

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: February 12, 1958

Released: February 14, 1958

CAPITAL AIRLINES, INC., DOUGLAS C-47A, N 88835,
NEAR CLARKSBURG, MARYLAND, JUNE 22, 1957

The Accident

A Capital Airlines training flight crashed near Clarksburg, Maryland, about 0750^L on June 22, 1957. Although no fire occurred, the airplane, N 88835, was totally destroyed. The instructor and two pilot trainees, the only occupants, were killed in the crash.

History of the Flight

Training flight H-3 was scheduled by Capital (Capital Airlines) flight training department for Captain Carl R. Burke, instructor, and two copilots, Henry A. Podgurski and Robert K. Thomas. This was the second of a series of six flights being made for the purpose of giving Messrs. Podgurski and Thomas flight instruction to prepare them for upgrading from copilot to captain.

The flight was dispatched in accordance with visual flight rules to operate in an area northwest, north, and northeast of Washington, D. C. This area was used by Capital as its local practice area for training flights.

The aircraft was fully serviced with 820 gallons of fuel. Its gross take-off weight was less than the maximum allowable and the center of gravity was within allowable limits. The weather was clear and was not a factor in this accident.

Takeoff was made at 0625. At 0631 the flight advised the company by radio of the trip number, time of takeoff, fuel aboard, and flight duration. There were no other radio contacts with the flight.

At approximately 0745, N 88835 was observed in the vicinity of Clarksburg, Maryland, by many people who saw it during several minutes of flight and in its plunge to the ground.

Investigation

In its final descent, N 88835 passed almost straight down through a group of trees, landing on top of an automobile. The fuselage forward of the cargo door was demolished when the aircraft struck in a nose-down near-vertical attitude. The rearmost part of the fuselage and empennage received relatively little damage and came to rest with the trailing edges of the rudder and elevators

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

wedged against trees. The left wing separated from the aircraft as a result of impact forces upon it acting aft and upward. All other major components remained attached to the aircraft and were in their general relative positions. No fire occurred.

A complete and exhaustive study of the entire wreckage was made. It was determined that the flaps were retracted and that the landing gear was down and locked at impact. Both gear assemblies had failed rearward. The attaching and actuating struts of both were broken or severely mutilated.

The right wing, although still attached to the center section, exhibited a damage pattern from forces acting upward and rearward. Both wings were most severely damaged along the leading edge with compression damage apparent from leading to trailing edge. Wing spar webs and caps in both wings and center section were broken or cracked in numerous places. Although both wing tips were torn and deformed, they showed no indication of rotational motion of the aircraft at impact.

The empennage was distorted as a result of contacting trees in the descent to the ground. The rear cabin bulkhead had been displaced forward, allowing the remaining fuselage to sag and causing several deep wrinkles in the skin.

Several smaller pieces of the aircraft structure were detached at impact and were found in the wreckage area. There was no evidence found of fatigue cracking, aircraft deformation, or structural failure prior to impact.

Because of the unusual nature of this accident special attention was given to the examination of flight controls and systems to determine, if possible, any malfunction which could have resulted in impaired control of the aircraft in flight. All flight surfaces, with the exception of an outboard portion of the right aileron, remained attached to their respective supporting structures. This outboard section of right aileron, detached by impact, was recovered in the wreckage area. It, as well as all other flight controls, sustained impact damage.

All primary control cables were traced and examined. None of these cables was broken; however, several of the links and bell cranks to which these cables attach, or pulleys over which they run, were bent or broken. No wedging or binding, other than that caused by impact, was found in these control systems.

Trim tab controls were damaged in the crash. During the aircraft breakup all trim tab control cables failed in tension. In this breakup the trim tabs were probably displaced by unbalanced cable forces that resulted.

Nothing was found in the control surfaces or control systems to indicate inflight malfunction of any kind.

Detailed examination of the remaining portions of the aircraft revealed no indications of failure or malfunction prior to impact. All observed damage to fuel, oil, and hydraulic lines was the result of the crash. Destruction of the cockpit area and fuselage was so complete that no significant findings could be obtained. However, there were no indications of structural fatigue or inflight failure which might have resulted in loss of or difficulty of control.

