Nosewheel control failure, BAe 146, EI-CPJ

Micro-summary: **Nosewheel control was lost during rollout for this BAe 146.**

Event Date: **2005-10-07 at 1823 UTC**

Investigative Body: **Aircraft Accident Investigation Board (AAIB), Great Britain**

Investigative Body's Web Site: **http://www.aaib.dft.gov/uk/**

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INCIDENT

Aircraft Type and Registration:	BAe 146, EI-CPJ
No & Type of Engines:	4 Lycoming LF507-1F turbofan engines
Year of Manufacture:	1994
Date & Time (UTC):	7 October 2005 at 1823 hrs
Location:	Runway 10, London City Airport, London
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 41
Injuries:	Crew - None Passengers - None
Nature of Damage:	None known
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	60 years
Commander's Flying Experience:	11,000 hours (of which 5,000 were on type) Last 90 days - 150 hours Last 28 days - 38 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During the landing roll, after the nose wheel made contact with the runway, the nose wheel steering system was found to be ineffective and the nose landing gear began a violent shimmy, which continued until the aircraft came to rest. Initial examination revealed that the anti-torque links central pivot bolt was missing, although it was not determined whether this had been a consequence of, or had precipitated, the shimmy. Later examination revealed that the nose wheel steering/ friction damper breakout torque was some 34-40% of the specified value and the oleo inflation pressure some 28% above its specified value.

History of the flight

After a gentle touch down on Runway 10, the nose wheel started to vibrate as it made contact with the runway. When braking was applied to the main wheels, the vibration became severe; brake pressure was then reduced, but the vibration persisted and the nose wheel steering was found to be inoperative. Because of the severity of the vibration, the aircraft was brought to rest as quickly as possible, using moderate differential braking to maintain directional control, and the first officer transmitted a PAN call to ATC.

After having come to rest, the airport Rescue and Fire Fighting Service (RFFS) attended the aircraft and the commander was asked by ATC to communicate directly with them on 121.6 MHz. The crew then saw a fireman

apparently attempting to communicate with the aircraft by means of a hand-held radio, but nothing of his message was heard on board the aircraft. He was asked to repeat his message, and, on that occasion, communications improved sufficiently that most of his message was received. An engineer then attended the aircraft and, after carrying out a visual inspection of the nose landing gear (NLG) climbed into the cockpit via the electronics bay and informed the crew that a bolt was missing from the torque link assembly. The aircraft was subsequently towed to its stand, and the passengers disembarked normally. The missing bolt was not recovered, despite an extensive search both at London City Airport and its departure airfield.

Aircraft examination

Detailed inspection of the NLG by the operator's line engineering staff, and later by specialists from the landing gear manufacturer, confirmed that the bolt which forms and the central pivot in the torque link assembly was missing. It was also established that after this bolt had detached, the upper half of the torque link had pivoted down such that its free end had come into contact with a shoulder on the lower (sliding) part of the landing gear. In doing so, it had become, in effect, a solid strut which had prevented the oleo from compressing during the roll out. As a consequence, the full weight of the nose, some 2.5 tonnes, had been supported by the trapped upper link.

Except for localised damage on the nose leg itself, caused directly or indirectly by the torque link disconnection, no damage was found either on the NLG assembly or in the nose wheel bay. The NLG was subsequently removed from the aircraft and taken to the manufacturer's facility where it was subjected to detailed examination. No abnormalities could be found externally except for localised damage to the torque link components and adjoining parts of the landing gear housing, which had evidently occurred after, and as a direct consequence of, the bolt separation.

Subsequent checks carried out in a test rig revealed that breakout torque of the nose wheel steering/castering friction damper was approximately 35-40% of the specified value. It was considered by the manufacturer that the effect of this would be to predispose the gear to a divergent shimmy oscillation, of the type which had occurred during the landing. Also, evidence was found of internal oil leakage past the seals of the oleo strut, and its inflation pressure was found to be approximately 28% above the specified value; apparently in compensation for the loss of oil from the working section of the strut. However, this was not considered to have been a causal factor in the violent shimmy or the loss of the torque link bolt.

To date, no explanation has been found for the separation and loss of the torque link bolt assembly, nor has it been possible to determine whether the loss of the bolt was the cause, or merely a symptom, of the shimmy which occurred during the landing. The NLG manufacturer is undertaking further detailed inspection of the unit concerned as it undergoes repair and overhaul, and an addendum will be issued to this report in the event that further information of relevance comes to light.