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October 27, 2025

Aviation Investigation Report AIR-25-07

Ensure Learjet Main Landing Gear Are Securely Attached

Introduction

The National Transportation Safety Board (NTSB) is providing the following information to urge the Federal Aviation Administration (FAA) to immediately act on the safety recommendations in this report concerning the potential for incorrectly attached main landing gear on certain Learjet airplanes to separate from the wing structure during landing. We identified this issue during our ongoing investigation of a fatal runway excursion involving a Learjet 35A, N81VN, while landing at Scottsdale Airport (SDL), Scottsdale, Arizona, on February 10, 2025. Additional support for the recommendations in this report is derived from our review of investigations and reports of three prior events involving incorrectly attached main landing gear on Learjet airplanes. The NTSB is issuing one urgent safety recommendation and one non-urgent safety recommendation to the FAA.

Background and Analysis

On February 10, 2025, about 1438 mountain standard time, a Learjet 35A, N81VN, was landing on runway 21 at SDL when it departed the left side of the runway and impacted a parked Gulfstream G200.¹ The Learjet's captain was fatally injured, the first officer (FO) and one passenger were seriously injured, and one passenger received minor injuries; additionally, an occupant inside the parked airplane, which was not operating at the time, sustained serious injuries. The Learjet was substantially damaged. The corporate flight was operating under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91.

A witness at a golf course near the final approach path captured an 11-second video showing the airplane on final approach with the left landing gear trailing aft from its normal position. Figure 1 shows still images from the video of the accident

¹ Visit [nts.gov](https://www.nts.gov) to find additional information in the [public docket](#) for this ongoing NTSB investigation (case number [WPR25FA088](#)). Use the [CAROL Query](#) to search safety recommendations and investigations.

approach compared to a photograph of the airplane from a previous flight. Evaluation of the video indicated that the strut was facing aft.²

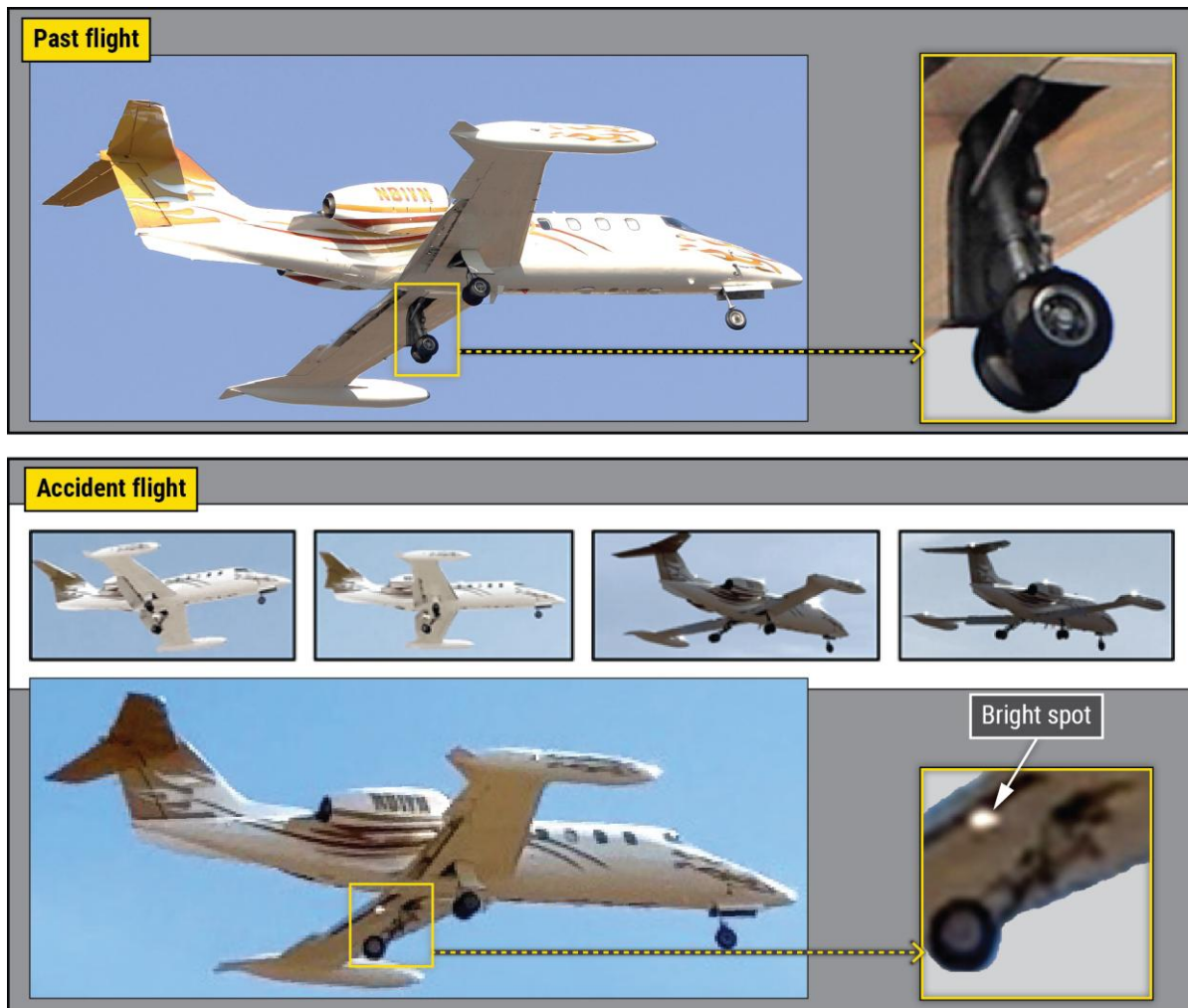


Figure 1. Still images from a witness-supplied video showing the left landing gear askew while on approach to the runway, compared with a prior photo of the accident airplane (Source of previous flight photo: www.jetphotos.com).

