

ACCIDENT

Aircraft Type and Registration:	Cessna 401, N401JN	
No & Type of Engines:	2 Continental TSIO-520-E5B piston engines	
Year of Manufacture:	1966	
Date & Time (UTC):	21 January 2007 at 1206 hrs	
Location:	Blackpool Airport, Lancashire	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Right wing, right landing gear and right propeller damaged	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	58 years	
Commander's Flying Experience:	1,091 hours (of which 531 were on type) Last 90 days - 6 hours Last 28 days - 3 hours	
Information Source:	AAIB field investigation	

Synopsis

During the rollout, following an uneventful flight, the right main landing gear (MLG) collapsed. Subsequent investigation revealed a fatigue failure and overload of the arm attachment holes on the right MLG torque tube. The crack appeared to have been growing since around 2001. A Supplementary Inspection Document (SID) issued by Cessna in 2004 recommended inspections of the arm attachment holes of the torque tube but the inspection had not been carried out on N401JN. This SID is mandatory on aircraft registered in Europe used for commercial air transport, and will be mandatory from September 2008 for those used privately. The SID is not mandatory for US-registered aircraft, such as N401JN. One Safety Recommendation has been made.

History of the flight

Following an uneventful local flight, the aircraft returned to Blackpool for an ILS approach and landing on Runway 28. The wind at the time was from 250° at 24 kt. Prior to landing the pilot carried out the 'before landing' checklist, checking for three green landing gear 'down and locked' lights. Both the pilot and co-pilot cross checked and verified that the lights were illuminated. The subsequent landing was normal and the aircraft then travelled to a point about 100 metres short of taxiway Charlie, where the right main landing gear collapsed. Damage was sustained to the right wing, flaps and right engine propeller. After shutting down the aircraft the pilot and the co-pilot exited normally and were uninjured.

Aircraft description

The electrically-operated landing gear extension and retraction system on the Cessna 401 has an electrical actuator, situated in the middle of the aircraft, which operates a bellcrank. The bellcrank drives push-pull tubes, outboard, to the left and right main landing gear torque tubes respectively, via landing gear door bellcranks.

The rod end of the drive push-pull tube fits into an arm assembly of a torque tube and is secured by a nut and bolt through arm attachment holes, (see Figure 1). The torque tube drives a push-pull tube attached to the main landing gear bellcrank, which allows the gear to retract and extend around the main pivot point. To achieve a positive downlock the side brace of the gear is rigged to be over centre when the gear is locked down.

