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CIVIL AERONAUTICS BOARD

# ACCIDENT INVESTIGATION REPORT

Adopted: July 12, 1951

Released: July 17, 1951

**EASTERN AIR LINES, INC., JACKSONVILLE, FLORIDA, OCTOBER 10, 1950**

**THE ACCIDENT**

At approximately 1805,<sup>1</sup> October 10, 1950, an Eastern Air Lines' aircraft, Lockheed Constellation 749A-79, N-104A, Flight 604, landed at the Imeson Airport, Jacksonville, Florida. Immediately following the touchdown, the left main landing gear retracted and the aircraft swerved to the left off the runway. None of the occupants was injured. The aircraft was substantially damaged.

**HISTORY OF THE FLIGHT**

Eastern Air Lines' Flight 604 departed from Miami, Florida, at 1630, October 10, 1950, for Newark, New Jersey, via the scheduled intermediate point of Jacksonville, Florida, with a flight crew consisting of F L Dorsett, captain, H R Rivenbark, first officer, and A K Gault, flight engineer. On board were 23 passengers, 2,900 gallons of fuel, 140 gallons of oil, and 988 pounds of cargo. Total aircraft weight was 87,198 pounds which was within the certificated limit of 93,635 pounds. The load was distributed so that the center of gravity was within approved limits.

The flight proceeded in a routine manner and at 1744, reported that it was over the Bayard Fan Marker, 19 miles southeast of Jacksonville, at an altitude of 2,500 feet. At approximately 1746, the flaps were extended to 60 percent, at which time the crew observed that the secondary hydraulic system pressure gauge fluctuated between 800 and 1,700 pounds per square inch. At 1749, as the flight was turning from base leg to final approach, the landing gear was extended. However, the landing gear warning lights in the cockpit indicated that the left main landing gear was not in the down and locked position. For this reason, the approach was discontinued and the landing gear retracted.

The flight circled east of the airport, during which time the landing gear was again extended, but the warning lights still indicated that the left main landing gear was not in the locked position. The aircraft was then flown at a low altitude past the control tower, at which time it appeared to the tower personnel that both landing gears were fully extended.

Since the warning lights in the cockpit were still indicating that the left main landing gear was not locked down, an attempt was made to extend the gear by the use of the emergency hydraulic system. The landing gear lever was placed in the down position and the hydraulic hand pump selector to the gear position. The hand pump was then actuated for approximately three to five minutes and then abandoned since no pressure resistance was felt on the pump handle. The aircraft made a second low flight past the tower, at which time a company mechanic advised that both landing gears appeared to be fully extended. The warning lights still indicated that the landing gear was not locked down but since darkness was approaching, it was decided to land immediately on Runway 23, which is 7,200 feet in length. A normal approach was made and the landing accomplished on the right side of the runway. Immediately following landing, the left main gear was observed to slowly retract, and the aircraft swerved to the left, coming to rest approximately 3,600 feet from the approach end and 50 feet to the left of the runway. The evacuation of the passengers was orderly.

At the time of the accident, the weather was clear, visibility twelve miles, wind from the northwest at three miles per hour. Official sunset was at 1802.

**INVESTIGATION**

The aircraft came to a stop on a heading of approximately 140 degrees resting on the left wing flaps, the No 1 engine nacelle,

<sup>1</sup>All times referred to herein are Eastern Standard and based on the 24-hour clock.

the nose landing gear, the aft under section of the fuselage, and the left lower fin and rudder

The right main landing gear was under the right wing having sheared off at the securing fulcrum fitting just below the attachment lug, following the retraction of the left main landing gear. There was no evidence of any malfunctioning or failure to the right main landing gear prior to the landing. The left main landing gear was undamaged and in the retracted position in the wheel well.

The left wing sustained only minor damage which was confined to the wing flaps and the wing tip. Both flaps were extended 60 percent. Damage to the fuselage and empennage was minor, consisting of distortion and wrinkling of the under surfaces. The right wing sustained substantial damage, having ruptured inboard of and adjacent to the No. 3 engine nacelle when the right main landing gear failed in a rearward, inboard and upward direction. All engines and propellers were intact, however, the propeller blades had been bent rearward. Damage to the engine nacelles was minor and confined to the under surfaces.

The nose gear was intact and in the down and locked position. The safety lock was in place and the wheel was turned fully to the right against the stop.

Examination of the left main landing gear mechanism disclosed that the down lock down line had failed at its point of attachment to the down lock release cylinder which allowed hydraulic fluid to escape, and resulted in a loss of secondary hydraulic system pressure and fluid. Because of this, it was impossible to lock the left main landing gear in the down position by secondary hydraulic system pressure.