A review of airport surveillance videos and automatic dependent surveillance – broadcast (ADS-B) data indicate that at 1438:16, the airplane touched down on

² A circular bright spot can be seen on the bottom of the left-wing flap above the dangling left landing gear strut. The appearance of the bright spot is consistent with it being illuminated from the left landing gear light, which normally illuminates in the forward direction; however, the location of the bright spot in the video suggests the strut is facing aft.

runway 21 just before the aiming point markings with full flaps extended.³ The airplane immediately entered a left-wing-low attitude and began veering left, exiting the runway surface. The airplane traveled over the rock-covered runway safety areas located between the runway and taxiways. The left main landing gear separated from the airplane and came to rest, as shown in figure 2, adjacent to taxiway B. The airplane crossed taxiway B, collided with a windsock, and entered the ramp area where it struck the right side of the parked Gulfstream G200 (see figure 3). The airplane was not equipped with thrust reversers and the drag chute was not deployed.⁴

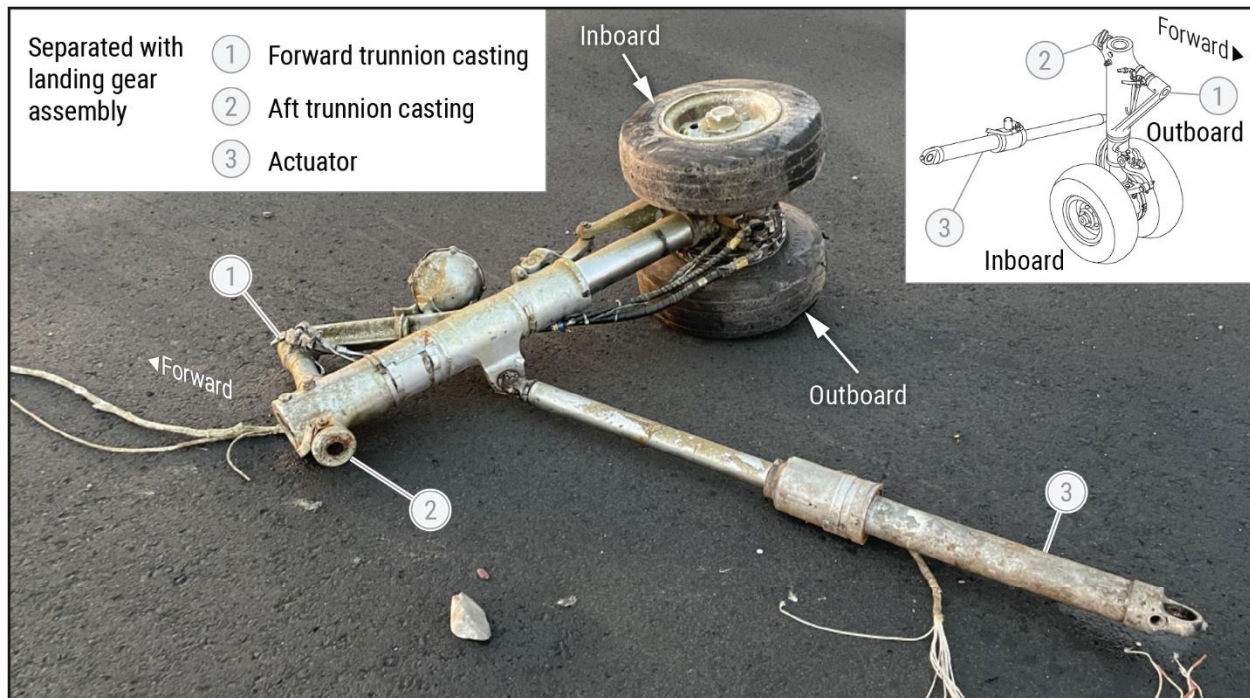


Figure 2. Left main landing gear at the accident site with inset diagram of the landing gear assembly (Inset source: Bombardier).

³ According to the FAA, ADS-B uses GPS satellite signals to provide air traffic controllers and pilots with accurate information that will help keep aircraft safely separated in the sky and on runways. Aircraft transceivers receive GPS signals and use them to determine the aircraft's precise position in the sky, which is combined with other data and broadcast to other aircraft and air traffic control facilities.

⁴ The drag chute is a pilot-deployed deceleration device designed to supplement wheel braking by increasing aerodynamic drag during landing. On Learjet models not equipped with thrust reversers, such as the Learjet 35A, the drag chute serves a similar purpose—helping to reduce landing rollout distance, particularly on short or contaminated runways.



Figure 3. Video excerpts showing the landing rollout to impact.

