

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR24LA110

MATERIALS LABORATORY

Factual Report 24-037

November 8, 2024

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A. ACCIDENT INFORMATION

Location: Chino, California
Date: March 10, 2024
Vehicle: Beech 60, N167U
Investigator: Stephen Stein, AS-WPR

B. COMPONENTS EXAMINED

Left main landing gear pushrod assembly, outboard main landing gear door pushrod assembly, pressure boot, and uplock cable pieces.

C. EXAMINATION PARTICIPANTS

Specialist Matthew R. Fox, Ph.D.
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

An overall view of the submitted components associated with the left main landing gear (MLG) is shown as received in figure 1. The left main landing gear pushrod assembly was fractured at two locations, and the inboard piece was bent upward near the middle of the piece. The uplock cable was fractured, and the outboard MLG door pushrod was slightly bent.

As assembled on the aircraft, the inboard ends of the MLG pushrods are attached to arms on the left and right sides of the MLG actuator, and the outboard ends of the MLG pushrods are attached to arms on the MLG side braces. The inboard ends of the inboard MLG door pushrods are attached to arms on the forward and aft sides of the MLG actuator. The outboard ends of the inboard MLG door pushrods are linked to the inboard ends of the outboard MLG door pushrods, and the outboard ends of the outboard MLG door pushrods are attached to the MLG door panels. As the MLG actuator rotates approximately 180 degrees from the extended to retracted position, the MLG pushrods displace approximately 7 inches inboard, retracting the MLG through rotation at the upper ends of the side braces. Simultaneously, the inboard MLG door pushrods are displaced outboard to open the MLG door panels and then back inboard to close the panel covering the inboard ends of the retracted MLG. The MLG pushrod and outboard MLG door pushrod extend through a pressure boot where they pass through the fuselage skin. In the opening for the MLG push rod, the pressure boot is clamped to a bushing that slides on the rod as the MLG extends and retracts.

The uplock cable fracture was examined using an optical stereomicroscope. The wires were generally oxidized and dry to the touch. The fracture features on

many of the wires were smeared with local bending deformation and contact damage adjacent to the fractured ends consistent with contact with another object at the fracture location. Wires without smearing damage were thinned from necking deformation consistent with ductile overstress fracture. No evidence of a progressive fracture mechanism such as fatigue and no splaying from elastic rebound were observed.

The inboard and outboard fractures in the left MLG pushrod were located approximately 14 inches and 31 inches from the inboard attachment, respectively. The tubular cross-section of the pushrod was collapsed at both fracture locations, consistent with local bending. At the outboard fracture location, the tube was bent consistent with the inboard end moving aft relative to the outboard end. At the inboard fracture location, the tube was bent consistent with the inboard end moving forward relative to the outboard end. Fracture features at each location were on slant angles consistent with ductile overstress fracture. The overall deformation and fracture pattern was consistent with buckling from compression loading.

The pressure boot had been disassembled from the bushing on the left MLG pushrod before the parts were received as shown in figure 1, and the clamp for attaching the boot to the bushing was not included in the submitted components. The bushing was positioned on the outboard piece of the pushrod tube adjacent to the outboard fracture location as indicated in figure 1. The bushing did not move when hand forces were applied to slide the bushing outboard from its as-received position.

The left MLG pushrod had a yellowish-green coating, consistent with primer, at the inboard end. At the outboard end, the pushrod had white paint covering the yellowish-green primer. A portion of the pushrod on either side of the bushing had a green coating, also consistent with primer, with overspray onto the yellowish-green primer and white paint at the respective inboard and outboard ends of the green-coated area. Along a length approximately 3.4 inches inboard and 3.5 inches outboard of the 2-inch-long bushing, the green primer was rubbed, exposing bare metal especially inboard of the bushing where sliding contact marks were also observed. The remaining green primer was substantially bubbled and flaked away from oxidation of the underlying surface.

