Transporta nelaimes gadījumu un incidentu izmeklēšanas birojs

Transport Accident and Incident Investigation Bureau of the Republic of Latvia

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FINAL REPORT No. 4-02/3-20(1-21)

ON AVIATION SERIOUS INCIDENT INVOLVING AIRCRAFT TECNAM P2008 JC OF ERIVA LTD., REGISTRATION No. YL-EVA AT AERODROME ĀDAŽI ON 1 SEPTEMBER 2020

The Transport Accident and Incident Investigation Bureau is functionally independent from all aviation authorities of the Republic of Latvia which assess aircraft airworthiness, perform certification of air operators, organise flights, ensure aircraft maintenance, assess the qualification of the personnel, and organise air traffic control and work of airports. The task of the Investigation Bureau is to investigate civil aviation accidents, serious incidents and, if necessary for improvement of flight safety, also incidents. The sole purpose of investigation in accordance with Annex 13 to the Chicago Convention on International Civil Aviation and Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC is to increase flight safety and to prevent repeating of aviation accidents and incidents, and also, if necessary, to develop safety recommendations.

The investigation conducted by the Transport Accident and Incident Investigation Bureau is not related to determination of guilt or liability of a person.

FINAL REPORT No. 4-02/3-20(1-21)

On aviation serious incident involving aircraft Tecnam P2008 JC of ERIVA Ltd., registration No. YL-EVA at aerodrome Ādaži on 1 September 2020

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ATIS - Automatic terminal information service
CAA - Civil Aviation Agency
GPS - Global Positioning System
A/C - Aircraft
VFR - Visual flight rules
UTC - Coordinated Universal Time

TAIIB - Transport Accident and Incident Investigation Bureau
JAA - Joint Aviation Authorities
JAR - Joint Aviation Rules
AGL - Above ground level
FCL - Flight crew licensing
Kts - knot (nautical mile per hour)
RPM - rpm (revolutions per minute)
AMM - Aircraft Maintenance Manual
CAMO - Continuing Airworthiness Management Organisation
MOE - Maintenance Organization Exposition
DOA - Approved Design Organisation
FH - Flight hour

GENERAL INFORMATION ON THE AVIATION SERIOUS INCIDENT

All information in the Final Report is indicated according to the local time (UTC + 3).

On 1 September 2020 an aviation serious incident involving aircraft Tecnam P2008 JC, registration No. YL-EVA, occurred at aerodrome Ādaži. Upon making a 180 degree left turn at the start of runway 33, nose landing gear leg attachment of the aircraft broke off. During the incident the aircraft sustained insignificant damages, the pilot and the passenger did not sustain injuries in the aviation serious incident.

Figure 1. Aircraft at the site of incident

INVESTIGATION

Investigators of the Transport Accident and Incident Investigation Bureau (TAIIB) received information from the aerodrome staff by phone on the aviation serious incident involving the aircraft Tecnam P2008 JC, registration No. YL-EVA, which had taken place in the area of aerodrome Ādaži.

Aviation accident investigators of the TAIIB went to the incident site in order to ascertain the circumstances of the serious incident and to question the witnesses thereto.

The aircraft was moved from the incident site and placed in the hangar of aerodrome Ādaži for its storage and for further investigation of the incident.

1. FACTUAL INFORMATION

1.1. History of the Flight

On 1 September 2020, the aircraft Tecnam P2008 JC, registration No. YL-EVA, flew out of aerodrome Spilve (EVRS) where it had undergone maintenance and landed at aerodrome Ādaži (EVAD). After landing the aircraft was prepared for the next flight, and the pilot and the passenger taxied to the holding point of runway 33 of the aerodrome. In order to line up with the runway at the holding point before take-off, the aircraft made a 180 degree left turn and the nose landing gear leg collapsed as a result of which the nose part of fuselage of the aircraft started to incline to the left side, the propeller touched the surface of the runway causing the engine to stop. The aircraft sustained insignificant damages to the structure.

Figure 2. Damage to the nose landing gear

1.2. Injuries to Persons

None.

1.3. Damage to Aircraft

The aircraft sustained the following damages to the structure:

- propeller blades of the aircraft have been damaged;

Figure 3. Damage to the propeller

- the left-hand angle flange of the nose landing gear leg attachment has been broken off;