Each main gear assembly attaches to the airplane (wing) structure at three points (indicated in figure 2): through the forward and aft trunnion pins (with striker plates on the trunnions to actuate microswitches) and through the main gear hydraulic actuator.^{5,6} Figure 4 provides an illustration of the left main gear assembly and aft trunnion attachment in its correct configuration. During installation, the aft trunnion pin is inserted through a bushing on the aft trunnion fitting (located on spar 7), into the aft side of the trunnion casting.^{7,8} When properly positioned, holes in the aft trunnion pin and the trunnion casting align, allowing a retaining bolt to be

⁵ A trunnion pin is a cylindrical pivot or shaft designed to allow rotation or serve as a hinge point within a mechanical assembly. On airplane landing gear, a trunnion pin is often used to secure the landing gear strut to the supporting structure.

⁶ Striker plates are mechanical contact surfaces that physically actuate microswitches indicating gear position.

⁷ The trunnion casting refers to the entire structural component cast from metal that forms part of the landing gear assembly.

⁸ Spar 7 refers to the primary longitudinal structural member running spanwise in a Learjet wing, in a horizontal plane, to which the aft trunnion fitting of the main landing gear assembly is attached, serving as the fixed load path for landing and retraction forces.

inserted through both; shims on either side of the aft trunnion fitting ensure proper alignment of the holes.⁹ The retaining bolt is then secured with a castellated nut and cotter pin.

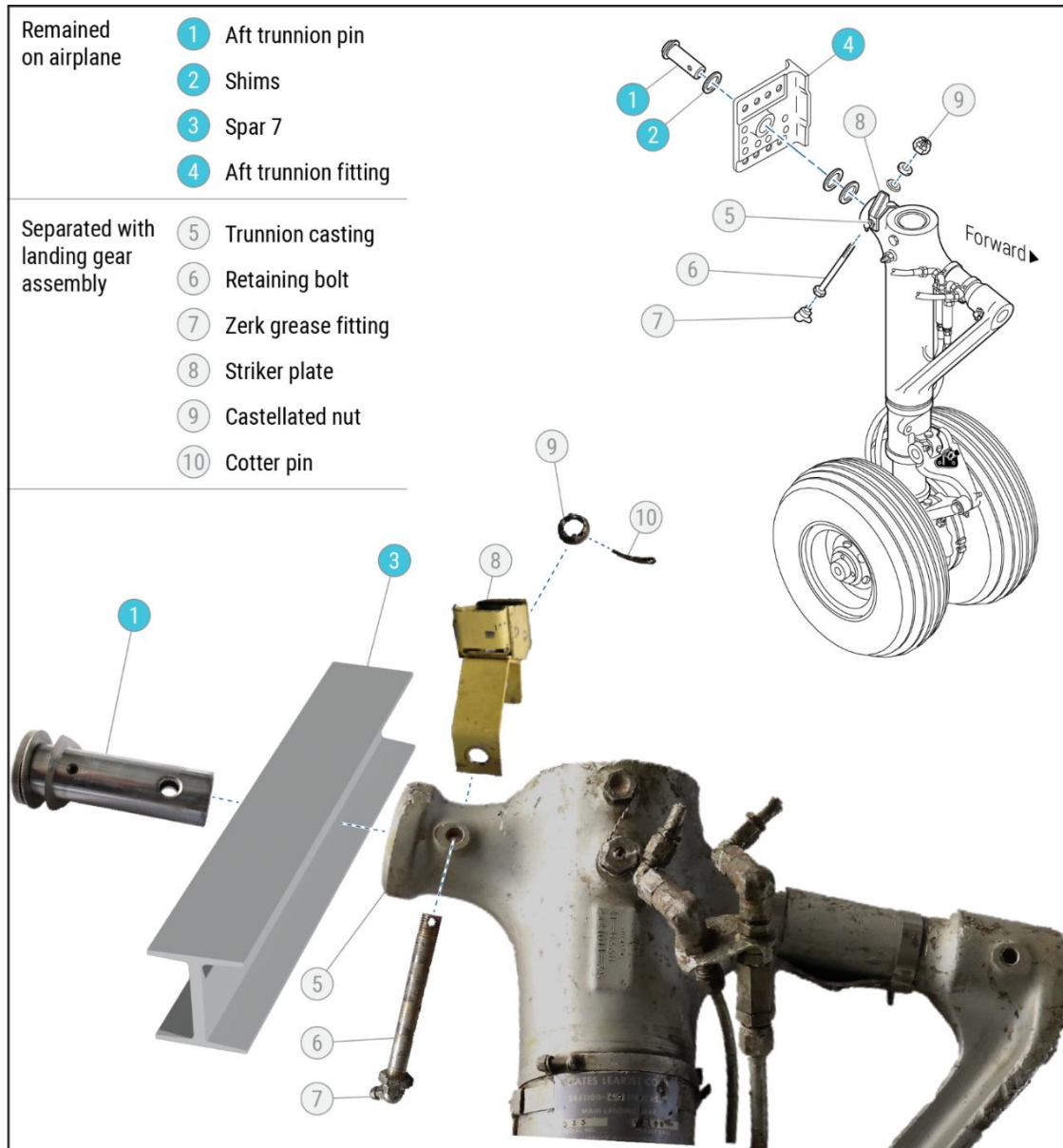


Figure 4. Accident parts composited into a schematic view of the left main landing gear assembly (Inset source: Bombardier).