Both powerplants were meticulously examined for possible malfunction. The engines, although heavily damaged by impact, showed no signs of operational difficulty. Cylinders, pistons, valves, bearings, etc., were normal and had received proper lubrication. There was no scoring or overheating evidenced on moving parts and no contamination found in the oil. All of the damage noted to both engines and their accessories was inflicted at impact. The propellers also showed no evidence of operational malfunction. Both were rotating and in low pitch and operating when the aircraft struck the ground. All blade bending and other damage resulted from contact with the ground.

An examination of aircraft and powerplant records disclosed that scheduled inspections and maintenance had been properly and satisfactorily completed. Pilot flight log writeups had been corrected and there were no carryover maintenance items. Capital had complied with all airworthiness directives pertaining to this aircraft. Overhaul of engines and propellers was normal and proper. There were no repetitious malfunctions or uncorrected items in any of these records that would affect the airworthiness of the aircraft.

Copilots Podgurski and Thomas were being given flight training by Captain Burke in preparation for their ATR (Airline Transport Rating) examination and upgrading to captain. This training is conducted under a program set up by the flight training department of Capital and includes ground school and flying training. The flight training consists of a minimum of six two-hour periods. In each period the trainee flies the airplane through a standard set of maneuvers which are designed to acquaint him fully with the flying characteristics of the airplane at various speeds and attitudes and in various configurations.

Accuracy of headings, speeds, and altitudes is stressed to develop the precision required in air carrier operations.

This series of maneuvers teaches the pilot to control his aircraft safely under any circumstances or emergency situation he is likely to encounter. Climbing and level turns, descents, slow flight, approach to stalls, are among the various exercises practiced under simulated instrument conditions. Aircraft spins are prohibited and consequently are not demonstrated. They are, however, discussed and the spin characteristics are described by the instructor in the ground school training.

Both copilots, Podgurski and Thomas, had several thousand flying hours in DC-3 aircraft and had flown as copilots with Capital for several years. Captain Burke was very experienced and although he had been an instructor for only a short time was considered extremely competent.

Company witnesses described the flight training curriculum in detail. The maneuvers taught are arranged in a fairly rigid sequence so as to give the pilot the most benefit from each training period. These witnesses thought, because Captain Burke followed the standard curriculum fairly closely, they could estimate what maneuver his pupil would be executing at a given time after takeoff. All thought it probable, because the flight had been airborne approximately 1-1/4 to 1-1/2 hours, that it would have progressed through the sequence of maneuvers to the "canyon approach."

The "canyon approach" simulates letting down to an airport surrounded by obstructions, followed by an emergency pull-up, and it combines most of the

airwork taught each student. Proper execution requires exact control of air-speed, altitude, headings, power settings, and cockpit procedures, all of which must be accomplished under the "hood."

The Capital flight instruction manual states:

"RECTANGULAR PATTERN AND CANYON APPROACH."

"a. Stress accuracy of heading and timing of legs and turns (vary pattern to emphasize necessity of listening closely to instructor).

"b. Stress smoothness and proper commands in proper order during abandoned approach.

"c. If engine/s is cut importance of controlling aircraft during emergency."

Specifically, for the "canyon approach" the student simulates an approach making a rectangular pattern. He then performs an "in range" cockpit check and lowers one-half flaps. When airspeed slows to 95 knots he calls for extension of the gear and full flaps. With power off, he descends 1,000 feet holding 95 knots. At 200 feet above the simulated airport elevation, (generally selected as 3,000 feet m. s. l.) he levels off, applies full power, orders gear and flaps "up," and begins a maximum performance climb at 85 knots. At this point the instructor may, in his discretion, "cut" an engine. If an engine is "cut" the student must complete the emergency procedure and continue climbing at 85 knots for 300 feet. He then increases speed to 95 knots and makes a 180-degree standard rate turn.

In this instance the aircraft was observed by numerous people. Their descriptions of its flight coincide closely with the first portion of the "canyon approach," and lend substantial corroboration to the belief that the accident occurred during the execution of that maneuver.

