

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: June 24, 1953

Released: June 26, 1953

NORTHEAST AIRLINES, INC., - LA GUARDIA FIELD, NEW YORK,
FEBRUARY 6, 1953

The Accident

At 1950^{1/}, February 6, 1953, a Northeast Airlines Convair 240, N 91239, operating as Flight 825, crashed on Runway 13, La Guardia Field, New York. At low altitude during final approach, a violent yaw to the right developed rapidly and the aircraft became uncontrollable. First contact with the runway was with the right main landing gear, then the right propeller, and the right wing tip. The aircraft sustained major damage and came to rest to the right of Runway 13, 765 feet from the point of initial impact. There was no fire. Six passengers reported minor injuries.

History of the Flight

Flight 825 originated at Portland, Maine, and arrived at Boston, Massachusetts, a crew change point, at 1810. The new crew consisted of Captain Alva V. R. Marsh (pilot-in-command), Captain Eugene P. Rooney (first officer), and stewardess Joan Sexton. An IFR flight plan was approved for a cruising altitude of 8,000 feet MSL between Boston and New York.

The flight departed Boston on schedule at 1838. In addition to the crew, there were 41 passengers aboard. The gross takeoff weight was 39,574 pounds, which was within the permissible takeoff gross weight and the load was properly distributed with relation to the center of gravity.

The pilot reported over Meriden, Connecticut at 1926. Upon reporting over Port Chester, New York, at 1943, La Guardia Approach Control was advised that the flight was operating in VFR conditions, the IFR clearance was cancelled, and the flight proceeded VFR. The flight was sighted by the La Guardia local air traffic controller when over New Rochelle at 1946. Shortly thereafter, Flight 825 was cleared to land on Runway 13.

Weather conditions at La Guardia were: Ceiling 3,500 scattered, measured 6,000 overcast, visibility eight miles, wind south at 10 miles per hour, and altimeter setting 30.14.

The landing check list was completed before final approach. Just short of the field boundary,^{2/} at about 100 feet altitude, the pilots heard an

^{1/} All times referred to herein are Eastern Standard and based on the 24-hour clock.

^{2/} Estimated by Captain Rooney to be "a couple of hundred feet short of the runway."

unusual sound on the right side of the aircraft which was variously described as a muffled, rattling, buzzing, or a soft cracking sound similar to that produced by propeller tips in cold weather, or a sound similar to inserting a piece of paper in an electric fan. An increase of r.p.m. on the right propeller accompanied the sound. The approach was being made at 130 m.p.h. The propellers had been set at approach r.p.m. of 2300, and 25 to 27 inches of manifold pressure. The rate of descent had been stabilized at approximately 600 feet per minute. Captain Marsh, who had flown the entire trip from Boston, was making the approach. At the same time the sound was heard, the aircraft pulled sharply to the right. Captain Marsh immediately applied left rudder and aileron to counteract the effect of the yaw, which rapidly became worse. Almost simultaneously, at about 50 feet altitude, he applied power on both engines. The noise decreased but the yaw became worse, so he closed the throttles. By this time, full left rudder and aileron had been applied, but the aircraft was uncontrollable and struck Runway 13 an instant later.

Evacuation of the aircraft by the passengers was orderly. Several passengers thought that the aircraft had simply made a hard landing and nearly all left through the loading door at the left rear of the cabin as Captain Rooney instructed them to do; however, several made their exit through the front main entrance at the rear of the cockpit. Both doors opened readily. All occupants were out of the aircraft in from one and one-half to two minutes.

Investigation

Captain Marsh testified that he received no indication that the aircraft stalled, nor did he feel any buffeting. He had not flared out for landing, he said, nor was there any opportunity to do so once the aircraft became uncontrollable. He stated that no malfunction of any aircraft component was experienced during the flight from Boston. Anti-icing equipment was not in operation during the approach and he was positive that there was no icing.

Captain Rooney, the first officer, also testified that the flight was routine until the occurrence. All items on the landing check list had been completed. He was calling airspeeds on final approach and stated that it had been reduced to 130 m.p.h. He first heard the noise when the Captain reduced power to almost or full off. Very shortly thereafter, when Captain Marsh applied power, Captain Rooney noted that the throttles had been advanced the same amount and that the engine tachometers indicated 2000 r.p.m. for the right and 1500 for the left. Captain Marsh then cut the power entirely. Captain Rooney grabbed the flight controls a few moments before impact and found that full left rudder and aileron had already been applied.

Both pilots stated that the elevator control was neither pushed forward nor pulled back when left controls were applied. When the aircraft struck the runway on the right landing gear, the longitudinal axis of the fuselage was about parallel with the ground. Captain Rooney stated that he heard no backfiring, nor did he notice any buffeting.