⁹ Shims are donut-shaped, thin, peelable laminated spacers used in aircraft assemblies to fine-tune clearances and alignment during installation or maintenance.

Preliminary findings in this ongoing investigation indicate that, months earlier, the aft trunnion pin was not correctly installed when the main landing gear was installed. The aft trunnion pin was inserted through the aft trunnion fitting but had not been inserted far enough into the trunnion casting for the two holes to align. The retaining bolt had been installed and secured in the aft trunnion casting without going through the hole in the aft trunnion pin.

Postaccident examination of the left wheel well found the aft trunnion pin intact and still positioned in the aft trunnion fitting on spar 7, though no forward shims were present. Removal of the access panel adjacent to the aft trunnion fitting gave investigators visual access to the trunnion pin's shoulder and aft shims, which were not making contact with the aft surface of the aft trunnion fitting. An excessive amount of grease was piled below the pin (see figure 5).

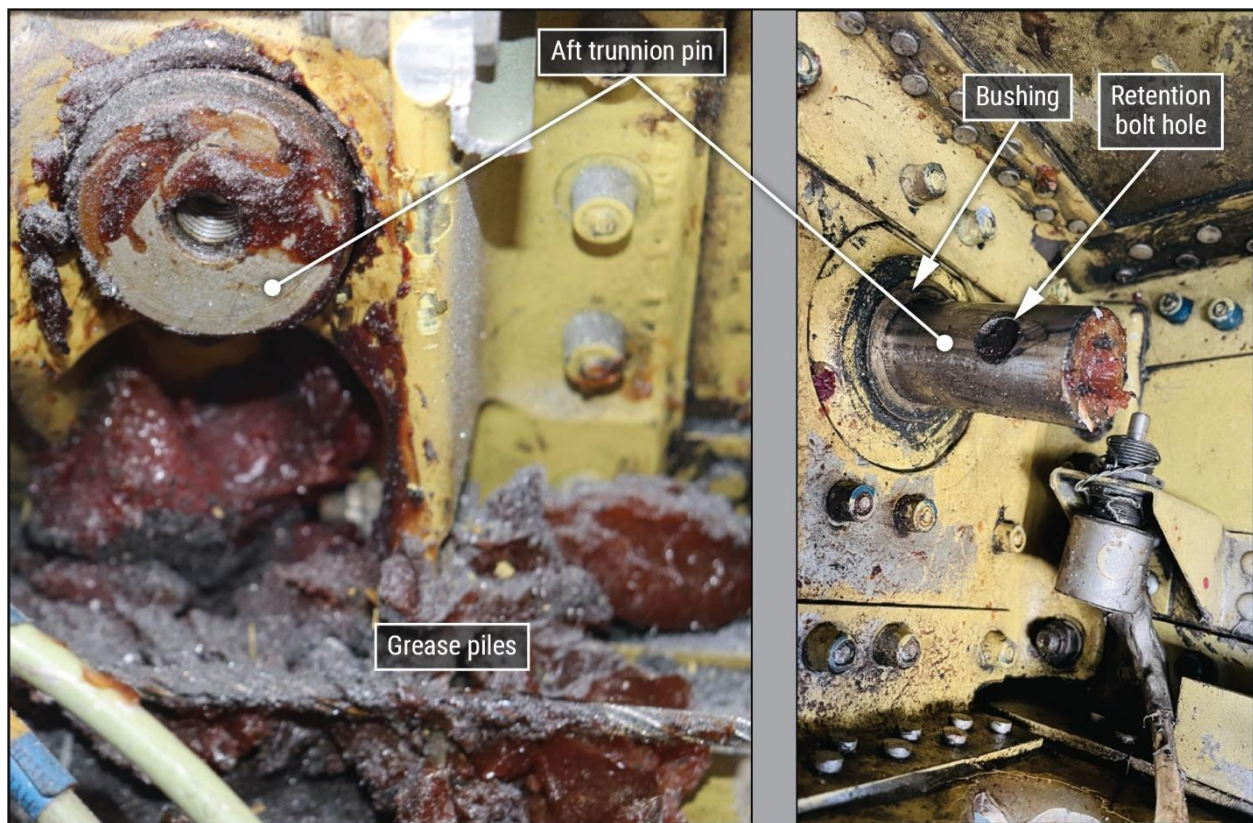


Figure 5. Left main landing gear aft trunnion pin.

Note: The left photograph shows the area aft of spar 7; this area is not visible unless an access panel is removed and remains very difficult to view even with the panel removed. The right photograph shows the interior of the left wheel well.

More significantly, the on-scene examination found that the aft trunnion pin was no longer seated within the aft trunnion casting: The aft trunnion casting

remained intact on the left main gear, which, as previously mentioned, had separated from the airplane. The retaining bolt—intended to pass through the aft trunnion pin to secure the main gear strut to the airframe—was found intact on the left main landing gear, inserted through its aft trunnion casting and secured with a castellated nut and cotter pin (see figures 6 and 7). The absence of the aft trunnion pin (which remained intact on the airplane) from the trunnion casting indicated that the retaining bolt was secured to the aft trunnion casting without passing through the aft trunnion pin.