The down lock down line and its fittings were removed from the aircraft for further examination. The line was 52S aluminum alloy approximately 20 inches long, with single flares at each end which were fitted with coupling nuts and sleeves. When the line failed at the down lock release cylinder, it slid through the sleeve leaving the coupling nut and sleeve still attached to the cylinder. The separation occurred at the outer lip of the flare approximately 3/64 of an inch from the end of the tubing. The outer lip of the flare was found inside

the coupling nut and when the line separated, the sleeve lost its grip on the tube and hydraulic pressure pushed the tubing through the sleeve. The wall thickness of the flared end of the tube was reduced to a razor sharp edge at the point of failure.

It was evident from the markings on the line that the sleeve had cut through the flared end of the tube, due to excessive torquing of the coupling nut. The fact that the sleeve could not be easily removed from the coupling nut due to interference with the internal threads of the nut, was a further indication of excessive torquing. Eastern Air Lines had not established a torque value for this coupling nut, however, the aircraft manufacturer specified a torque value and recommended that a torque wrench be used for its installation.

Prior to the removal of the down lock down line, the aircraft was placed on jacks and functional tests of the hydraulic system were conducted. It was found that the left main landing gear would not lock in the down position by the secondary hydraulic system pressure. The landing gear, however, did fully extend and lock when the emergency hydraulic system was operated. During these tests it took approximately 181 cycles of the hydraulic hand pump before the gear locked in the down position, and it was only on the last eight strokes that there was back pressure on the hydraulic hand pump. The initial lack of back pressure is normal until the main landing gear actuating cylinders have been filled with hydraulic fluid and to fill these cylinders, it takes practically all of the required strokes of the hand pump.

The CAA Approved Airplane Operating Manual (revised) dated April 22, 1949, a copy of which was carried in the aircraft, provided as follows regarding emergency extension of the landing gear:

- "1. Landing gear lever 'DOWN' position
  2. Hand pump selector aft or 'GEAR' position
  3. Use full strokes of the hand pump
- Note: About 245 full strokes are required over two and one-half to three minutes to extend and lock all gears."

The Eastern Air Lines Flight Engineers Manual, the only company manual carried aboard the aircraft, provided as follows:

regarding emergency extension of the landing gears

"1 Landing gear lever 'DOWN'

2 Hand pump selector aft to 'GEAR' position

3 Actuate hand pump using full strokes

Note Main struts will drop of their own weight with assistance of air drag after pressure from hand pump has unlocked the uplatches. Nose strut must be pumped down against the air drag, requiring about 245 full strokes of pump lever during approximately 2 1/2 minutes "

In the Flight Engineers Manual, there is an inference not contained in the Aircraft Operating Manual, that the main gear will fall and lock in the down position. However, it was determined that while the main landing gear will drop of its own weight when the up locks have been released, it will not always lock in the down position. Also, a full stroke was not defined in either manual, that is, whether it is a cycle or a half cycle. The fact that a full stroke as used in the Approved Airplane Operating Manual, as well as the Flight Engineers Manual, actually meant a full cycle consisting of two one-way strokes of the hand pump handle was not known to some crew members involved until after the accident.

The captain and the first officer differed in their interpretation of the meaning of the phrase "full stroke" as used in the manuals. The captain described it as a full stroke in one direction, while the first officer interpreted it as a cycle. The captain was of the opinion that the pumping should be abandoned because no back pressure had been obtained. However, the copilot only decided to abandon pumping when he had actuated the pump for a period of time which he considered sufficient to have placed the gear in the down and locked position. The lack of any pressure resistance on the pump handle did not enter into the copilot's decision. No attempt was made by the crew to check the normal operation of the hand pump, which could have been done by placing the emergency selector valve to the brake position and operating the hand pump. However, this procedure would only indicate that the pump was operating, and that fluid was in the emergency

tank, and would not have indicated a failure of the emergency system if it had occurred between the pump and the landing gear. Neither of the crew members observed the fluid level in the emergency tank when the hand pump was being operated. If the emergency system had been functioning normally, the fluid level in the emergency tank would have dropped below the sight gauge.

During the original qualification training for the Constellation aircraft, each crew member was required to attend ground school, which included 16 hours of lecture time on the hydraulic system, and also was required to pass a written examination upon completion of the course.

When Eastern Air Lines first qualified flight crews in the Lockheed Constellation it was not possible to extend the landing gear by the emergency system without damaging the hydraulic power pumps. This was due to the fact that such an operation required that the hydraulic fluid supply to the pumps be shut off, however, the pumps would be damaged if operated without the fluid. Subsequent to the original qualification program and prior to the accident the hydraulic pumping installation was modified so that the fluid to the pumps could be shut off without damaging the pumps. Eastern prior to the accident did not require that Constellation crews simulate an emergency extension of the landing gear.

#### ANALYSIS

As stated above, the left main landing gear did not lock in the down position because of the failure of the down lock down line, which was due to excessive and repeated torquing of the coupling nut. The aircraft manufacturer specified a torque value for this coupling nut and recommended that a torque wrench be used for its installation. The company had no established torque value for this coupling nut. If a torque value had been specified and adhered to, it is probable that the line would not have failed.