Several passengers corroborated the statements of the pilots. One, a pilot employed by another airline, advised that he felt a slight buffeting

as the propeller tone changed. Another, a former bomber pilot, said that in the final approach he heard a sound which he associated with reversal of one or both propellers. Another passenger thought that the aircraft had either landed or that a propeller or propellers had reversed in the air, for the sound which he heard was similar to that which he had previously experienced as a passenger in Convair aircraft when the propellers were intentionally reversed after landing.

The right wheels struck the runway 270 feet past the threshold to Runway 13 and a few feet to the right of the centerline, followed shortly further on by contact with the right propeller, right nacelle, right wing tip, right stabilizer, left main landing gear, and nose wheel. During the skid, the right wing sheared between the right nacelle and the fuselage, swinging back against the fuselage. The augmentor tubes of the right nacelle pierced the upper right side of the cabin. With failure of the right wing, the right stabilizer contacted the runway. The left wing was relatively undamaged and remained attached to the fuselage. The left main landing gear was torn from the wheel well, while the right main landing gear remained extended and attached to its nacelle.

Examination of the cabin revealed that the fuselage was generally intact. The basic seat structures were intact and undistorted, with the exception of certain portions of some seat backs.

Examination of both engines revealed that they were in good operating condition and capable of developing power at the time of the accident.

Normally, the propellers cannot be put in reverse pitch until the aircraft is on the ground. The contacts on an electrical switch on the left main landing gear are closed when the aircraft's weight is on the wheels, causing a solenoid to energize. This in turn unlocks the throttle reversing mechanism on the pilot's pedestal, and permits rearward movement of the throttles into the reverse quadrant.

The throttle locks can also be released manually by either pilot by pulling a manual override control handle, conveniently located on each side of the pedestal, one for each pilot. Outward movement of this control has the same effect on the throttle lock as does the energizing of the solenoid. The solenoid plunger and the manual override control mechanism are spring-loaded. Thus it is necessary for the pilot to hold the handle out to enable him to pull the throttle into the reverse range while the aircraft is airborne. The throttle cannot be retarded past the idle position when the handle is in the "in" position.

As a result of a previous incident involving an unwanted reversal of both propellers while airborne, Northeast Airlines added an item to the before-landing check list to make positive determination that the override control was in. It was found during check rides that some pilots checked this item by "snapping" the manual override handle. This was improper procedure, as the company operations manual showed, and was brought to the attention of all pilots by memorandum issued by the Assistant Chief Pilot on October 16, 1952, stating that it should never be operated in flight.

Both pilots testified that they were cognizant of these instructions and the reason for their issuance, and therefore were positive that they had not operated the manual override control handle throughout the flight or during the final approach, and had checked visually to ascertain that it was in the "in" position while completing the before-landing check list.

Since there was a likelihood that the right propeller might have reversed during final approach for landing, the propeller investigation was planned with this possibility in mind. Prior to removal of the aircraft to a nearby hangar, considerable examination and testing of control units and wiring was made. Additional functional tests and visual examinations were made in more detail at the hangar. Various units were tested and clearances measured at the Curtiss Wright factory, Northeast Airlines shops, and the U. S. Bureau of Standards laboratories. The results of these numerous visual examinations and tests are described later in the report.

All three blades of the right propeller were bent and curled aft from the leading edge toward the face side to approximately the 48-inch station. After removal of the blades, gear teeth marks were observed on each barrel shelf. By matching blade gears to these impact marks, it was found that they represented a blade pitch position of plus 3.1 degrees with reference to the 42-inch station. Examination of the power unit after removal revealed that it had traveled past the increase r.p.m. limit switch toward reverse pitch to a position representing a blade angle of minus .3 degree with reference to the 42-inch station. This seeming discrepancy is explained by the difficulty of determining the precise blade angle at impact. The two methods of measuring blade angle at impact showed, however, that the blades were in nearly flat pitch position.

The power unit was tested after reinstallation on the aircraft and its operation proved normal in all respects. In all instances the r.p.m. limit switch opened the circuit as intended. The power unit did not overtravel the high r.p.m. limit at any time during these tests. The unit was subjected to functional tests under load at the Curtiss Wright factory and at the overhaul base of Northeast Airlines; the results of these tests showed satisfactory operation.

The increase r.p.m. limit switch was cycled numerous times both while on the aircraft and after removal for more detailed examination. It functioned normally in all instances.

Functional tests of the synchronizer, made at the Curtiss Wright factory, revealed no significant discrepancies in its operation.

