Air Accident Investigation Unit Ireland

INCIDENT REPORT
Tecnam P2002-JF, EI-WAT, Inis Mór Airfield, Aran Islands, Co Galway, Ireland 15 April 2010

Department of Transport
Tourism and Sport
An Roinn Iompair
Turasóireachta Agus Spóirt

AAIU Report No: 2011-012

State File No: IRL00910027

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In accordance with the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents, on 15 April 2010, appointed Mr. Thomas Moloney as the Investigator-in-Charge to carry out a Field Investigation into this Incident and prepare a Report. The sole purpose of this Investigation is the prevention of aviation Accidents and Incidents. It is not the purpose of the Investigation to apportion blame or liability.

Aircraft Type and Registration:	Tecnam P2002-JF, EI-WAT
No. and Type of Engines:	1 x Bombardier-Rotax 912 S2
Aircraft Serial Number:	086
Year of Manufacture:	2008
Date and Time (UTC):	15 April 2010 @ 12.15 hrs
Location:	Inis Mór Airfield, Aran Islands, Co Galway, Ireland (EIIM)
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - Nil Passengers - Nil
Nature of Damage:	Minor
Commander's Licence:	Private Pilot Licence issued by U.K. Civil Aviation Authority (CAA)
Commander's Details:	Male, aged 33 years
Commander's Flying Experience:	161 hours, of which 69 were on type
Notification Source:	EIIM Airfield Manager
Information Source:	AAIU Field Investigation

SYNOPSIS

The aircraft landed on Runway (RWY) 14 at EIIM and decelerated to taxi speed on the runway. The Pilot felt an initial slight downward tilting movement to his port side. He turned off the runway onto a taxiway, and almost immediately felt a further rapid drop of the port wing. The Pilot halted the aircraft, shut down the engine and he and his passenger exited the aircraft. Subsequently, it was found that a nut had come loose and separated from the port landing gear inner securing bolt, allowing the port landing gear to partially collapse. The Investigation makes two Safety Recommendations.

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft departed from its home base at Waterford Airport (EIWF) at 10.40 hrs on a cross-country flight to EIIM. The aircraft made an uneventful approach and what the Pilot described to the Investigation as *"a good landing"* on RWY 14. The Pilot stated that the aircraft decelerated to taxi speed, and was still on the runway about 50 m short of the turn-off to the parking area when he felt a *"slight downward tilt motion on the port side"*. His initial reaction was that the aircraft had suffered a puncture, and he elected to continue taxiing in order to clear the runway. The Pilot stated that as the aircraft turned right onto the taxiway leading from the runway to the Terminal, *"the port wing rapidly dropped further down with a rapid ratchet sound"*. The Pilot immediately halted the aircraft on the taxiway, shut down the engine, and he and his passenger exited the aircraft normally. A spacer and washer from the aircraft main landing gear were located on the taxiway in close proximity to where the aircraft came to a halt. The AAIU authorised the Airfield Manager to move the aircraft off the taxiway, and airfield staff subsequently moved it to a secure area alongside the ramp.

1.2 Technical Information

The Tecnam P2002-JF is a twin seat, single engine aircraft with a tapered, low wing, fixed main landing gear and steerable nosewheel.

A schematic diagram of one side of the main landing gear is shown in **Figure No. 1**. Each main landing gear consists of a steel spring-leaf strut (Item 1), which is connected to the fuselage utilising two longitudinally mounted structural members (2 and 3) described in the aircraft documentation as "keelsons". Two spacers (4 and 5) are inserted between each spring-leaf strut and the keelsons, and the aircraft inner lower skin is between the keelson and the spacer (5). Two bolts (7) with torqued self-locking nuts secure the individual strut to the edge of the outer keelson via a light alloy tie (6) while a single bolt (8) with a torqued self-locking nut, with a deformed thread locking feature, secures the inboard end of the strut to the inner keelson (3).