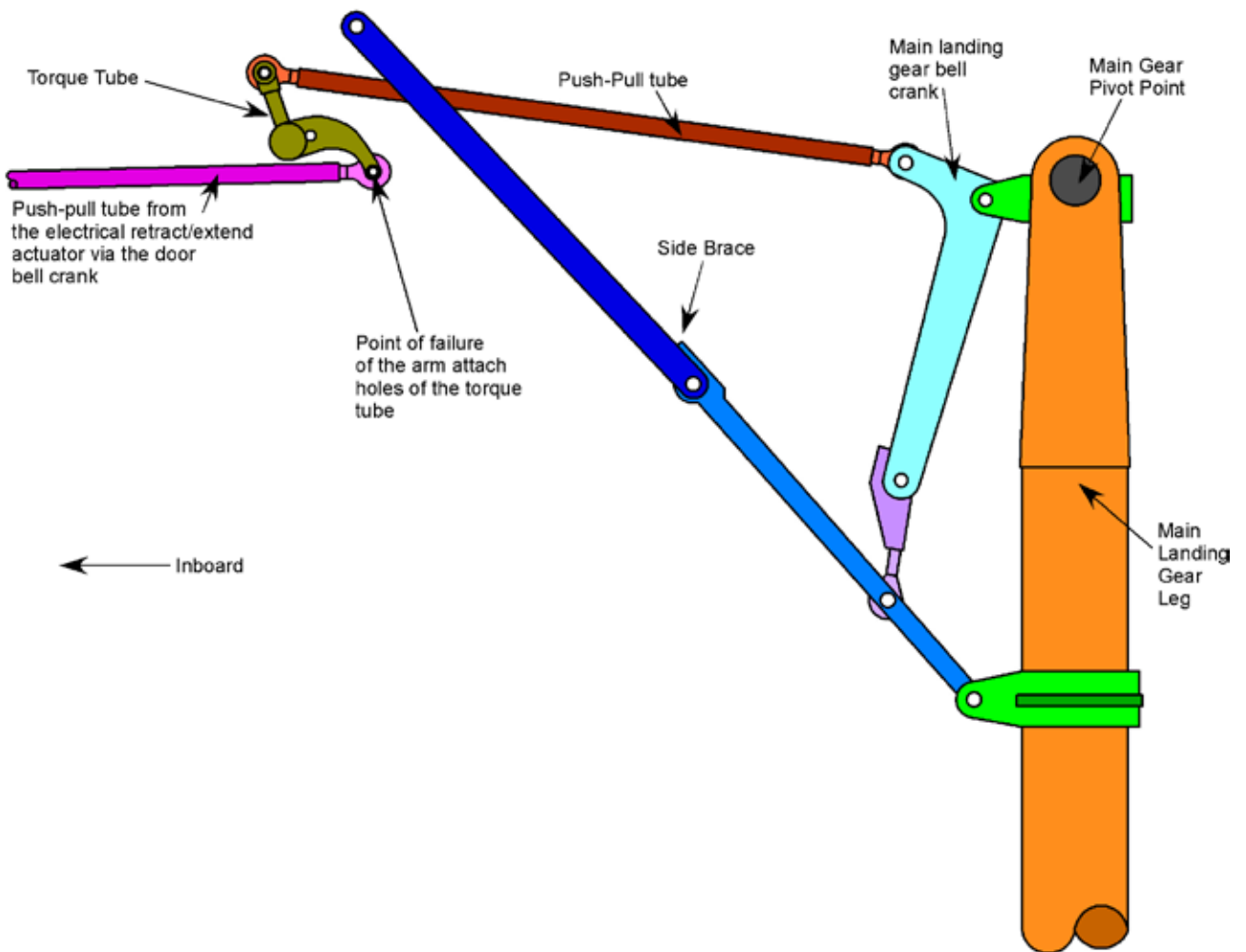


Figure 1

Representative diagram of the right main landing gear extend/retract mechanism

Aircraft examination

The aircraft was recovered from the runway and taken to a local hangar where it was found that the right main landing gear torque attachment holes had failed, (see

Figure 2). The failure was such that the pushrod that provided drive to the torque tube from the electrical retract/extend actuator had disconnected.