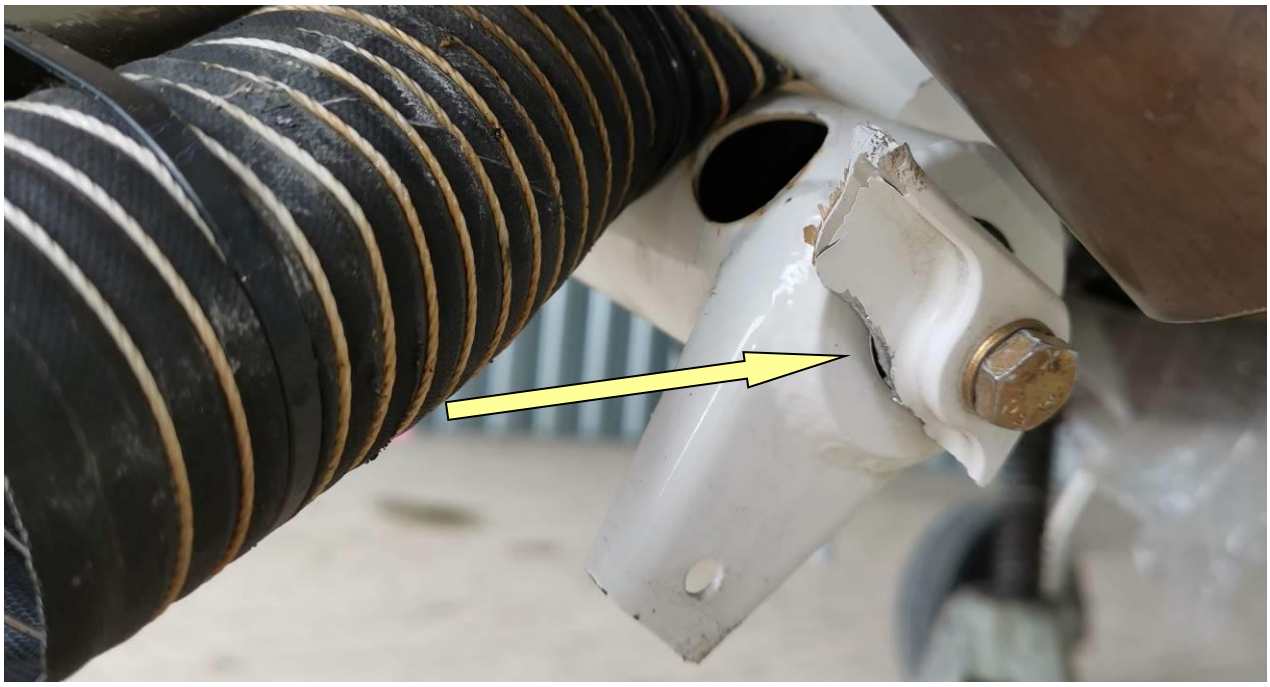

Figure 4. Breaking point of the left-side angle flange of the nose landing gear leg

- the right-hand angle flange of the nose landing gear leg attachment has been deformed due to the incident;

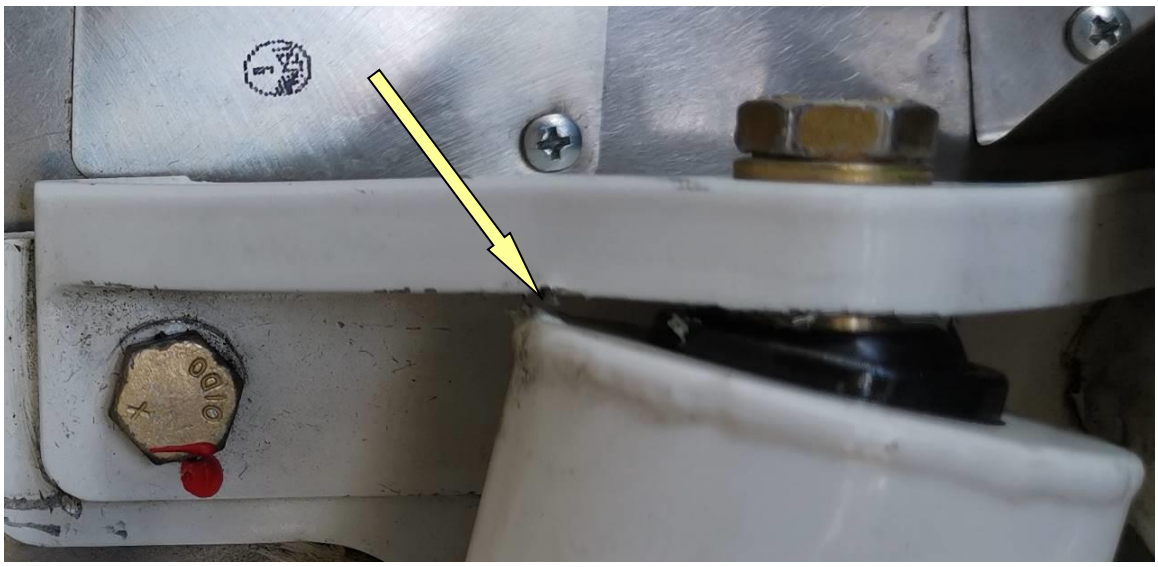

Figure 5. Right-hand angle flange

- the lower engine cowling has been damaged;

Figure 6. Damages to the lower part of fuselage of the aircraft

The aircraft sustained insignificant damages to the structure in the aviation serious incident and can be restored for further operation.

1.4. Other Damage

The surrounding environment and land have not sustained any damages.

1.5. Personnel Information

Aircraft pilot:	- Citizen of the Republic of Latvia, 22;
Pilot licence:	- Flight crew licence LVA.FCL.001107P, issued on 13 September 2018 by the CAA of Latvia, ratings valid: SEP (land) until 31 August 2022;
Medical certificate:	- Class 2 medical certificate LVA/MED-2-A-3015, issued on 8 July 2016 by the CAA of Latvia, valid until 8 July 2021;
Total flight hours:	- 76 hours;
Last qualification check of the aircraft pilot:	- on 27 August 2017;
Flight hours on the day before the aircraft serious incident:	- None;
Flight hours on the day of the aircraft serious incident:	- None.

1.6. Aircraft Information

1.6.1. General Information

Aircraft Tecnam P2008 is a single-engine two-seat aircraft with a strut braced high wing and fixed landing gear, manufactured in Italy.

Figure 7. Aircraft Tecnam P2008 JC (photo of ERIVA Flight School)

It is the first Tecnam aircraft which features composite components. Modification of the aircraft Tecnam P2008 JC is a certified version according to the provisions of EASA CS-VLA.