Figure 6. Left main landing gear aft trunnion casting at the accident site with white lines indicating attachment of the retaining bolt and striker bracket.

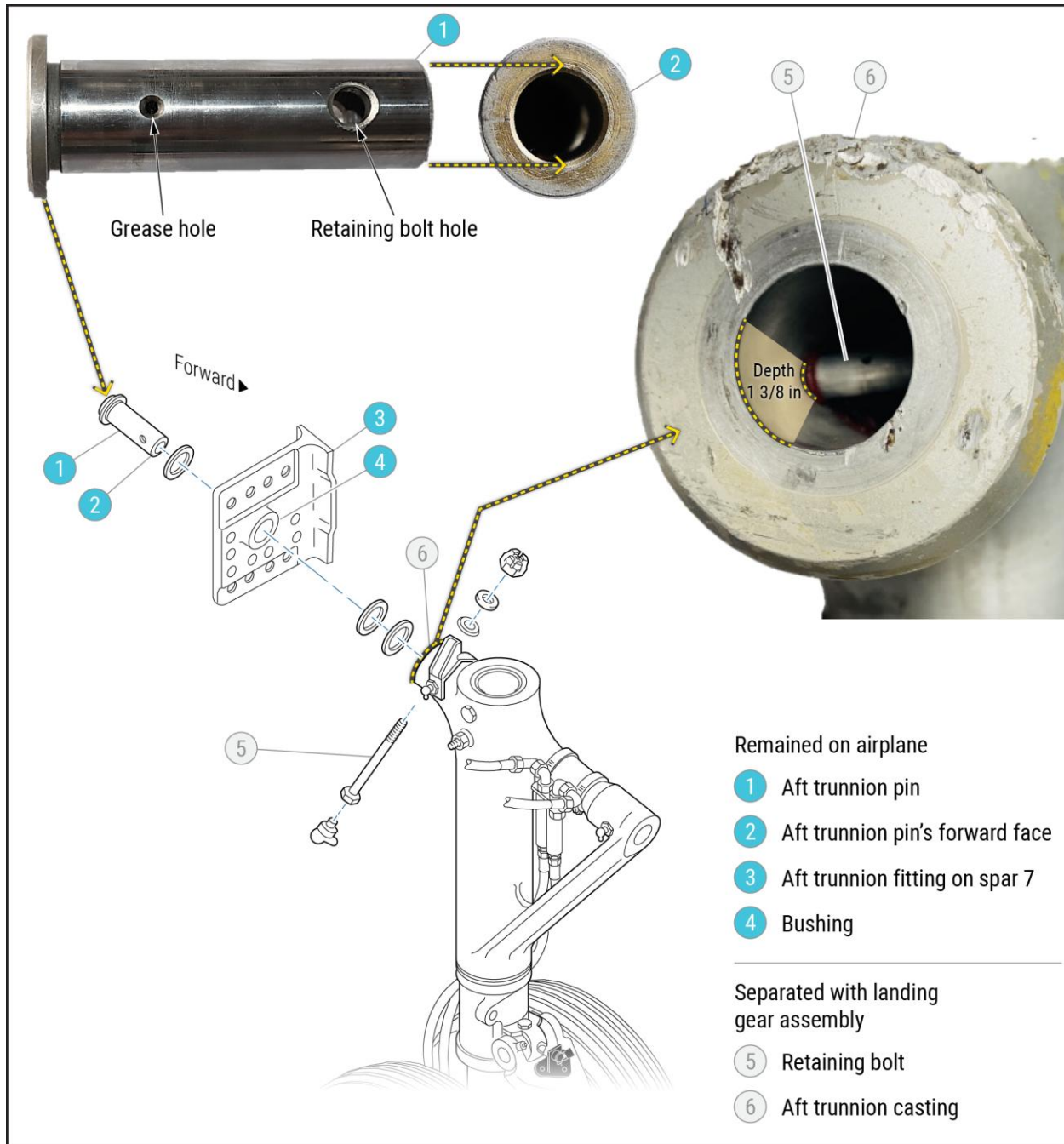


Figure 7. Left main landing gear aft trunnion pin and aft trunnion casting from the accident airplane, with retaining bolt secured through the latter but not the former (Source [inset diagram]: Bombardier).

On scene examination of the airplane found the left main gear's forward trunnion pin correctly assembled. The forward trunnion pin remained secured in the forward trunnion casting. The left main gear actuator remained connected to the

strut, but the inboard attachment point was no longer fastened to the airframe and exhibited evidence of separation consistent with accident forces. The right main landing gear remained attached to the airframe and was in the down and locked position.

During further examination of the aft trunnion fitting, investigators measured the distance between the shoulder of the aft trunnion pin and the aft surface of the aft trunnion fitting. The aft trunnion pin's shoulder was protruding off the aft trunnion fitting by 1 3/8 in—a distance that corresponds to the depth within the aft trunnion casing at which the retaining bolt is located (see figure 7).¹⁰ If the retaining bolt is secured through the trunnion casting without engaging the trunnion pin in the trunnion casing, as was found during the examination of the accident left main landing gear assembly, then the trunnion pin's grease hole (intended as an access point for lubricating the bushing) will protrude aft of the bushing, allowing grease to migrate into the wing bay behind spar 7. This scenario is consistent with the observed excess grease piled below the trunnion pin in the wing bay behind spar 7.