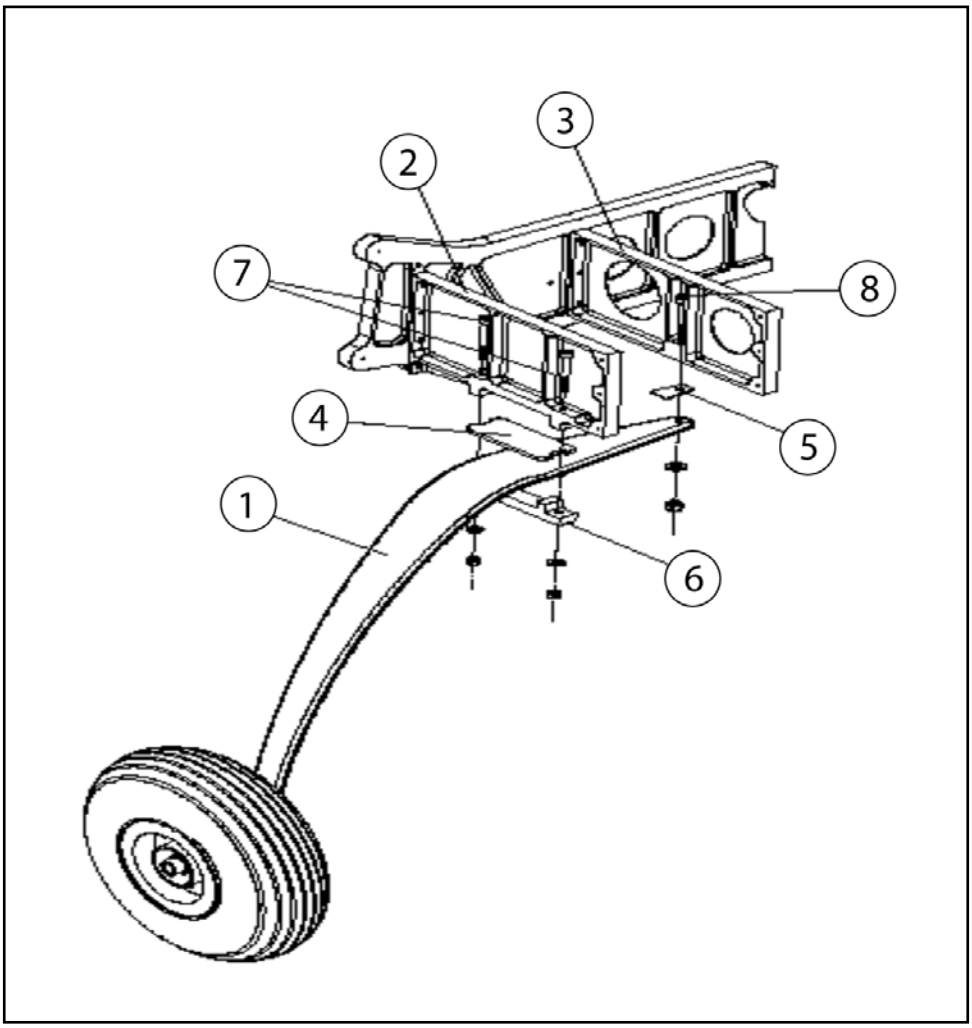

Figure No. 1: Main Landing Gear Assembly

1.3 Damage to Aircraft

The Investigation surveyed the aircraft on the day following the Incident. The inboard end of the left landing gear strut had dropped down off the securing bolt (Item 8 in **Figure No. 1**) and had punctured the fuselage outer lower skin, **Photo No. 1.** The inboard securing bolt was still in place. The self-locking nut was missing. The spacer (measuring 40 mm by 34 mm) and washer which had been found on the taxiway were confirmed as being the spacer identified as Item 5 in **Figure No. 1** and a washer from the inboard strut securing assembly. Part of the strut, just outboard of the outer keelson had come into contact with the lower surface of the port wing, which was pushed up and wrinkled.