Approximately 40 witnesses furnished statements to the Board's investigators. Although there were several conflicting descriptions and most of the people saw the airplane for only a short time, the Board was able to reconstruct the probable path of the aircraft for the last few minutes of the flight. The airplane was observed flying in a northeasterly direction about 2-1/2 miles southwest of the crash site. It appeared to be flying slowly and descending slightly with its engines backfiring at an altitude variously estimated as from 1,500 to 3,000 feet. It flew in a straight line for about two miles. When considerable power was applied the airplane apparently gained some altitude in a climbing turn to the right. Almost immediately the aircraft rolled slightly to its left while losing some altitude. It then rolled over the top and entered a spin to the right.

Analysis

The Board, for two reasons, believes that this accident took place while the pilot was executing the abandon-approach phase "canyon approach" maneuver. First, Capital personnel familiar with the training program estimated that if the training flight had been normal up to the time of the crash, it would have

met the time requirements to progress up to the "canyon approach." Second, the several persons who saw the aircraft in flight were able to describe its path. From these descriptions it appears that the aircraft was traveling in a southerly direction, and then made a 90-degree left turn to a heading which was somewhat northeasterly. It continued on this latter heading straight ahead but descending slightly with power off for a distance of about two miles, at which point power was applied and the aircraft started a climbing turn. No other maneuver or combination of maneuvers fits this description as closely as does the "canyon approach."

The "canyon approach" has long been taught by many airlines and is considered a standard exercise. CAM 21,² which sets out the qualifying criteria for an ATR, includes the requirement that each applicant for such rating satisfactorily demonstrate, by flight check, his ability to perform this maneuver.

In a "canyon approach" the pilot must fly his aircraft with extreme precision at low airspeeds to obtain maximum performance. The Board has long recognized that this type of training is essential to qualify a pilot to be able to handle his aircraft safely at all times. In fact, CAR Part 21 prescribes these as minimum standards which pilots must exhibit in order to qualify for an ATR.

The Board also recognizes that during some of these maneuvers the aircraft will be flown so as to exceed the limits normally expected in airline flying (although not beyond the placarded limits of the aircraft). This practice is conducted under the supervision of qualified instructors and it is, therefore, completely compatible with the Board's policies of safety.

Eyewitnesses stated that the aircraft pulled up and started a slight turn to the right, indicating the "abandon-approach" phase of the maneuver. At this point the pilot is simulating an emergency pull-up, i. e., maximum rate of climb at an airspeed of 85 knots, which permits adequate control of the aircraft. As previously stated, this maneuver must be executed with precision because overcontrolling or rough handling of the controls could result in a stall and/or spin.

A spin at this point could also be induced as a result of some mechanical or structural failure or deformation. Further corroboration of the fact that no mechanical or structural failure existed is that recovery from the spin had been started and rotation had stopped when impact occurred. Because of the absence of any such evidence it must be concluded that the pilot inadvertently allowed the aircraft to exceed its capabilities, stall, and enter a spin.

Spin characteristics of the DC-3 (C-47) have been described in several NACA reports. There are also available several reports from pilots who have spun the DC-3 both intentionally and unintentionally. These reports show that in the unintentional or inadvertent spin considerably more altitude is lost than in an intentional spin before recovery can be effected. Presumably, this is due to the element of surprise. Altitude loss, as much as 3,000 feet, has been reported by experienced pilots, in an inadvertent spin of only one turn.

Tests show that altitude loss per turn in a steady spin is about 600 feet. Further, that after the rudder is reversed rotation will stop in approximately one turn and that the loss of altitude for this final turn will be approximately 1,000 feet. When rotation is stopped the aircraft will be vertical. It will

then require an additional 2,000-2,500 feet of altitude to return to level flight.

In the instant case, spin rotation had stopped before the aircraft struck the ground in a near vertical attitude. Most witnesses said they saw several turns in the spin. Using the data above, it is evident that the aircraft entered the spin from an altitude of at least 2,500 feet above the ground. This determination, significantly, is in agreement with the altitudes of the aircraft as estimated by eyewitnesses. It is also significant that this altitude is approximately the altitude at which the aircraft would normally be expected to be during the abandon-approach phase of the "canyon approach." It will be remembered that Capital personnel stated that the usual procedure was to use 3,000 feet above sea level as the simulated elevation for the "canyon approach." Therefore, because the average elevation of the terrain in the vicinity of Clarksburg is 500 feet above sea level, the aircraft would be approximately 2,500 feet above the ground.