As a result of this accident, the carrier has replaced all the subject lines made of 52S material with lines made of Everdur. Due to the higher strength of this material it is capable of withstanding, without failure, repeated torquing at the maximum value likely to be applied in service without the use of torque wrenches.

As demonstrated by tests following the accident, the left main landing gear could have been locked in the down position by the use of the emergency hydraulic system. However, because of the crew's lack of familiarity with the emergency hydraulic system, the hydraulic hand pump was not actuated sufficiently to lock the left main landing gear in the down position. Furthermore, no attempt was made to check the emergency hand pump for normal operation, instead, the operation of the hand pump was prematurely abandoned. This lack of familiarity was due primarily to inadequate training by Eastern Air Lines.

Since the accident, Eastern has distributed to all its flight crews specific information on the hydraulic system of the Constellation type aircraft, with particular emphasis on the operation of the emergency hydraulic system. The company has also made it mandatory that each Constellation crew physically extend the landing gear with the emergency system. Moreover, the company has made it mandatory that during each six-month check every Lockheed Constellation crew perform a manual extension of the landing gear by the use of the emergency system. In addition to the copilot performing this function on each six-month check, it is required that the captain move to the copilot's seat and go through the procedure also.

#### FINDINGS

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

- 1 The company, the aircraft, and the crew were properly certificated
- 2 Prior to the landing at Jacksonville, the left main landing gear did not lock in the down position

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3 An attempt by the crew to lock the landing gear in the down position by the emergency hydraulic system was not successful

4 The landing was accomplished with the left main landing gear not locked down and following the landing, it retracted

5 The left main landing gear down lock down line had failed, which resulted in the loss of secondary hydraulic system pressure and fluid

6 The down lock down line failed due to excessive torquing of the coupling nut

7 Eastern Air Lines had not specified a torque value for the coupling nut

8 The emergency hydraulic system was functioning normally

9 Due to the crew's lack of familiarity with the emergency hydraulic system they did not lock the left main landing gear in the down position

10 The unfamiliarity with the emergency system was due to a lack of adequate training by the company

#### PROBABLE CAUSE

The Board determines that the probable cause of the accident was the unsuccessful attempt of the crew to lock the landing gear manually, due to lack of training in the operation of the emergency hydraulic system

#### BY THE CIVIL AERONAUTICS BOARD

/s/ DONALD W NYROP

/s/ OSWALD RYAN

/s/ JOSEPH P ADAMS

/s/ CHAN GURNEY

Josh Lee, Member of the Board, did not participate in the adoption of this report

# Supplemental Data

## INVESTIGATION AND HEARING

The Civil Aeronautics Board received notification of the accident at 1845, October 10, 1950, from Eastern Air Lines and immediately initiated an investigation in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. As part of the investigation a public hearing was held in Coral Gables, Florida, on December 7, 1950.

## AIR CARRIER

Eastern Air Lines, Inc., is a scheduled air carrier, incorporated in the State of Delaware, and has its principal place of business at 10 Rockefeller Plaza, New York, New York. It is the holder of a certificate of public convenience and necessity from the Civil Aeronautics Board and also holds an air carrier operating certificate issued by the Administrator of Civil Aeronautics. The company is authorized to engage in scheduled air transportation with respect to persons, property, and mail to various points including Miami and Jacksonville, Florida, and Newark, New Jersey.

## FLIGHT PERSONNEL

Captain F L Dorsett, age 47, had been employed continuously by Eastern Air Lines since February 8, 1935. He had a total of 10,278 flying hours, of which 2,422 hours were accumulated in the Constellation type aircraft. He had flown a total of 78 hours in the last 30 days and had had 70 hours

rest previous to the subject flight. His last CAA physical examination was accomplished April 21, 1950, and his last instrument check, on June 22, 1950. He was qualified as a Constellation pilot as of July 1947. He holds a valid Air Transport Rating No 3922.

Copilot H R Rivenbark, age 31, had been continuously employed by Eastern Air Lines since July 25, 1945. He had accumulated a total of 6,398 flying hours, of which 345 hours had been obtained in the Constellation type aircraft. In the last 30 days, he had flown 77 hours and had a rest period of 70 hours previous to the subject flight. His last CAA physical was accomplished July 26, 1950. He is a holder of a valid Airman Certificate No 463300 with a commercial rating.

Flight Engineer A K Gault, age 28, had been continuously employed by Eastern Air Lines since April 26, 1947. He had accumulated a total of 2,336 flying hours, all obtained in the Constellation type aircraft. He is a holder of Flight Engineers Certificate No 846934 and an Engine Mechanic Certificate No 1180967.

## AIRCRAFT

The aircraft, a Lockheed Constellation Model 749A-79-12, N-104A, was placed in scheduled service by Eastern Air Lines on June 3, 1947. At the time of the accident, the aircraft had a total of 10,435 hours. It was equipped with four Wright Cyclone engines, C-18-BD1 and four Hamilton Standard propellers No 33-E60.