Manufacturer:	- Costruzione Aeronautiche Tecnam S.r.l., Italy;
Aircraft model:	- P2008 JC;
Serial number:	- 1104;

Year of manufacture:	- 2018;
Registration No.:	- YL-EVA;
Registration licence:	- EVA20190411REG, issued by the CAA of Latvia on 11 April 2019;
Airworthiness Review Certificate:	- LV ARC EVA20190411a, issuer CAA of Latvia, extended by Your Came Service Ltd. (LV.MG.0017) until 10 April 2021;
Total running time:	- 902.2 hours;
Running time after the last 100 FH hour technical maintenance:	- approximately 1.2 hours;
Registered owner:	- ERIVA Ltd. (Flight School);
Operator name:	- ERIVA Ltd.

1.6.2. Structure of the Nose Landing Gear of the Aircraft

The nose landing gear leg structure of the aircraft Tecnam P2008 JC is fixed in three points. There are mounting angle flanges at the two bottom points (Figure 8 (**1**)) where horizontal longitudinal axis is fixed in ball bearings (Figure 9), legs are secured with a shock absorber of oleo-pneumatic type (Figure 8 (**2)**) at the top part which ensures shock absorbing of the nose landing gear of the aircraft while in vertical motion.

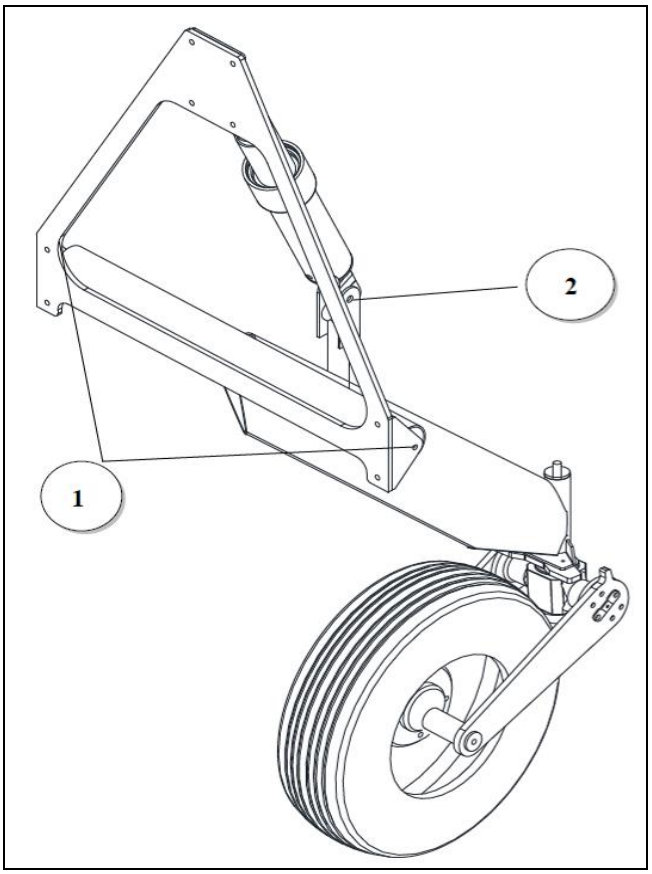

Figure 8. Scheme of the nose landing gear leg attachments of the aircraft P2008 JC (AMM 32-30)

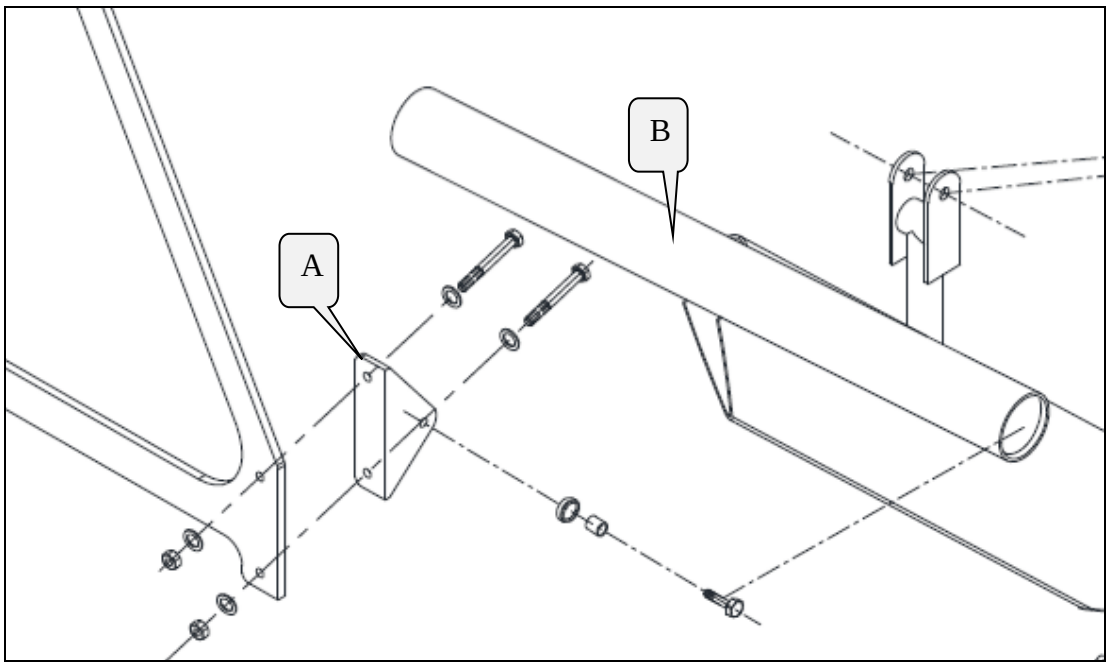

Figure 9. Scheme of the hard attachment of the nose landing gear angle flange (**A**) to the horizontal longitudinal axis (**B**) (AMM 32-30)

