



This investigation has been conducted in accordance with
*Annex 13 to the ICAO Convention on International Civil
Aviation, EU Regulation No 996/2010 and
The Civil Aviation (Investigation of Air Accidents and Incidents) Regulation; Legal
Notice 16 of 2013.*

Under these Regulations, the sole objective of the investigation of an accident or incident is the prevention of accidents and incidents in the future. It is not the purpose of this investigation to assign fault or blame and the reporting process should not be used to determine liability.

Small Accident/Incident Report

1. General Information.

Location: Malta International Airport	Accident Number: BAAI/SIR-002-2019
Date & Time: 10 th September 2018, approximately 1200 hrs (Local)	Registration: 9H-MSF
Aircraft: Tecnam P92 JS Echo	Aircraft Damage: Significant
Defining Event: Main landing gear failure after landing	Injuries: No injuries reported
Flight Conducted Under: VFR	

2. Synopsis

The aircraft landed on Runway 23 and suffered a left main landing gear failure, coming to rest on the runway to the left of the centre-line on a heading of 195° (Magnetic), at the end of the second touch-down zone.

3. Findings

The Bureau of Air Accidents (Malta) determines the probable cause(s) of this accident to be:

Findings: Collapse of an undercarriage leg during roll-out due to failure of a retaining nut.

4. Factual Information:

History of the Flight

The flight departed Reggio Calabria (Italy) on a cross-country training flight to Malta. The aircraft landed on Runway 23 at Malta International Airport with the student pilot at the controls. Following touch-down the left main landing gear failed and the aircraft came to rest on the runway, approximately 4.5m to the left of the centerline, at the end of the aiming point markings of the runway on a heading of 195° (magnetic).



Figure 1. The accident aircraft following the incident.

Injuries to Persons

Crew: None

Passengers: None

Other: None

Damage to Aircraft

The following visible damage identified on the accident aircraft at the crash site:

- Collapsed left main landing gear
- Broken left main landing gear attachments to airframe
- Damaged airframe structure in the area of the left main landing gear attachment
- Scraped left main wing tip
- Scraped left tail plane tip

Other Damage

None

Pilot Information

Certificate: EASA CPL (A) issued by DGAC (France)

Age: 24

Airplane Rating(s): Single Engine Piston (Land); Multi Engine Piston (Land); Flight

Seat Occupied: Left

Other Aircraft Rating(s): NA

Restraint Used: Seat harness

Instrument Rating(s): Instrument Rating (Single and Multi Engine);

Second Pilot Present: Yes

Instructor Rating(s): Instructor (CPL-A Restriction)

Toxicology Performed: No

Medical Certification: Class 1, issued by DGAC (France)

Last Medical Exam: 30th August 2018

Occupational Pilot: Yes

Last Flight Review or Equivalent: 31st August 2018

Flight Time: 928

Co-Pilot Information/Trainee

Certificate: Not Applicable (NA) - Trainee

Age: 27

Airplane Rating(s): NA
Seat Occupied: Right
Other Aircraft Rating(s): NA
Restraint Used: Seat harness
Instrument Rating(s): NA
Second Pilot Present: Yes
Instructor Rating(s): NA
Toxicology Performed: No
Medical Certification: Class 1, issued by Transport Malta
Last Medical Exam: 16th February 2018
Occupational Pilot: NA
Last Flight Review or Equivalent: NA
Flight Time: 82 hrs

Aircraft and Owner/Operator Information

Aircraft Make: Tecnam
Registration: 9H-MSF
Model/Series: P92 JS Echo
Aircraft Category: Single engine Airplane
Year of Manufacture: 2013
Landing Gear Type: Tricycle
Seats: 2
ELT: Not installed
Registered Operator: Malta School of Flying Company Ltd.
Operating Certificate(s) Held: Approved Training Organisation, issued by Transport Malta (Certificate No. MLT.ATO.04)
Date/Type of Last Inspection: 6th September 2018 – 100 Hour check
Certified Max Gross Wt.: 600kg
Time Since Last Inspection: 26 hours (including accident flight)
Airframe Total Time: 2699 hours
Engine Manufacturer: Bombardier – Rotax GmbH
Engine Model/Series: 912-S2
Rated Power: 83.5kW (98.6bhp) @ 5800rpm for 5 minutes and 69.0kW (92.5bhp) at 5500rpm continuous.