When assembled correctly, the pin is fully inserted into the trunnion; therefore, the pin's shoulder head will sit flush against the surrounding wing strut structure/fitting. When the retaining bolt is not inserted through the hole in the pin, the retaining bolt prevents the pin from being (correctly) fully inserted into the trunnion. As shown in figure 8, this obstruction results in the pin bearing against the retaining bolt rather than seating fully within the trunnion, leaving the pin's shoulder visibly protruding from the aft spar surface.

¹⁰ As noted earlier, the trunnion *casting* refers to the entire structural component cast from metal that forms part of the landing gear assembly. The trunnion *casing* refers specifically to the inner cylindrical bore within the casting that receives the trunnion pin.

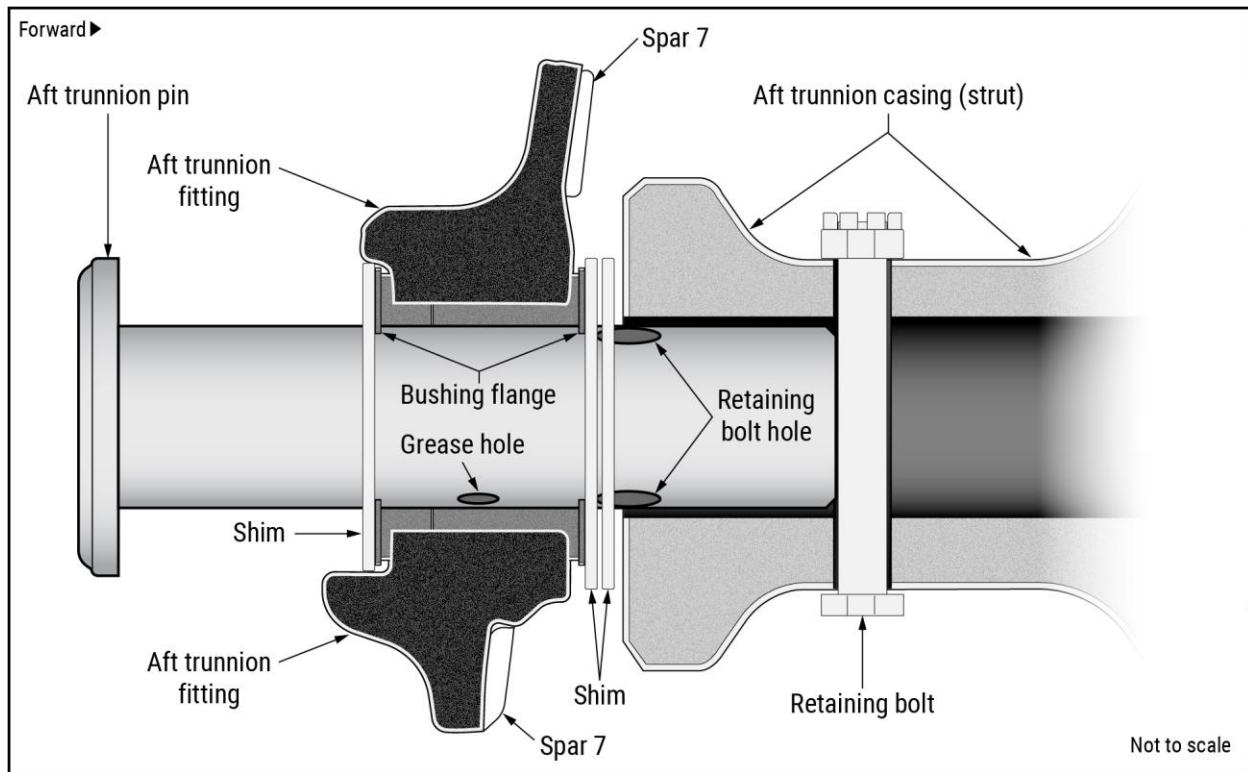


Figure 8. Cross-sectional illustration of insecurely attached landing gear.

Note: For illustrative clarity, the retaining bolt is shown vertically. In actuality, the retaining bolt's axis is oriented perpendicular to the plane of the illustration (that is, it would be installed into the page).

According to postaccident interviews, the same flight crew for the accident flight had a landing mishap with the same airplane on June 20, 2024, in McAlester, Oklahoma.¹¹ A video of the event revealed that the airplane landed hard just short of the runway surface and bounced several times. As a result of the hard landing, both left main landing gear tires burst. The captain hired a mechanic, who had worked on the airplane during its previous ownership, to perform a hard landing inspection. This work was completed several weeks after the event. The mechanic stated in a postaccident interview that he followed the Learjet 35A maintenance manual for all of the work he performed, which included removing both main landing gear to facilitate the required inspections.

The Learjet maintenance manual specifies that installation of the main gear strut begins by securing the forward trunnion pin. The mechanic then should raise the strut so that the forward trunnion pin engages in the forward bearing. Thereafter, the

¹¹ The NTSB did not receive a notification about this occurrence and did not open an investigation for it.

mechanic should align the trunnion with the aft trunnion fitting. Shims should be placed onto the aft trunnion pin before inserting it into the trunnion fitting on the aft side of spar 7; additional shims are then placed on the aft trunnion pin before inserting it into the main gear strut's aft trunnion casing, ensuring that there is no gap at the attachment point between aft trunnion fitting's forward surface and the trunnion casing.