The brush block connector was tight, as it should be, and was removed from the aircraft. An ohmmeter check at this location revealed that the increase r.p.m. limit switch was "open"; the other limit switches were in the "closed" position. Resistance measurements at the brush block and slip ring were satisfactory. Upon removal of the brush block, practically all of the brushes were found broken; however, the power unit had operated satisfactorily prior to removal and none of the brushes showed any wear or abrasion such as would be expected if they had been broken and were out of position at the time the engine was operating. No abnormal condition was revealed during disassembly

and examination of the brush block and slip rings. Relocation of the reverse slip ring had been accomplished in accordance with a factory recommendation.

The reverse switching, reverse pitch, and normalizing relays were subjected to an internal examination. The condition of the contacts was satisfactory, and they exhibited no tendency to stick when the relays were actuated. No foreign matter was found. All relays functioned normally during checks of the system. Both reverse pitch relays were checked prior to removal of the aircraft from the scene, and were found in the normalized, or unlatched, position.

All system wiring was checked with an insulation tester which utilized 50 volts for faults to ground, or between adjacent wires; satisfactory resistance measurements were obtained in all cases, and all filter capacitors showed satisfactory resistance values. Voltage was applied to the system, and nothing abnormal was revealed. Detailed examination of the wires along their entire length revealed no abnormalities, nor was any shown in examination of dis-assembled connectors.

The lower cargo terminal rack, filter boxes, relay boxes, and pull boxes were examined for loose or mislocated terminals, foreign objects, or chafed wires; no significant irregularities were observed.

Close attention was given to the high r.p.m. limit switch, for malfunction of the switch could result in overtravel of the power unit toward reverse pitch. One of the two stationary contacts was worn more than the other and its curved contour was somewhat altered. A black deposit was also observed, but was found to be non-conductive. During numerous operations of the switch, it functioned as intended in all instances. A laboratory examination of the switch indicated no evidence of malfunctioning.

The switch controlling the primary throttle lock mechanism and its circuit, operated by the left landing gear, was in a normal condition. The throttle lock mechanism in the pedestal, including the manual override control, operated freely. In flight configuration, it was not possible to pull the throttles past the stops even when abnormally high throttle forces were used. The throttle lock solenoid had been modified to minimize the effects of residual magnetism. Wiring in the pedestal was adequately secured to prevent chafing; the terminals were secure and properly positioned and no loose or dangling wires were observed. The manual override control warning lights functioned properly.

Maintenance records for the speed reducer and motor and brake assembly installed on the right propeller were examined but there was no evidence found which would indicate that there was any relation to possible cause of this accident.

Detailed examination of the entire right propeller and its control system failed to reveal the reason for overtravel past the high r.p.m. limit switch position of plus 26 degrees, nor was any mechanical or electrical malfunction found.

The power unit of the left propeller was found at the full increase r.p.m. limit, with the limit switch open. There was no indication that the left propeller had malfunctioned.

Maintenance records for the aircraft and engines reflected that the aircraft was being operated within the approved inspection and overhaul periods for various component units. All applicable CAA airworthiness directives had been complied with.

Investigation disclosed that the company, the aircraft, and the crew were properly certificated.

Analysis

Since investigation disclosed no failure or malfunction of either engine, the aircraft structure, or evidence that the left propeller had changed pitch, the discussion will be concerned principally with the right propeller. Weather was not a factor in this accident.

In general, the right propeller blades overtraveled the low pitch stop through one of two reasons; namely, malfunction of the right propeller or improper operation of the propeller controls.

Every known probability was explored to determine whether electrical or mechanical malfunction of the propeller or its control mechanism could have occurred. As previously shown, detailed examination of the right propeller and its entire control system failed to reveal the reason for overtravel past the low pitch blade limit. No evidence was found during investigation of the propeller system and the throttle lock system which would indicate that an unwanted propeller reversal resulted from malfunction of any unit. Considerable attention was devoted to the low pitch (high r.p.m.) limit switch, since failure of this switch to open the circuit at low power would cause the propeller to move into the pitch range below the high r.p.m. limit. Although this switch had been in operation for a longer period of time than was recommended by the manufacturer and one of the stationary contacts exhibited considerable wear, the switch when first checked was "open" and opened as intended when actuated numerous times. The pilot's testimony that as power was progressively reduced the r.p.m. of both engines was observed to drop below the r.p.m. setting of 2300 rules out the possibility that this switch failed to open, for had this occurred, the r.p.m. of the right engine should have been maintained at 2300 by the propeller synchronizer.

It will be recalled that the reverse pitch relays of both propellers were found in the normalized position. Had the right propeller been reversed by movement of the throttle rearward past the idle stop, the reverse pitch relay would have been actuated to the "latched" position and would have remained latched until the normalizing relay was actuated. In normal operation this latter operation occurs when a ground is furnished to the normalizing relay coil by the closing of the high r.p.m. limit switch, which occurs when the propeller is returned to the high r.p.m. limit position of 26 degrees, positive. The position of minus .3 degrees at which the power unit was found indicates this did not occur. A momentary short to ground of the automatic and manual increase r.p.m. circuit would have normalized the reverse pitch relay. It is possible that such a short could have occurred at the location of separation of the wires when the wing broke off or at the brush block when the brushes were broken. The first possibility is unlikely, since the portion of the circuit connected to the normalizing relay remained connected to the

disconnect plug and was undisturbed. Also, a resistance and functional check of the brush block prior to its removal did not indicate any irregularity.