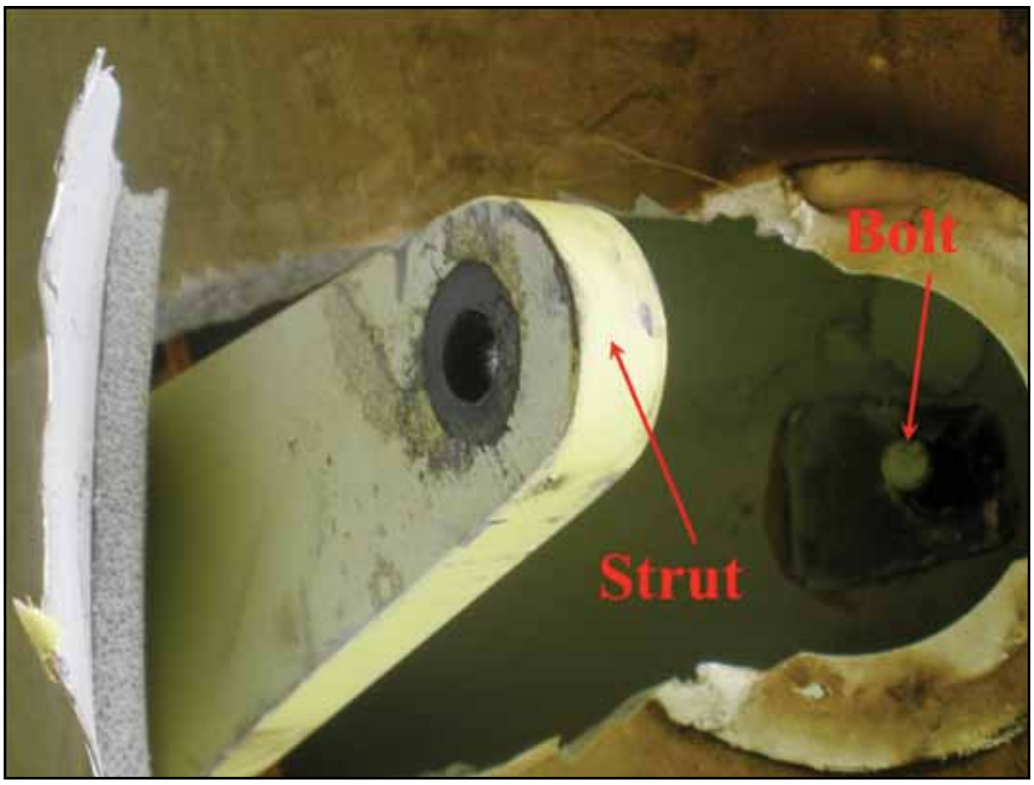

Photo No. 1: Damage to Fuselage Outer Lower Skin

A search back along the ground track over which the aircraft had travelled on the runway and taxiway was carried out and the missing self-locking nut was found on RWY 14 approximately 50 m before the taxiway turn-off. The threads on both the bolt and nut were intact, as was the nut deformed thread locking feature.

1.4 Maintenance

The aircraft was maintained by a licensed aircraft engineer based at EIWF, between its delivery new to Ireland in 2008 and the date of the Incident. A Certificate of Airworthiness for EI-WAT was issued by the Irish Aviation Authority on 29 October 2009 and an Airworthiness Review Certificate had been issued by the licensed engineer on 10 September 2009, valid until 9 September 2010. The latest entry in the aircraft log-book prior to the Incident flight, which was dated 11 April 2010, showed a total of 499 hrs flown since manufacture.

The aircraft had sustained damage in a previous landing incident at EIWF in December 2008. The subsequent Certificate of Release to Service, issued following the required repairs and a concurrent 100 hr inspection, recorded that the undercarriage/wing attachments were inspected and satisfactory.

There was no record that the main landing gear had been removed during the repair work, although the left hand main wheel spat had been repaired and re-fitted.

The Maintenance Schedule for the aircraft calls up a visual check of the *"steel spring struts, connection clamp and fastening of bolts"* on each 50 hr and 100 hr inspection. This check is done through a small inspection hole, looking vertically upwards towards the bolt and nut assembly.