Meteorological Information and Flight Plan

Conditions at Accident Site: Visual Meteorological Conditions

Condition of Light: Day

Lowest Cloud Condition: --

Lowest Ceiling: NA (no overcast – few cloud)

Wind Speed/Gusts: / Turbulence Type/Severity (if applicable): --

Forecast/Actual: --

Wind Direction: --

Forecast/Actual: --

Altimeter Setting: Temperature/Dew Point: --

Precipitation and Obscuration: Nil

Departure Point: Reggio Calabria (LICR)

Type of Flight Plan Filed: VFR

Destination: Malta International Airport (LMML)

Type of Clearance: VFR

Departure Time: 0954 hrs (Local)

Type of Airspace: Class D (Malta International Airport)

Airport Information

Airport: Malta International Airport (LMML)

Runway Surface Type: Asphalt

Airport Elevation: 247ft (Threshold Runway 23)

Runway Surface Condition: Dry

Runway Used: RWY 23

Approach: VFR

Runway Length/Width: 2376m/45m

Approach/Landing: VFR

Wreckage and Impact Information

There was no debris left on the runway or its environs. Tyre marks identified to be that of the accident aircraft were identified from 57m from where the aircraft came to rest, starting and continuing to the right of the centerline until the left tyre mark became discontinuous, which corresponds to vibration of the wheel following undercarriage failure. The tyre marks then turned to the left leading to where the aircraft came to rest (Figure 2). There was no evidence of tyre skid due to locked brakes noted on the tyres at the accident site.