1.6.3. Maintenance of the Aircraft

Upon ensuring maintenance of the aircraft Tecnam P2008 JC, registration No. YL-EVA, according to the Continuing Airworthiness and Maintenance Programme [EV-MP-EVA Iss.1, Rev.1/2008/101 Ed.1, Rev.5], the Continuing Airworthiness Management Organisation (CAMO) "Your Came Service" Ltd. issued the Work Order YL-EVA-20 (EASA Part-145 Approval LV.145.0019) on 27 August 2020 to EASA Part145 maintenance organisation "AeroRestoration" Ltd.

In the time period from 31 August 2020 to 1 September 2020 the maintenance organisation "AeroRestoration" Ltd. performed every 100 FH hour inspection at the aerodrome Spilve for the aircraft P2008 JC, serial number 1104, according to the maintenance Work Order YL-EVA-20. The following inspections were included in the work performance actions:

- the 100 FH hour inspection of the aircraft according to the Aircraft Maintenance Manual (AMM) No. 2008/101 (Edition 1, Revision 5) 10.10.2018, of the manufacturer of the aircraft Tecnam P2008 JC;
- the 100 hour engine running inspection according to the maintenance manual No. P/N 899191 (Edition 3, Revision 1) of the manufacturer of ROTAX engines.

After completion of the maintenance works of the 100 FH hour inspection of the aircraft, the report on the works performed by "AeroRestoration" Ltd. did not include a reference to any additional works the performance of which would have been required to eliminate the deficiencies or damages detected during the performance of maintenance works. Therefore "AeroRestoration" Ltd. issued the Certificate Release to Service.

1.6.4. Operation of the Aircraft after the Maintenance Performed

After the 100 FH hour maintenance on 1 September 2020, the aircraft Tecnam P2008 JC, registration No. YL-EVA, was handed over to representatives of "ERIVA" Ltd. at aerodrome Spilve from the maintenance organisation AeroRestoration" Ltd. No technical problems in relation to the aircraft were detected during the flight from aerodrome Spilve to aerodrome Ādaži.

According to the pilot, when preparing the aircraft for the flight from aerodrome Ādaži, no technical defects or notes on the technical state of the aircraft were detected during pre-flight inspections according to the checklist.

1.7. Meteorological Information

Was not requested. The serious incident is not related to meteorological conditions on 1 September 2020.

1.8. Aids to Navigation

Information is not essential for investigation.

1.9. Communications

Information is not essential for investigation.

1.10. Aerodrome Information

Aerodrome Ādaži (ICAO code – EVAD):

- designed for visual flights;
- aerodrome runway markings 15/33;
- elevation – 8 feet;
- runway surface: asphalt.

Location:

- Rīga District, Ādaži Municipality, “Eimurlauki";
- direction and distance from Ādaži village: 2.2 NM NW.