Removal of the landing gear legs with a check for proper curvature and integrity is required at 1200 hr intervals. The last scheduled inspection prior to the Incident was a 100 hr, which was certified on 12 March 2010 at 469 aircraft hrs. The paperwork for this inspection indicates that the requisite visual checks were carried out and duly certified.

The licensed engineer who carried out all the maintenance on EI-WAT stated to the Investigation that the main landing gear legs had not been removed from the aircraft since its delivery to Ireland, and that therefore the bolts and nuts in question had never been worked on.

On inspection of the aircraft during its strip-down for repair, the Investigation noted that a hole, approximately 14 mm in diameter, had been drilled in the aircraft inner lower skin, overlapping the hole for the retaining bolt, **Photo No. 2**.

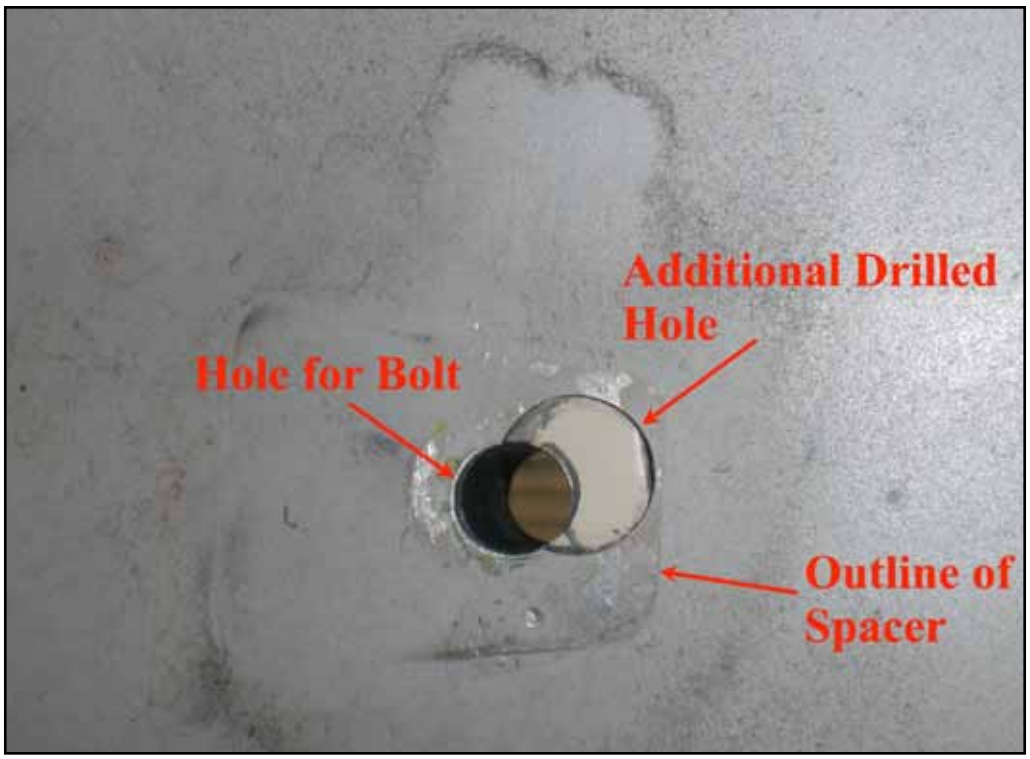

Photo No. 2: Drilled Holes in Skin

The keelson is visible through the 14 mm hole. Since the keelson is not drilled at this location, and since the landing gear had not been removed subsequent to the aircraft's delivery to Ireland, it is most probable that this hole was drilled in the skin during the aircraft's manufacture.

The outline of where the spacer had been is also visible in the photo. There were also some surface deformities visible on the aircraft skin in the area where the spacer was in contact with the skin.