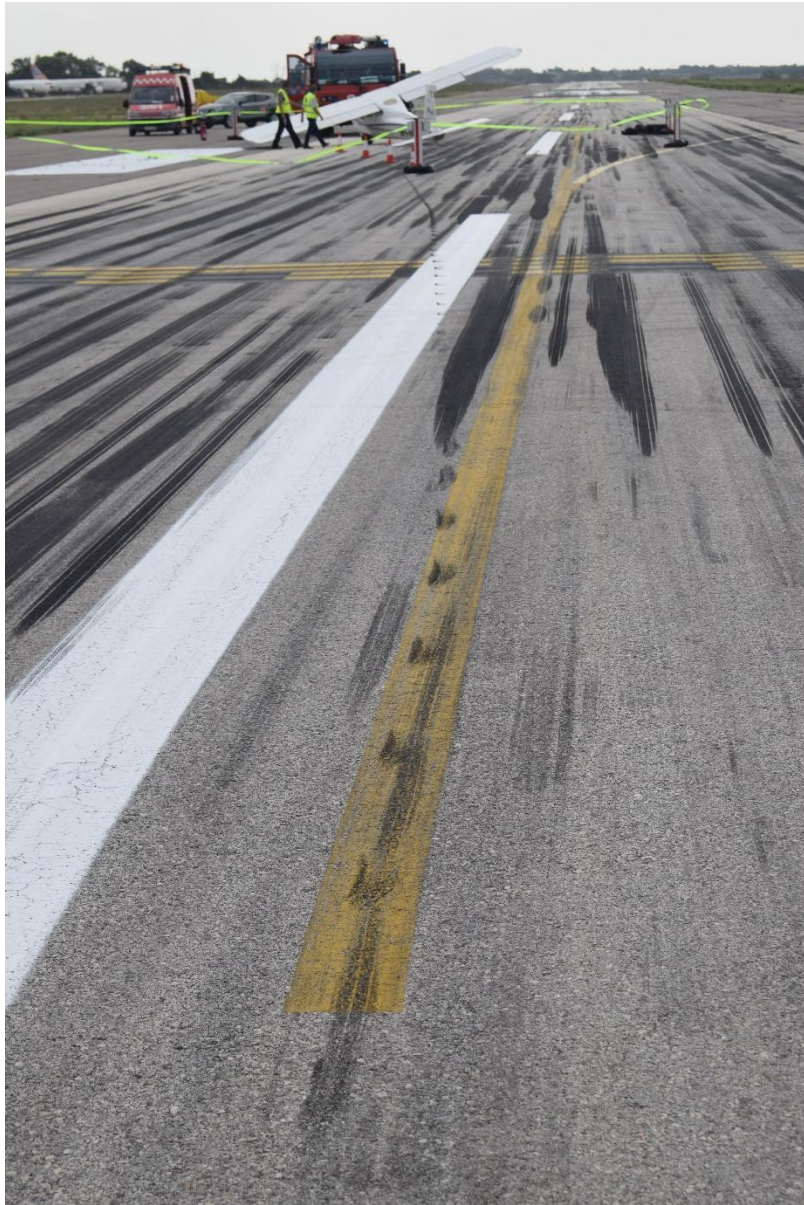


Figure 2. The accident aircraft at rest and the tyre marks generated by the left main undercarriage.



Figure 3. The left main undercarriage leg of the accident aircraft and the tyre marks generated by the left main undercarriage immediately prior to coming to a halt.

Fire

There was no pre- or post-crash fire.

5. Analysis

The instructor pilot reported that the aircraft left Malta International Airport on the 9th of September 2018 at 0730hrs (Local) for navigation exercises in Italy. The complete route followed on the day of the accident was Reggio Calabria (LICR) – Lamezia Terme (LICA) - Crotona (LIBC) – Reggio Calabria (LICR) – Malta (LMML). The handling of the aircraft on the ground was reported to be normal throughout the two days. The approach to Runway 23 at Malta International Airport (LMML) was normal. The flare was normal with the student pilot controlling the aircraft well. There was no noticeable ballooning.

The touch-down and roll-out were normal until the brakes were applied. At this point a vibration similar to nose-wheel shimmy was felt. The vibration became severe until aircraft tilted left-wing down and came to rest.

The crew reported that the braking applied was not hard and on previous landings normal braking was applied.

The discontinuity of the left tyre mark (Figure 2) is consistent with that of a failed landing gear, with the tyre being presented at an oblique angle to the direction of travel of the aircraft. This will have resulted in the tyre vibrating on the failed gear. The higher rate of discontinuity as the aircraft slowed down to come to rest (Figure 3) further corroborates the finding, indicating that the landing gear failed after touch-down and during the roll-out phase.

Investigation of the failed undercarriage at the accident site revealed that, whilst the spring appeared undamaged, the fastening system failed. The structure is shown in Figure 3. The undercarriage leaf spring (1) is attached to the airframe via three bolts/nuts, with the outer two (5) holding a clamp (4) and the inner one (6) together securing the spring in place against the airframe structural beam. Leather liners (2, 3) cushion the spring on the beam.

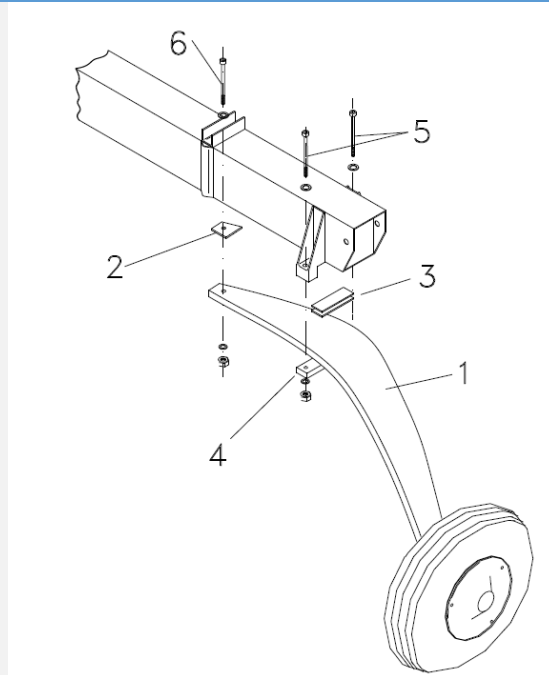


Figure 4. The main undercarriage and its attachment to the airframe on the P92 JS (Source: Tecnam, reproduced with permission).