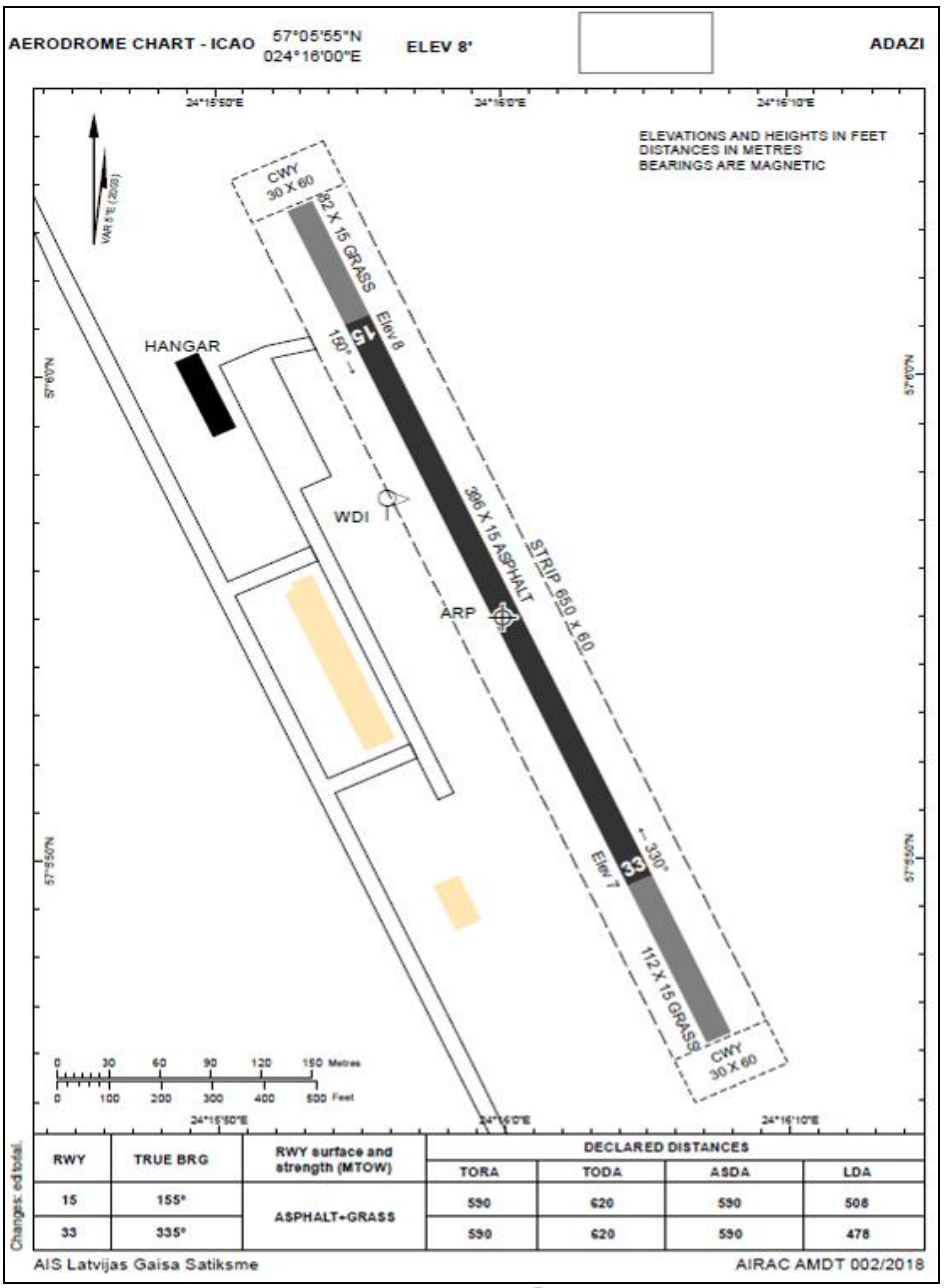

Figure 10. Aerodrome Ādaži (AIP)

Aerodrome Ādaži is designed for general aviation flights, it is not equipped with instrumental landing systems and is freely accessible. The surface is even, in satisfactory condition.

1.11. Flight Recorders

- The aircraft is not equipped with flight recorders.
- The investigation has at its disposal a video recording from 21 June 2020 of landing of the aircraft Tecnam P2008 JC, registration No. YL-EVA, on the nose landing gear at aerodrome Ādaži.

1.12. Wreckage and Impact Information

None.

1.13. Medical Information

Alcohol concentration test in exhaled air (measurement: 0.00 permil) was performed for the pilot of the aircraft. Measuring device "AlcoQuant 6020", serial No. A113149.

1.14. Fire

Had not been caused.

1.15. Survival Aspect

The aircraft pilot and the passenger were not injured.

1.16. Tests and Research

After dismantling of the left-hand angle flange of the nose landing gear leg of the aircraft, its visual inspection was performed and the structure of attachments of the nose landing gear was inspected in detail.

In order to determine the reasons for destruction of the material of the left-hand mounting angle flange of the nose landing gear leg of the aircraft and to establish the potential damages before flight or during previous service, the damaged mounting angle flange was sent for the performance of metallurgical expert-examination to the Department of Mechanical Engineering and Mechatronics of the Faculty of Mechanical Engineering, Transport and Aeronautics of Riga Technical University (RTU).

1.16.1. Metallurgical Investigation of Fracture in the Left-hand Angle Flange of the Nose Landing Gear Leg of the Aircraft

The Department of Mechanical Engineering and Mechatronics of the Faculty of Mechanical Engineering, Transport and Aeronautics of Riga Technical University (RTU) was assigned to perform the technical analysis of the fracture in the left-hand angle flange of the nose landing gear leg, to determine the nature of the fracture and the circumstances of its occurrence.

The reply of the Department of Mechanical Engineering and Mechatronics of the Faculty of Mechanical Engineering, Transport and Aeronautics of Riga Technical University (RTU) of 7 October 2020 to the questions asked is provided in the conclusion prepared.

Conclusion of Investigation of the Fracture in the Angle Flange

The mounting angle flange of the nose landing gear of the aircraft (manufacturer part number P/N 28-8-1050-1), made of aluminium alloy using injection molding technology, is of good quality.

Upon landing, the parts of the nose landing gear leg structure of the aircraft are subjected to dynamic load. The angle flanges are being subjected to load via the horizontal longitudinal axis of the landing gear, thus causing bending stress **P** therein (Figure 11).

Figure 11. Both fractured parts of the left-hand flange and the action direction of force P

The fracture has formed in the left-hand angle flange. After fracturing thereof, the horizontal longitudinal axis became loose and the nose landing gear leg remained fixed only in the right-hand angle flange (Figure 12).

