and fall to the ground. Both lights were observed 30-45 seconds and seemed to fall with approximately the same speed. There was then a momentary flash originating at or near the ground which illuminated the base of the clouds, approximately 10,000 feet above. When the controllers observed the lights they initiated action to determine if any aircraft were in distress. Radio calls were made to all aircraft in the Denver area of responsibility and all except Flight 629 were accounted for. It was soon learned that the flight had crashed and all 44 occupants had been killed.

The wreckage of the aircraft was spread along a north-northwest heading and covered an area of approximately six square miles. Within this area all the major components of the aircraft were found. The tail group was located about 4,600 feet south-southeast of two deep craters which contained large portions of both wings, the four powerplants, and main landing gear. The forward fuselage was roughly 600 feet north of the craters and the left outer wing panel was found approximately 600 feet south of the craters. This scatter of the heaviest and largest pieces of wreckage showed that the aircraft disintegration began in flight at an appreciable altitude and that the separation of the tail assembly occurred before separations of the wings and forward fuselage.

The aft fuselage was found to have been torn into a multitude of bits and pieces. Portions of the structure were strewn over the ground in a wide path extending south-southeast approximately four miles from the main wing wreckage, the less dense fragments being at the farther distances. Pieces of very low density material, such as paper and cabin insulation, were found as far as nine miles south-southeast. Many pieces of the aft fuselage comparable in density to the tail group were found in the area adjacent thereto. This dispersal indicates that the aft fuselage was shattered simultaneously with the separation of the tail assembly and that winds aloft carried the less dense pieces considerable distance during their fall to the ground. The severity of fragmentation indicates extremely violent shattering of this section of the airplane.

The forward fuselage from the nose rearward to a position approximately in line with the wing spar came to rest where it struck the ground. Although severely flattened by impact, the various pieces remained in their normal horizontal relationship to one another. The complete lower part of this structure was in position at the bottom of the wreckage. The fuselage nose cap bore no signs of impact; however, a small box of electric motor equipment carried as cargo and weighing 164 pounds, was imbedded in the ground directly below a hole it made upon impact through the forward cargo compartment floor. The importance of these observations was that they showed the forward fuselage assembly struck the ground with great force in an upright attitude while descending almost vertically.

As previously stated major portions of the wings and center section were located in two craters, one of which was about 150 feet north of the other. In the south pit, which was about 20 feet wide, 25 feet long, and 6 feet deep, were located the Nos. 1 and 2 powerplants as well as a portion of the left wing. The north crater, somewhat longer and deeper than the other, contained the Nos. 3 and 4 engines and portions of the right wing. The depth of the craters again indicated the nearly vertical descent of the components that made them. The distance between craters showed that both wings separated from the fuselage prior to impact.

In addition to severe breakup of the structure, extensive fire damage occurred. This was due to ignition of the fuel and oil which saturated the ground in and around the craters. Despite efforts to extinguish the fires, burning continued for three days. The fire pattern in all cases clearly established that the fires occurred following impact.

At an early phase of the Civil Aeronautics Board's investigation its investigators became aware that an explosion had occurred aboard this flight while at an altitude of several thousand feet above the ground. It was also clear that the explosion was of such great intensity that it would be unusual for it to have been caused by any system or component of the aircraft. This awareness was strengthened by smudge marks and odor characteristic of an explosive that persisted on pieces of the fragmentized wreckage known to have been part of the fuselage structure in the area of the No. 4 baggage compartment. The marks and odor were particularly noticeable on passenger baggage, mail sacks, and clothing known to have been contents of this compartment.

Because of the possibility of adverse weather conditions and in order to reconstruct the fuselage, the hundreds of pieces of wreckage were transported to a warehouse where CAB investigators worked to rebuild the aft fuselage structure in a mockup fashion by refitting each fragment into its original position of construction. The mockup showed that the pieces were progressively smaller from all directions toward a point in the No. 4 baggage compartment. Many pieces were mere fragments or were entirely missing in that area. This reconstruction and examination showed very conclusively that the aft fuselage disintegrated from extremely violent forces which originated in a very concentrated area within the baggage compartment below the aft buffet and just slightly left of the centerline of the aircraft. The forces were shown to have acted in all directions from this point. These blew the cabin floor upward, the fuselage bottom shell outward, the aft bulkhead of the baggage

compartment rearward, and its forward bulkhead forward. There is nothing in the structure of this part of the aircraft that could be the source of such an explosion.

The detailed examination of the aircraft wreckage disclosed no evidence of fatigue cracking, structural failure, or malfunctioning controls prior to the explosion. According to maintenance records of the aircraft covering its service history, it had been properly maintained. Pilot complaints had been corrected and there were no existing discrepancies affecting the airworthiness of the aircraft.

The four engines and propeller hubs were found buried 6 to 10 feet in the two previously mentioned craters. All propeller blades were also recovered from these pits or from the immediate areas. The locations of these parts indicate that they remained attached to the two main pieces of the wing until ground impact. Examination of these badly damaged components disclosed no evidence which would indicate that any mechanical or operational difficulty was experienced with them prior to the start of disintegration of the aircraft.

Numerous pieces of the aircraft and its contents, bearing the sootlike smudges, were subsequently examined in the F.B.I. laboratory to determine, if possible, what type of explosive material caused the destruction of the aircraft. The chemical analysis revealed that the residues were those to be expected from the explosion of dynamite which contained sodium nitrate. The analysis further disclosed that the residues on many of the parts contained manganese dioxide, a major component of the mixture contained in dry cell batteries. Eleven pieces of material which could have originated from an Eveready "Hot Shot" battery were found. These items are two of the basic components of one type of a bomb.