The nut of the front outer bolt (5) was missing. The bolt and its thread were intact and a swarf was found on the thread (Figure 7). This is consistent with material that would be left behind on a nut being stripped off a bolt under tension. The bolt was partially recessed in its location (Figure 4 Left), in a position that is inconsistent with it retaining the clamp and bolt. It was extended to its fully seated position, exposing the shank, on site (Figure 7 Right). Presence of the swarf and of seal material (red, Figure 7) is consistent with a nut being installed.

The rear outer bolt (5) and inner bolt (6) were bent but still had the nut secured on them. The clamp (4) was scraped and the front hole was widened on the outer part (Figure 6 Right), which is damage consistent with the folding motion of the undercarriage leg and the clamp slipping out of the front outer bolt (5).

A search for the missing nut was carried out in the airframe, on the runway and its left shoulder but nothing was found.

Analysis of maintenance records indicate that a check of the undercarriage and re-tightening of the bolts was carried out during the 100 hour check on 6th September 2018 (2672.59 airframe hours) and, before that, on 10th August 2018 (2574.45 airframe hours). The works were approved by the same authorizing personnel.

Maintenance personnel of the company owning the aircraft reported that the aircraft type suffered from compression of the leather liners (Items 2, 3 in Figure 4), resulting in the nuts tightening against the shank of the bolt rather than against compression of the liners, leaving some play in the undercarriage. The company was in communication with the manufacturers on the matter.

Although it is possible that such play could have affected the integrity of the undercarriage anchorage, there is no evidence that this contributed to the accident.

The failure of the undercarriage leg occurred due to the failure and stripping of the front outer nut when being subjected to an axial (tensile) load during braking. The failure of the nut allowed the leaf spring to rotate, prising the clamp open and resulting in the bending of the rear outer and inner anchoring bolts. The nuts on these bolts, which will also have been subjected to high tensile loads, did not fail. The prising open of the clamp allowed the rotation of the undercarriage leaf spring, which came to rest in a general horizontal position.

In the context of the geometry of the undercarriage leg and its anchoring, it is unlikely that the front outer nut was stripped or missing on previous flights, as this would have resulted in the earlier collapse of the undercarriage leg on braking. It is, however, probable that the nut was already weakened prior to the accident flight and this gave way on braking during landing. There are several potential causes of such weakening, which includes use of counterfeit or incorrect parts, overtightening and hammering (which can be caused by play). The maintenance company reported that they purchase the nuts and bolts in question directly from the aircraft manufacturers and there was no evidence of use of incorrect parts or overtightening. Also, the pilot, who flew the aircraft during the last two days prior to the accident, did not notice any vibrations or knocking on previous sectors prior to the accident landing.

The cause of the failure of the nut and its subsequent stripping, therefore, could not be ascertained.



Figure 5. The collapsed left main undercarriage leg showing the leaf spring turned backwards.



Figure 6. Views of the collapsed left main undercarriage leg following the accident, showing the clamp (green) pulled off the front outer bolt.