A temporary bolt is installed on the shoulder area of the aft trunnion pin to check tolerances, after which the bolt is removed to insert the striker bracket. The mechanic should then secure the retaining bolt (with attached Zerk-type grease fitting) through the aft trunnion pin and trunnion casing with a nut and cotter pin on the other side. Thereafter, grease is added through the retaining bolt's grease fitting to migrate through the pin and (by way of the aft trunnion pin's grease hole) lubricate the bushing.

Another mechanic who subsequently lubricated the landing gear in December 2024 stated that nothing appeared unusual, but he remarked that the left landing gear took an excessive amount of grease.

Prior events

During the course of this investigation, the NTSB learned of three prior events in which Learjet landing gear disconnected from the airframe because the retaining bolt was not engaged through the aft trunnion pin.

On October 4, 1995, the left main landing gear of a Learjet 25B airplane, N47MR, collapsed during landing rollout at Will Rogers World Airport in Oklahoma City, Oklahoma. The pilot was able to pull the airplane up and perform a go-around, after which the pilot landed the airplane on the right main gear and nose gear. The airplane sustained minor damage, and there were no injuries. During postincident examination, it was discovered that the left main gear's aft trunnion pin was incorrectly installed and had backed out, allowing the gear to collapse (see figure 9).



Figure 9. Composite of N47MR accident photos (Source: Jon Dudek).

On February 4, 2001, the left main gear of a Learjet 25B airplane, N48WA, separated from the airframe shortly after touchdown at Saint Lucie County International Airport, in Fort Pierce, Florida, and the airplane skidded off the left side of the runway. According to the pilot, the airplane encountered a landing gear retraction problem after takeoff. Unable to resolve this problem, the crew decided to return to the departure airport for an emergency landing. The pilot reported that he lost directional control after the airplane touched down. The airplane sustained substantial damage; the pilot and crew were not injured. Examination of maintenance records revealed that the landing gear assembly had been removed and reinstalled during a recent maintenance procedure. The investigation determined that the mechanic had failed to properly install and secure the left main landing gear aft trunnion pin in accordance with procedures specified in the Learjet maintenance manual.¹²

On March 28, 2008, a Learjet VU-35A airplane operated by the Brazilian Air Force, FAB 2712, experienced a runway excursion after the left main landing gear collapsed upon touchdown at Recife/Guararapes–Gilberto Freyre International Airport in Recife, Brazil. The airplane sustained substantial damage; the three crew members and four passengers were uninjured. A report by the Brazilian Aeronautical Accident Prevention and Investigation Center, which investigated the accident, determined that the left main landing gear did not retract after takeoff; instead, the entire strut shifted backward. During landing, the pilot lost directional control of the airplane. Postaccident examination found the left aft trunnion pin loose in the wing

¹² Visit [ntsb.gov](https://www.ntsb.gov) to find additional information in the [public docket](#) for this NTSB investigation (case number [ATL01LA030](#)).

bay behind spar 7 without any signs of fracture or fatigue. The retaining bolt was found intact and still fastened through the left main landing gear's casting—having been installed without engaging the aft trunnion pin (see figure 10).

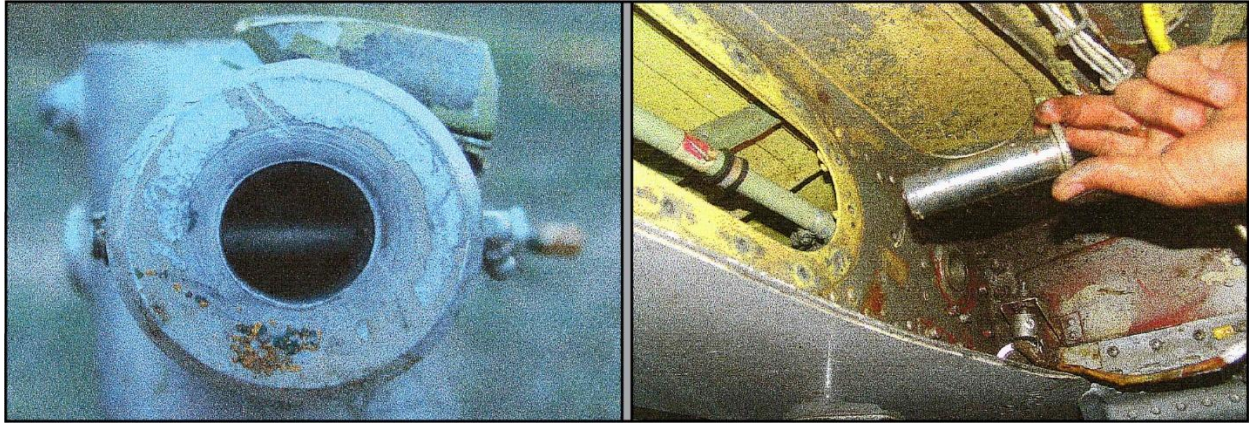


Figure 10. VU-35 accident photos (Source: Aeronautical Accident Prevention and Investigation Center of Brazil).