During the investigation an extensive search for eyewitnesses was made and numerous persons were found who heard the explosion. Others were located who not only heard it but also saw it. Their descriptions fully agreed with the physical evidence. Several witnesses who saw the aircraft before the explosion stated it appeared to be climbing at an estimated altitude of 5,000 feet and the engines sounded normal. This, they added, was suddenly interrupted by a brilliant flash and followed by a deafening explosion. The aircraft, in many parts, plunged to the ground where another explosion occurred. Flight tests showed that the altitude, course, and position of the flight when the explosion took place were normal for a routine operation.

The evidence, and the analysis of the evidence in this case, pointed to the possibility of an explosion. In the first hours following the accident Board investigators had uncovered definite clues indicating that an explosive force, probably from within the aircraft but alien to it, had torn the aircraft apart in flight. Subsequently, by meticulously piecing together hundreds of pieces of the torn and shattered fuselage on a chicken-wire covered wooden frame mockup of the original DC-6B fuselage, Board investigators specifically determined that a dynamite-type explosion had occurred within the No. 4 baggage compartment of the airplane. Consequently, on November 7, six days after the accident, the Board notified the Denver office of the Federal Bureau of Investigation of its findings so that the apparent criminal aspects involved could be pursued immediately, a police function that is outside the

Board's jurisdiction. Therefore, on the following day, November 8, the FBI notified the Board's investigators that it would proceed with responsibility for the criminal portion of the investigation.

Analysis

As evidenced by the scatter of the aircraft wreckage and the practically vertical descent of the individual pieces, it is obvious that the aircraft disintegrated at an appreciable altitude. The relative locations of the pieces proved that the first occurrence in the sequence of disintegration was an extremely violent shattering of the aft fuselage with separation of the tail group. Without the tail the remaining aircraft structure probably pitched nose down and fell with uncontrolled gyrations during which the wing and forward fuselage separations occurred.

The reconstruction and examination of the aft fuselage proved that the forces which caused the initial disintegration radiated from a point within the number 4 cargo pit. The very pronounced intensification in severity of fragmentation from all directions toward this point proved that the disintegration of the aft fuselage was caused by an extremely violent explosion emanating from a very localized origin. The violence was clearly shown by fragments which had been projected through the cargo compartment walls and ceiling as well as by tearing, denting, and curling of adjacent structure. This evidence is in sharp contrast to the damage of an explosion resulting from the ignition of any combustibles carried on and used during aircraft operation. Laboratory analysis confirmed this and determined the explosive material was dynamite.

On November 14, 1955, agents of the Federal Bureau of Investigation took into custody John G. Graham, the son of one of the passengers. Thereafter, he was indicted for acts leading to the destruction of the aircraft by means of a bomb explosion.

Findings

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

1. The carrier, the aircraft, and the crew were currently certificated.
2. The flight was properly dispatched; the aircraft gross weight was under the maximum allowable and the load was properly distributed.
3. Takeoff was normal and the flight made reports in conformity to its instrument clearance.
4. At 1903, eleven minutes after departure, an inflight disintegrating explosion occurred aboard Flight 629.
5. The aircraft was climbing normally and was on course when the explosion occurred.
6. Physical evidence showed conclusively the explosion took place in the number 4 baggage compartment of the aircraft.

7. The violence of the explosion and the physical evidence proved the explosion was not caused by any system or component of the aircraft.

8. Physical evidence at the scene and laboratory tests confirmed that the explosive material was dynamite, in the form of a bomb.

9. There was no evidence found to indicate malfunction or failure of the aircraft or its components prior to the explosion.

Probable Cause

The Board determines that the probable cause of this accident was the disintegrating force of a dynamite bomb explosion which occurred in the number 4 baggage compartment.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

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 on November 1, 1955, shortly after it occurred. An investigation was initiated in accordance with the provision of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. The circumstances of the accident made a public hearing unnecessary and none was held.

Air Carrier

United Air Lines, Inc., a Delaware corporation, has its general offices at 5959 S. Cicero Avenue, Chicago, Illinois. The corporation holds a certificate of public convenience and necessity issued by the Civil Aeronautics Board which authorizes the carriage of passengers, property, and mail. It also holds an air carrier operating certificate issued by the Civil Aeronautics Administration.

Flight Personnel

Captain Lee H. Hall, age 39, had been regularly employed by the company since December 1941. Official records of the CAA and the company indicate he had accumulated 10,086 flying hours, of which 703 were in the type equipment involved. Captain Hall possessed a valid airline transport rating, number 49477-40. His latest first-class medical certificate was dated October 19, 1955; there were no waivers.

First Officer Donald A. White, age 26, was employed by United Air Lines on March 10, 1951. Appropriate records indicated he had accumulated 3,578 flying hours, 1,062 in the DC-6B. He held a valid airline transport rating, number 1021604. His latest medical was accomplished August 3, 1955.

Flight Engineer Samuel F. Arthur, age 38, was a qualified first officer and flight engineer. He held a commercial pilot certificate, and a flight engineer certificate number 1124803. His total flying hours were 1,995, of which 336 were in DC-6B type aircraft.

Stewardess Peggy Lou Peddicord, age 22, received her training with the company and had been regularly employed since March 2, 1955.

Stewardess Jacqueline L. Hinds, age 26, was employed June 13, 1951, and, after regular stewardess training, served in that capacity with the company, assigned first to Washington, D. C., and after June 26, 1952, to Seattle, Washington.

The Aircraft

N 37559, a Douglas DC-6B, bore manufacturer's serial number 43538. It was owned and operated by the company and at the time of the accident had an aggregate of 11,949 flying hours, 133 since overhaul, 39 since last maintenance check, and 7 since the last thorough preflight. The aircraft was powered by Pratt and Whitney CB-16, R-2800 engines. The propellers were Hamilton Standard.