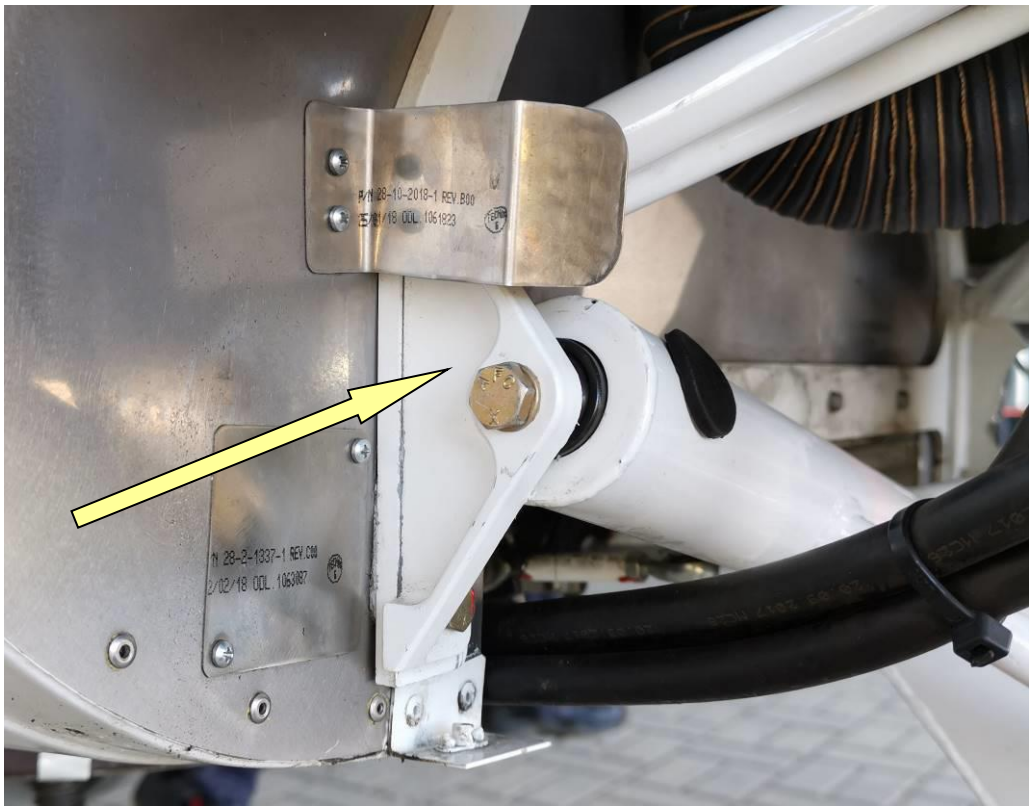

Figure 12. Right-hand angle flange of the longitudinal axis attachment

Upon performing analysis of the fracture, it was concluded that the starting point **S** of the fracture was located in a place where maximum bending stress operates. During operation, it does not exceed the designed load of the part.

Small damages to the surface layer with a little admixture of the part to the material or a defect in the structure of the material of the part are visible in the starting point of the fracture (Figure 13). During service of the aircraft the surface layer of the fracture evened out, became smooth and shiny. Notches of 3-6 mm in length are visible further along the fracture when the fracture stopped, however, at the event of the subsequent shock (hard landing) its further development resumed.

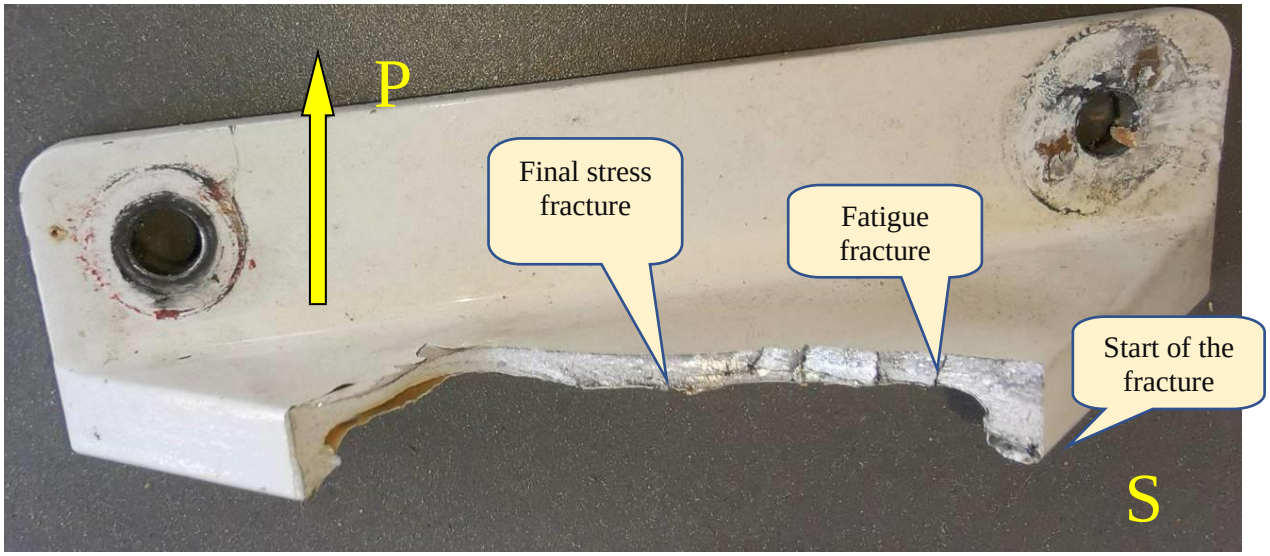

Figure 13. Image of the surface of the fracture

In this stage of development of the fracture (fatigue), the fracture is under low-cycle load, the structure of the landing gear leg keeps operating. Similar surface of the fracture is also visible in the part that has broken off (Figure 14).

Figure 14. Image of the fracture surface of the part that has broken off

When the fatigue fracture developed to the point that the remaining intact cross-section of the flange was not able to withstand the stress caused by the operational load, then the left-hand flange failure occurred. The final fracture is fine-grained, fragile, without plastic deformation.

1.17. Organisational and Management Information

1.17.1. Continuing Airworthiness of the Aircraft

On 11 April 2019 the Civil Aviation Agency issued the first-time Airworthiness Certificate LV ARC EVA20190411a for the aircraft.

On 7 April 2020 the Continuing Airworthiness Management Organisation (CAMO) "Your Came Service" Ltd. (LV.MG.0017) extended the Airworthiness Certificate LV ARC EVA20190411a for the aircraft Tecnam P2008 JC, registration No. YL-EVA, until 10 April 2021 according to the Continuing Airworthiness and Maintenance Programme EV-MP-EVA (Issue 1, Revision 1).