Both pilots testified that they did not pull the manual override handle out at any time during the flight, had not touched it during the La Guardia pre-landing cockpit check, and as part of this check ascertained that it was in the "in" position. Since the handle will automatically return to the "in" position when released, it would have been necessary for one of the pilots to hold it out while either one or both throttles were pulled past the detents into the reverse range. Both pilots stated that they took care not to pull the handle.

Following the accident, Northeast Airlines initiated a rewiring program on aircraft equipped with electric propellers to completely isolate the reversing circuit between the control pedestal and the propeller power unit. The company also modified its policy of retiring the low pitch limit switch after 1,600 hours flight time (which corresponded to the overhaul time for a propeller) to 800 hours. The company had originally retired these switches after not more than 1,000 hours of flight operation in accordance with the manufacturer's recommendations but had extended the retirement time early in 1952 from a maximum of 1,000 to 1,600 hours on the basis of operating experience. This extension of retirement time was given tacit approval by the CAA.

Findings

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

1. The carrier, the aircraft, and the crew were properly certificated.
2. The gross weight of the aircraft was within prescribed limits and the load was properly distributed with relation to the center of gravity.
3. The flight between Boston and the final approach at La Guardia Field was normal and routine.
4. At about 100 feet altitude and approximately 200 feet from the airport boundary during final approach, a yaw to the right developed rapidly and the aircraft became uncontrollable by the time the right main landing gear struck the runway.
5. The yaw increased when the captain temporarily applied power on both engines.
6. The yaw was caused by the blades of the right propeller travelling past the low pitch stop toward the reverse pitch range.
7. The blades of the right propeller were found in approximately flat pitch.
8. Detailed study of the right propeller and its control system failed to reveal any mechanical or electrical malfunction.

9. As part of the pre-landing check, the pilots ascertained that the propeller override control was in the "in" position.

Probable Cause

The Board determines that the probable cause of this accident was loss of control of the aircraft during final approach due to high drag from the right propeller. This drag was induced by the right propeller blades moving beyond the high r.p.m. limit stop since the blades were found in approximately zero geometric pitch. The cause of this unwanted propeller action could not be determined.

BY THE CIVIL AERONAUTICS BOARD:

/s/ HARMAR D. DENNY

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

Oswald Ryan, Chairman, did not participate in the adoption of this report.

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 by the Civil Aeronautics Administration within a short time after the occurrence. 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 at the Hotel Lexington, New York, New York, on March 5 and 6, 1953.

Air Carrier

Northeast Airlines, Inc., is a Massachusetts corporation with its principal offices at Boston, Massachusetts. 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 route described in this report, among others.

Flight Personnel

Captain Alva V. R. Marsh, age 44, had been employed by Northeast Airlines, Inc., since July 1, 1938. He held a valid airman certificate with an air transport rating for this make aircraft. Captain Marsh had a total of 14,702 flying hours, of which 3,093 were in the Convair during airline operation. His last physical examination prior to the accident was accomplished on August 28, 1952. He had a rest period of over 18 hours prior to this flight.

Captain Eugene P. Rooney, age 34, was employed by Northeast Airlines, Inc., as a first officer on January 16, 1943, and was promoted to captain on April 5, 1951. He held a valid airman certificate with an air transport and flight instructor ratings. He was qualified as a captain on DC-3 equipment and first officer on Convairs. His total flying time was 8,320 hours, of which 1,186 were in the Convair during airline operation. His last physical examination was accomplished on December 1, 1952. Captain Rooney had a rest period in excess of 18 hours prior to this flight.

Stewardess Joan Sexton, age 21, was employed by Northeast Airlines, Inc., on May 7, 1951, as a passenger service representative. She completed the company's stewardess training course and had served as a stewardess since March 16, 1952.

The Aircraft

N 91239, a Convair CV 240-13, Serial No. 159, was manufactured March 25, 1949. It was placed in service by Northeast Airlines on April 24, 1949, and

had accumulated 8,413 hours from date of manufacture. The aircraft was equipped with two Pratt & Whitney R-2800-CA-3 engines and Curtiss-Wright C632S-B352 propellers with type 9C2-0 blades. Since overhaul, the hub and blades of the right propeller had accumulated 1,071 hours, the motor and brake assembly 421 hours, and the speed reducer 1,497 hours.