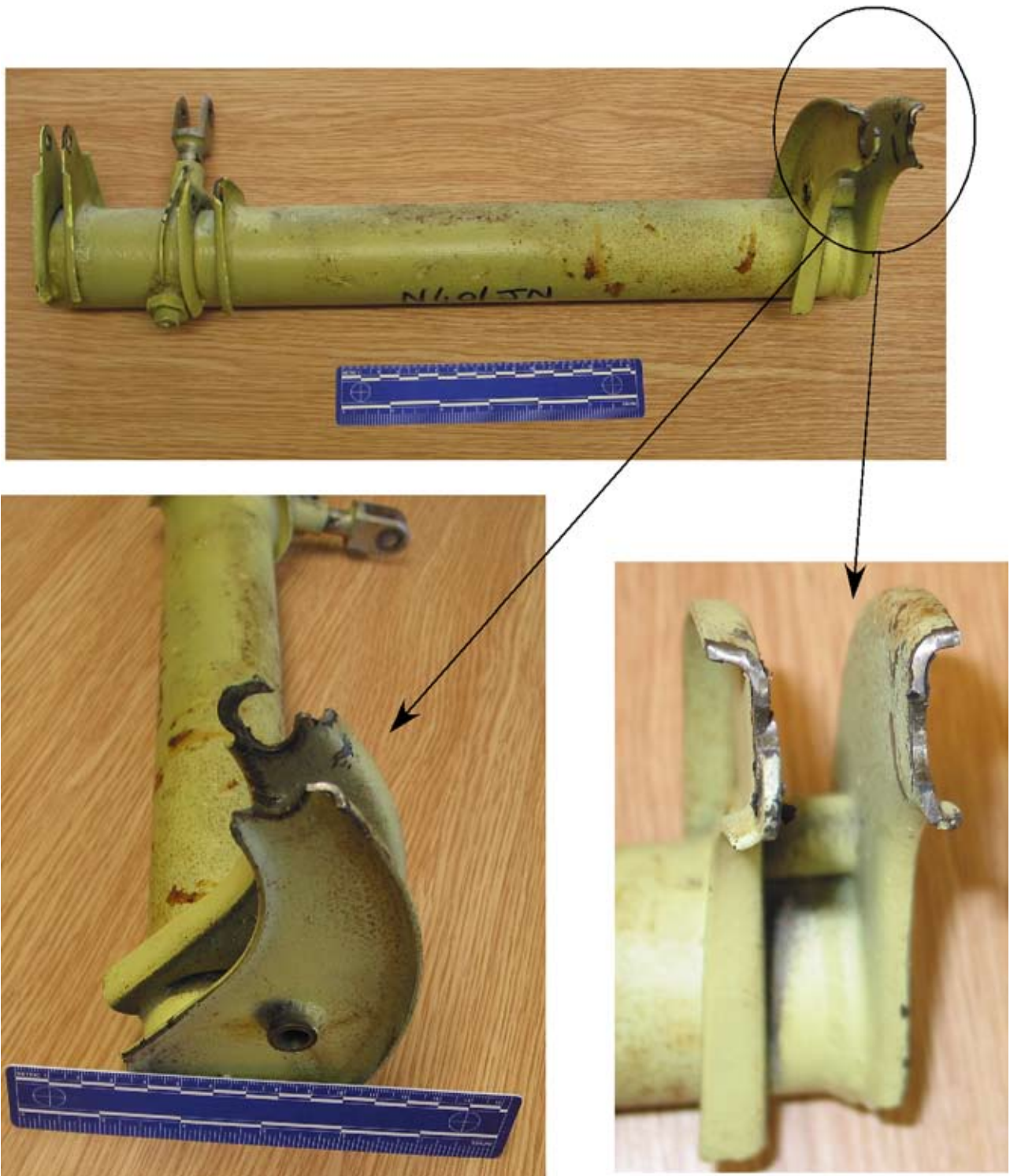


Figure 2
Failed right MLG torque tube removed from N401JN

The torque tube was removed from the aircraft and sent for detailed metallurgic examination. This revealed a slow progressive fatigue failure, followed by a rapid overload, (see Figure 3). The fatigue crack striations indicated that it had suffered up to 250 cycles before the final overload. Each cycle was probably related to an extension/retraction cycle of the landing gear.

Aircraft history

At the time of the accident the aircraft was 41 years old and had completed 3,450 flying hours. A review of the aircraft and the pilot log books revealed that 250 landings, prior to the accident flight, corresponded to about May 2001. The aircraft had previously been on the UK register, as G-ROAR.

The last disturbance of the right main landing gear was in 2003, although the right main landing gear torque tube was not removed or disturbed at that time. The last maintenance inspection was a 100-hour inspection on 6 October 2006, during which an inspection of the right main landing gear torque tube was not required.

Cessna Supplemental Inspection Document

In August 2004 Cessna issued a Supplemental Inspection Document (SID), 32-10-05, for the main landing gear torque tube assembly. The inspection calls for the removal of the torque tube assembly and a subsequent non-destructive inspection (NDI). One specific area in which the NDI is carried out is on the arm attachment holes that were found fractured on N401JN. The initial inspection of the torque tube should be carried out when the aircraft completes 10,000 landings or after 20 years,