In response to on-scene findings at the Scottsdale accident, on March 7, 2025, Bombardier issued a series of Learjet model-specific service bulletins (SBs), for airplanes equipped with the same type of landing gear (that is, with aft trunnion pin and retaining bolt); see table.

Table. Learjet models and corresponding postaccident service bulletins.

Model	Service Bulletins
Learjet 23/24/25	A23/24/25-32-20
Learjet 28/29	A28/29-32-21
Learjet 31	A31-32-25
Learjet 35/36	A35/36-32-29
Learjet 55	A55-32-26
Learjet 60	A60-32-42

Each of these SBs recommend that operators, within the next 25 flight cycles, remove the access panel on spar 7, confirm that the aft trunnion pin is seated flush against the shim and bushing flange, ensure the retaining bolt is correctly installed through the strut and trunnion pin, and correct any discrepancies before the next flight.¹³

¹³ The bushing flange is a sleeve-type bearing with a widened collar, the inner surface of which mates with the trunnion pin and the outer surface of which fits into the bore of the trunnion fitting.

The NTSB notes that compliance with SBs is not mandatory. In July 2025, the FAA's Corrective Action Review Board made a final determination that no additional FAA action is necessary for the Bombardier SBs. Consequently, the FAA has decided that it will not issue an airworthiness directive (AD) requiring mandatory implementation of the Bombardier SBs. We believe the FAA's decision not to issue an AD is incommensurate with the longstanding aviation safety risk associated with misassembly of Learjet main landing gear, as documented in this report, dating as early as 1995. The FAA's decision is particularly difficult to justify in view of the imminent risk of loss of life from a similar accident, the minimal effort required to accomplish the SBs—an estimated 2 hours per airplane—and the fact that Bombardier itself has urged the FAA to mandate compliance through an AD.

We furthermore note that according to Bombardier, only about 12% of the 1,883 in-service airplanes addressed by the SBs have reportedly completed the inspection.

We are concerned that without a requirement to perform the inspection procedures outlined in Bombardier's March 7, 2025, SBs, Learjet airplanes may continue to operate with improperly assembled main landing gear, since the insecure attachment resulting from such misassembly is not readily detectable during routine maintenance or preflight inspections. Given that installation of the aft trunnion pin without engaging its retaining bolt can result in the landing gear separating from the airplane during landing—thereby increasing the risk for loss of directional control and runway excursion—the NTSB concludes that a one-time inspection of certain Learjet models consistent with Bombardier's March 7, 2025, service bulletins is necessary to prevent main landing gear from collapsing as a result of misassembly in which the aft trunnion pin retaining bolt is secured without passing through the pin.

Therefore, the NTSB recommends that the FAA require, as a condition of continued airworthiness, operators and owners of applicable Learjet models to comply with Bombardier Service Bulletins (SBs) A23/24/25-32-20, A28/29-32-21, A31-32-25, A35/36-32-29, A55-32-26, and A60-32-42.

The NTSB is also concerned that Learjet maintenance manual procedures for installing the main landing gear do not contain a step to ensure that the aft trunnion pin is positioned correctly or that the retaining bolt is secured through it. In the absence of a required verification step, a mechanic could inadvertently install the retaining bolt without it passing through the trunnion pin, leaving the gear insecurely attached to the airframe; such misassembly may enter service undetected, increasing the risk of the main landing gear separating from the airplane during landing. The manual should include steps to confirm, by direct visualization, that the aft trunnion pin is seated flush against the shim and bushing flange, to ensure the retaining bolt is correctly installed through the strut and trunnion pin, and to correct any discrepancies. Therefore, the NTSB concludes that revision of Learjet maintenance manual procedures for installation of the main landing gear to include an explicit

procedural check that verifies correct engagement of the aft trunnion pin with its retaining bolt would ensure that the main landing gear is securely attached to the airframe.

Therefore, the NTSB recommends that the FAA require Bombardier to revise the maintenance procedures for the applicable Learjet models to include a check of the position of the aft landing gear trunnion pin and retaining bolt, following maintenance on the gear that requires removal of the aft trunnion, to ensure that the landing gear has been correctly attached to the airplane wing structure.

Conclusions

Findings

1. A one-time inspection of certain Learjet models consistent with Bombardier's March 7, 2025, service bulletins is necessary to prevent main landing gear from collapsing as a result of misassembly in which the aft trunnion pin retaining bolt is secured without passing through the pin.
2. Revision of Learjet maintenance manual procedures for installation of the main landing gear to include an explicit procedural check that verifies correct engagement of the aft trunnion pin with its retaining bolt would ensure that the main landing gear is securely attached to the airframe.

Recommendations

New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations.

To the Federal Aviation Administration:

Require, as a condition of continued airworthiness, operators and owners of applicable Learjet models to comply with Bombardier Service Bulletins (SBs) A23/24/25-32-20, A28/29 32 21, A31-32-25, A35/36-32-29, A55-32-26, and A60 32 42. (A-25-38) (Urgent)

Require Bombardier to revise the maintenance procedures for the applicable Learjet models to include a check of the position of the aft landing gear trunnion pin and retaining bolt, following maintenance on the gear that requires removal of the aft trunnion, to ensure that the landing gear has been correctly attached to the airplane wing structure. (A-25-39)

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Report Date: October 27, 2025

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