Submitted by:

Matthew R. Fox, Ph.D.
Chief Technical Advisor, Materials Laboratory

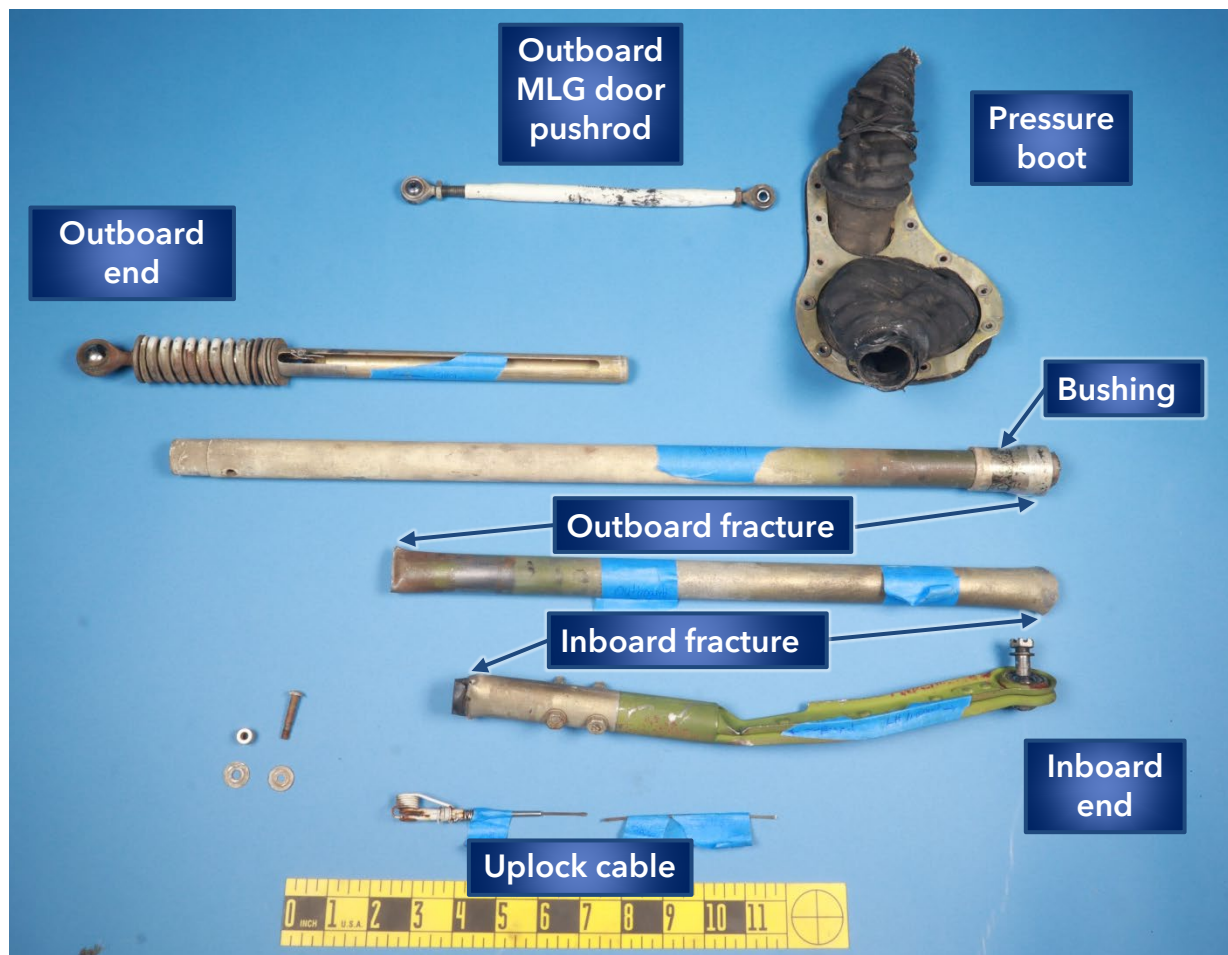


Figure 1. Overall view of the submitted components. The inboard end, outboard end, and fracture locations on the left MLG pushrod assembly are indicated.