From all these data, together with a preponderance of the evidence from eyewitnesses, it is determined that the aircraft spun from an altitude too low to permit complete recovery, and that although rotation had stopped considerably more altitude would have been necessary to allow the pilot to regain straight and level flight.

Findings

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

1. The company, aircraft, and crew were currently certificated.
2. The gross takeoff weight was less than the maximum allowable and properly distributed within approved center of gravity limits.
3. No malfunctioning of the aircraft, engines, or control systems was evident from the examination of the wreckage.
4. The pilots were executing a "canyon approach" maneuver at an altitude approximately 2,500 feet above the terrain (3,000 feet m. s. l.).
5. During the abandon-approach phase of this maneuver the aircraft was inadvertently stalled from which it entered a spin and crashed.
6. Although rotation had stopped before impact occurred there was insufficient altitude to effect a recovery.

Probable Cause

The Board determines that the probable cause of this accident was loss of airspeed while executing maneuvers during a training flight, resulting in a stall followed immediately by a spin from an altitude too low to effect recovery.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE
/s/ CHAN GURNEY
/s/ HARMAR D. DENNY
/s/ LOUIS J. HECTOR

Member G. Joseph Minetti did not take part in the adoption of this report.

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

Investigation and Taking of Depositions

The Civil Aeronautics Board was notified of this accident immediately. An investigation was initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions were taken at Hyattstown, Maryland, on July 24 and 25; at the CAB offices in Washington, D. C., on July 26; at the Washington National Airport on August 6; and at Santa Monica, California, on September 27, 1957.

Air Carrier

Capital Airlines, Inc., is a Delaware corporation and maintains its principal offices in Washington, D.C. The corporation holds a current certificate of public convenience and necessity issued by the Civil Aeronautics Board to engage in the transportation of persons, property, and mail. It also possesses a valid air carrier operating certificate issued by the Civil Aeronautics Administration.

Flight Personnel

Captain Carl R. Burke, instructor, age 32, was employed by Capital Airlines on July 31, 1950. He held a valid airman certificate with an airline transport rating for multi-engine land aircraft, Douglas DC-3, and Lockheed Constellation, and also held a flight engineer rating. Captain Burke had a total of 4,342 flying hours, of which 961 were in DC-3 equipment, and 415 hours of instrument time. He had received his last proficiency check January 11, 1957. He had passed his CAA physical examination on December 24, 1956. He was assigned as a flight instructor and completed Capital Airlines' flight instructor's course on June 10, 1957. He had completed 24 hours of flight instruction prior to the accident.

Trainee First Officer Henry A. Podgurski, age 37, was employed by Capital Airlines January 31, 1952. He held a valid airman certificate with commercial pilot rating for multi-engine aircraft, and instrument rating. He also held a rating as flight engineer. He had a total of 6,248 flying hours, of which 3,138 were in the DC-3, and 681 hours instrument time. His latest CAA physical examination was passed June 13, 1957. His last instrument check was passed February 2, 1957. He had received two hours of flying training for his ATR examination at the time of the accident.

Trainee First Officer Robert K. Thomas, age 30, was employed by Capital Airlines November 21, 1951. He held a valid airman certificate with a commercial pilot rating for single- and multi-engine land aircraft, and an instrument rating. He had a total of 5,226 flying hours, of which 2,801 were in DC-3 equipment, and 447 were on instruments. His latest CAA physical examination was passed May 11, 1957. His last instrument check was passed on June 13, 1957. He had received 3-1/2 hours of flight training in preparation for his qualification for an airline transport rating.

The Aircraft

N 88835, a Douglas C-47A, manufacturer's serial number 19448, was purchased from the U. S. Army on February 9, 1946. It had a total of 14,168 hours and 49 minutes of flying time. It was equipped with Wright G-200 engines, Hamilton Standard model 23E50 propellers, and was currently certificated by the Civil Aeronautics Administration.