1.17.2. Reporting on Occurrence Involving Aircraft

In accordance with the requirements of Regulation (EU) No 376/2014 of the European Parliament and of the Council, the mandatory reporting system has been established in the Flight School which includes a safety reporting procedure regarding occurrence involving aircraft during operation in electronic form. Incidents in relation to the hard landing of this aircraft had not been registered in the mandatory reporting system because, according to the information provided by the aircraft operator, no definition of "hard landing" is provided for in the flight manual of the manufacturer of the aircraft Tecnam P2008.

The term "hard landing" is used in Tables ATA 32-10 and ATA 32-30 "Troubleshooting" (AMM p. 587 and p. 624) in Chapter 32 "Landing gear" of the Aircraft Maintenance Manual (AMM) No. 2008/101 of the manufacturer of the aircraft Tecnam P2008 JC.

1.18. Additional Information

1.18.1. Activities Previously Carried out by the Manufacturer or Any Other Institution in Relation to the Nose Landing Gear of the Aircraft

According to the information on incidents related to damages to the nose landing gear of the aircraft Tecnam P2008 JC in the previous modifications of the aircraft (until s/n 1055), the manufacturer of Tecnam aircraft has developed the Service Bulletin SB 215-CS (Annex 1) which was approved by the EASA on 27 November 2019. According to the Service Bulletin SB 215-CS, the manufacturer recommends either to perform an additional inspection of the nose landing gear of the aircraft after every 25 flight hours, paying particular attention to the welding seams (**1**) (Figure 15) at the point where the shock absorber is attached to the landing gear leg, even removing the paint in order to identify the potential cracks and deformations as best as possible, or to install a modernised nose landing gear leg (according to MOD2008/059 and SB-217-CS) in order not to perform such inspections.

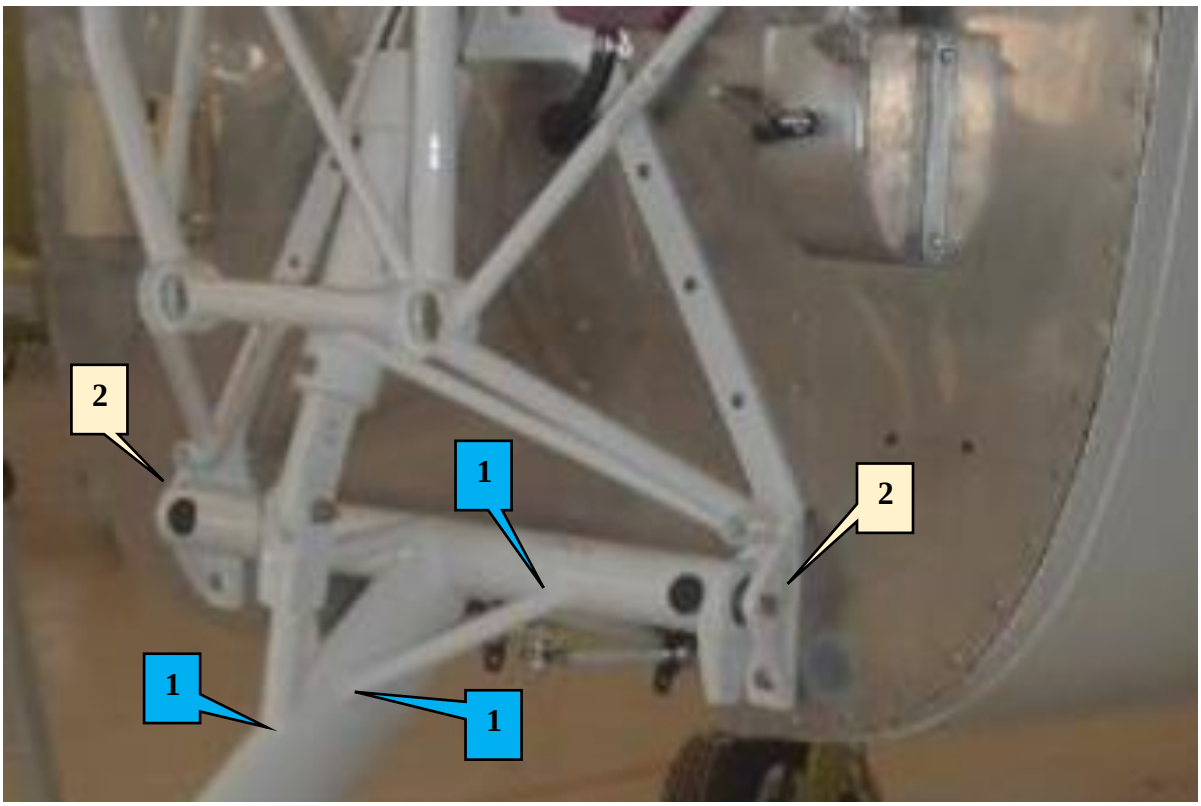

Figure 15. Structure of the nose landing gear of the aircraft

The recommendation of the Service Bulletin SB 215-CS of the manufacturer to perform an inspection of the nose landing gear structure of the aircraft after every 25 flight hours did not apply to the aircraft Tecnam P2008 JC, registration No. YL-EVA, which was involved in an aircraft serious incident on 1 September 2020 and it was not required to perform the inspection because the modernised landing gear leg according to MOD2008/059 and SB-217-CS was installed for the aircraft.