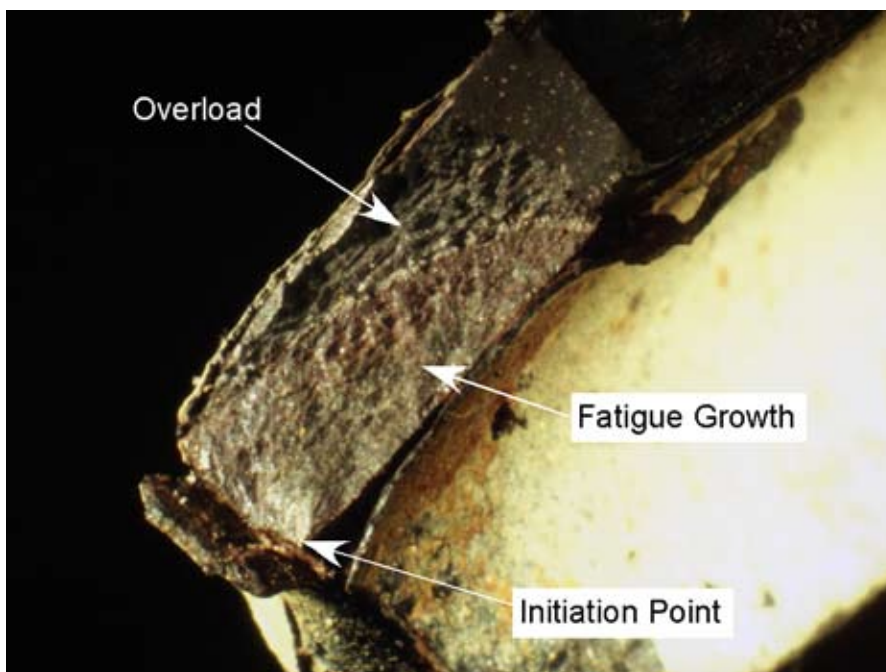


Figure 3

Microscopic image of the initiation and fatigue crack growth

with a repeat every 2,000 landings or 4 years. For aircraft that have already exceeded the initial inspection threshold, the SID specifies the inspection should be carried out within 400 landings or by 4 August 2005.

The SID is not mandatory for US-registered aircraft and therefore there was no formal requirement for the inspection to be carried out on N401JN. In Europe, European Commission Regulation EC 2042/2003 Annex 1 (Part-M) Rule M.A.302 requires that all aircraft should accomplish supplemental inspections as part of their maintenance programme. This rule is already applicable to all commercial air transport aircraft and will be applicable to all other aircraft, including those involved in private operations, from September 2008.

Analysis

The gear collapsed due to a failure of the arm attachment holes of the right main landing gear torque tube. The arm attachment holes had failed due to an initial fatigue

crack followed by a rapid overload. The fracture caused the pushrod from the electrical extend/retract actuator to disconnect and it is likely that this fracture occurred as the gear was extended for landing. Following the landing, a side load on the right gear caused it to collapse.

It could not be determined what caused the initiation of the crack in the arm attachment holes, although, it had been present and growing for a considerable time. The fatigue striations indicate that the crack had been present over 250 cycles, estimated as being since May 2001. There was no specific mandatory requirement to inspect the torque tube and its location on the aircraft made it difficult to carry out a visual inspection. To detect the crack would have required removal of the torque tube and an NDI.

In 2004 Cessna issued an SID to remove and inspect the torque tube. This was applicable to N401JN and, as the aircraft was over 20 years old, the initial inspection threshold had been exceeded. Thus the inspection

would have been carried out by 4 August 2005, had it been mandatory. Had the inspection been carried out it is possible that the crack would have been detected.

In Europe, for aircraft registered in EASA states, the Cessna SID is already mandatory for commercial air transport aircraft, and will be mandatory for all aircraft from September 2008. This date would have applied to this aircraft, had it remained on the UK register. However, N401JN was a US-registered aircraft and the SID would only be mandatory through the issue of an airworthiness directive by the FAA. To reduce the likelihood of further gear collapses, the following recommendation is made:

Safety Recommendation 2007-059

It is recommended that the Federal Aviation Administration mandate Cessna SID 32-10-05 for the Cessna 401/402 main landing gear torque tube, and mandate similar Cessna SIDs relating to main landing torque tubes of similar design.