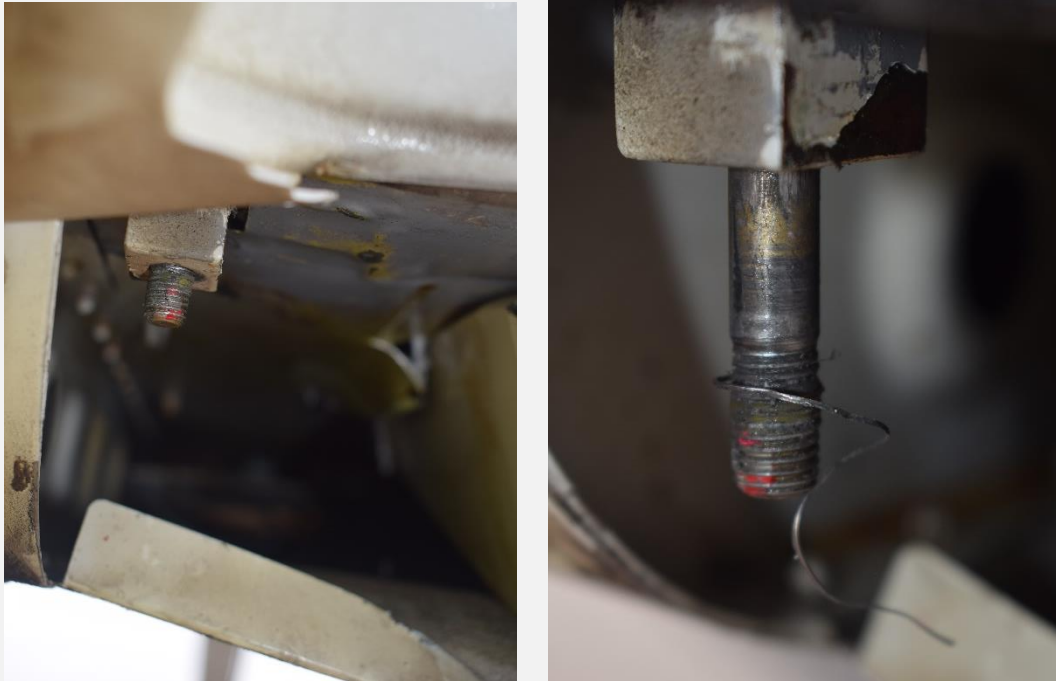


Figure 7. The front outer bolt, as found following the accident, without the nut (left) and after extracting the swarf from the thread (right).



Figure 8. The rear outer bolt, as found following the accident, bent by the clamp on the collapse of the undercarriage leg.

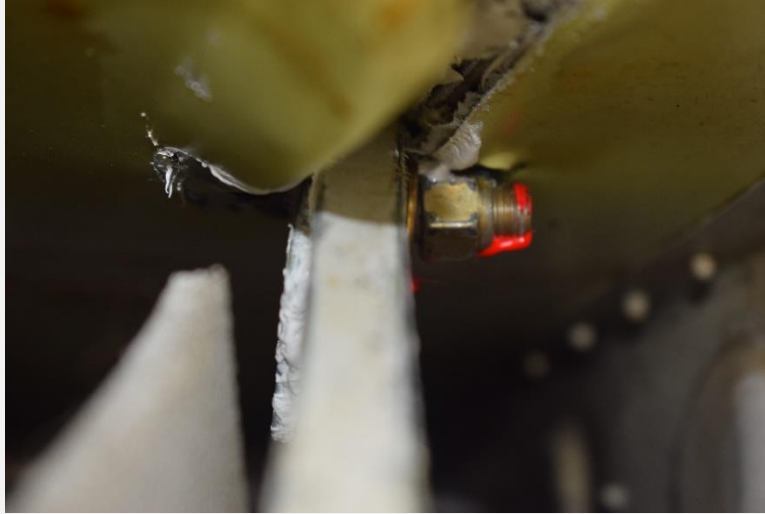


Figure 9. The inner bolt, during aircraft recovery following the accident, bent through 90 degrees by the undercarriage leg on its collapse.

6. Conclusion

The left main undercarriage leg of the aircraft collapsed during braking in the roll-out due to the failure and stripping of the front outer anchoring nut.

ABBREVIATIONS

EASA	-	European Union Aviation Safety Agency
ICAO	-	International Civil Aviation Organization
LIBC	-	Crotone Sant' Anna Airport ICAO Code
LICA	-	Lamezia Terme International Airport ICAO Code
LICR	-	Reggio di Calabria "Tito Minniti" Airport ICAO Code
LMML	-	Malta International Airport ICAO Code
VFR	-	Visual Flight Rules