2. ANALYSIS

The first unusual aircraft movement felt by the Pilot was a slight downward tilt motion on the port side, after the aircraft had slowed to taxi speed on RWY 14, approximately 50 m before the turn-off to the parking area. This was the same area of the runway on which the nut from the inboard end of the port landing gear strut was subsequently found. This suggests that the nut came off the bolt after the aircraft had landed and that the initial puncture of the lower skin by the strut occurred at this point, thus allowing the nut to fall from the aircraft. If the nut had been off the bolt before the aircraft had landed, then it is likely that the port landing gear would have collapsed as the weight came onto it at touch-down.

It is probable that, as the weight on the landing gear shifted during and following the turn off the runway, the inboard end of the strut cut further through the skin, and it became possible for the larger spacer to fall from the aircraft.

The inboard landing gear securing mechanism was reliant on the self-locking nut remaining in place on the bolt. As the threads on the bolt and nut had not been stripped, it is probable that the nut gradually unwound itself off the bolt over a period of time.

It is possible that the extraneous 14 mm hole drilled in the aircraft skin allowed some flexing of the spacer, which was installed directly beneath the hole, **Photo No. 2**. Such flexing of the spacer may have facilitated a loss of tension in the bolt/nut threads. In turn, this may eventually have caused the self-locking nut to loosen and to finally come off the bolt, thus causing the landing gear to partially collapse on that side.

The maintenance records of the aircraft were carefully reviewed and show no maintenance action on the main landing gear nut and bolt in question, other than the required visual checks.

Regular visual inspection of the bolt and nut assembly failed to detect the gradual loosening of the nut, although the Investigation notes that visual inspection of the area is difficult as the bolt can only be viewed vertically upwards through a small inspection hole.

The Investigation considers that the use of the self-locking nut with no further locking mechanism to be less than optimal in a safety-critical load bearing section of the aircraft, and therefore a Safety Recommendation is issued in this regard to the aircraft manufacturer.

The Investigation was also concerned by the drilling of an extraneous hole in the aircraft's inner lower skin, apparently during manufacture. The presence of this hole suggests a lapse in quality oversight during the manufacturing process and accordingly a second Safety Recommendation is issued to the aircraft manufacturer.

3. CONCLUSIONS

(a) Findings

1. The aircraft was being operated on a valid Certificate of Airworthiness and Airworthiness Review Certificate.

2. A torqued self-locking nut, used to secure the inboard part of the landing gear to the fuselage attachment mechanism, had become loose. It finally separated from its bolt, probably during the aircraft's landing run.

3. The port landing gear partially collapsed just after the aircraft taxied off the runway.

4. There was no evidence that the landing gear had been disassembled since aircraft manufacture.

5. The threads on the nut and bolt were not stripped.

6. An extraneous 14 mm diameter hole had been drilled in the aircraft's inner lower skin. This hole overlapped the hole containing the retaining bolt.

7. The drilled hole in the aircraft's inner lower skin may have allowed some flexing of a spacer, which in turn may have facilitated a loss of tension in the bolt/nut threads.

8. Regular visual inspections of the nut and bolt combination had failed to detect any loosening of the nut.

9. The self-locking nut was not sufficient to provide a secure locking mechanism for the inboard landing gear attachment.

(b) Probable Cause

The separation of a self-locking nut from its bolt caused the port landing gear to partially collapse.

4. SAFETY RECOMMENDATIONS

It is recommended that:

1. Costruzioni Aeronautiche Tecnam s.r.l. should consider the introduction of a modified locking arrangement at the inboard end of the landing gear struts. **(IRLD2011008)**

2. Costruzioni Aeronautiche Tecnam s.r.l. should instigate a review of manufacturing quality procedures, with particular emphasis on the eradication of defects such as the extraneous drilled hole identified in this Report. **(IRLD2011009)**

- END -

In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Regulation (EU) No 996/2010, and Statutory Instrument No. 460 of 2009, AIR NAVIGATION (NOTIFICATION AND INVESTIGATION OF ACCIDENTS, SERIOUS INCIDENTS AND INCIDENTS) REGULATION, 2009, the sole purpose of these investigations is to prevent aviation accidents and serious incidents. It is not the purpose of any such accident investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

Produced by the Air Accident Investigation Unit

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