1.18.2. Similar Occurrences with the Involved Type of the Aircraft

On 9 July 2017 an aircraft serious incident related to the landing of the aircraft Tecnam P2008-JC, registration No. G-OLIC in the London Ashford Lydd airport on the nose landing gear occurred as a result of which the nose landing gear of the aircraft was collapsed rearwards. The aircraft which crashed was marked with the serial number, i.e., with a modernised nose landing gear according to MOD2008/059 and SB-217-CS of the manufacturer of the aircraft. The investigation of the circumstances of the aviation serious incident was conducted by the Air Accidents Investigation Branch (AAIB) of Great Britain and it issued the AAIB Bulletin: 9/2017 EW/G2017/07/05.

1.19. Useful or Effective Investigation Techniques

Not applied.

2. ANALYSIS

2.1. Analysis of the Formation of the Fracture

Taking into account the results of the metallurgical analysis of the left-hand angle flange of the nose landing gear leg attachment, it was concluded in investigation that damages to the surface layer visible in the starting point **S** of the fracture of the angle flange had, potentially, occurred from a small admixture in metal (**a**) or due to structural defects that had occurred during the manufacturing process of the angle flange, and they, potentially, might have been the cause due to which the fracture in the angle flange started in the point **S** because the highest concentration of stress occurred in this place (Figure 16).

The fracture started in the upper part of the flange where a micro-crack had formed during service, later transforming into a fatigue fracture. Further development of the fracture displays nature of a low-cycle fatigue fracture, and it developed in several stages (**b**), forming the surface of stage fatigue fracture. During the low-cycle stage, the structure of the landing gear leg continued to operate normally until the aircraft serious incident on 1 September 2020.

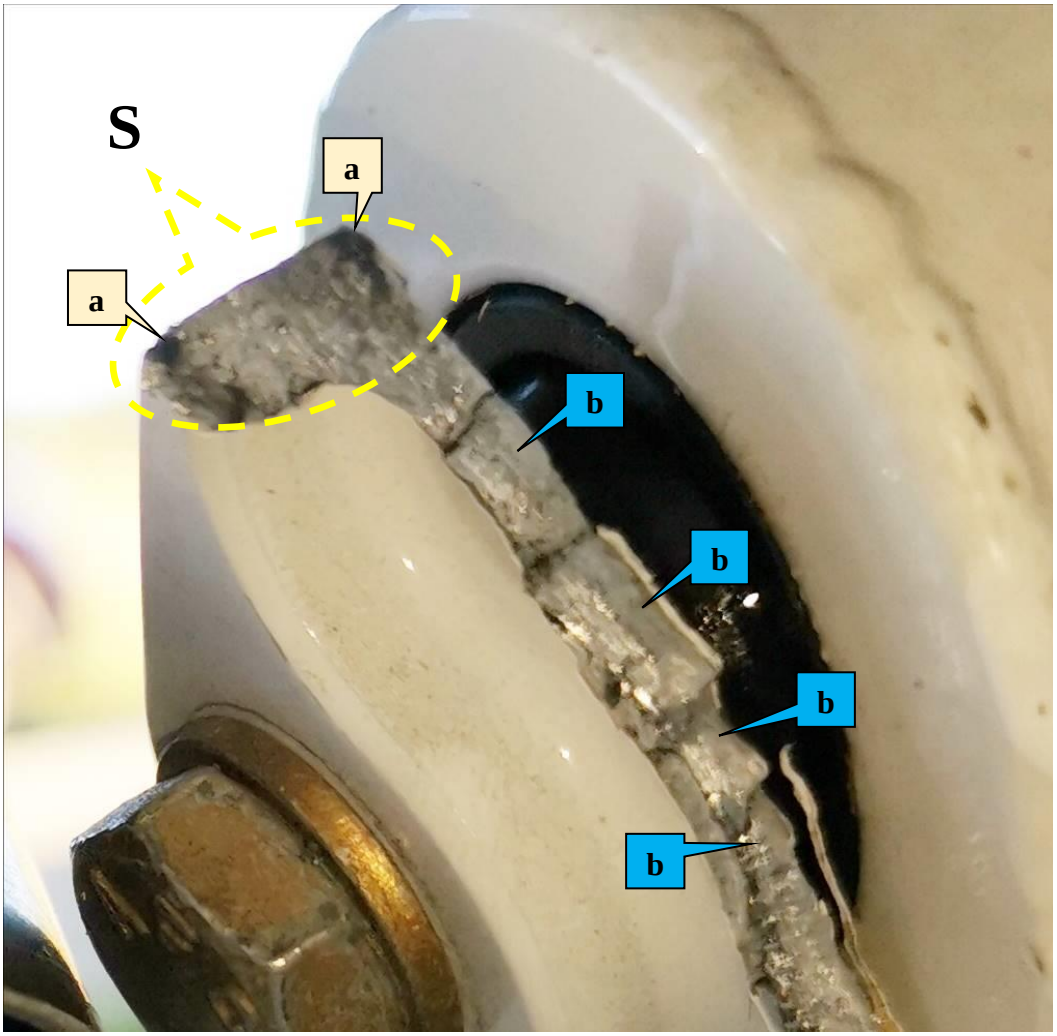

Figure 16. The broken-off fragment of the left-hand angle flange

The reason for the fracture on the very day of the event is potentially linked to the fact that the remaining undamaged cross-section of the damaged flange was only around 60 % which was not sufficient anymore for withstanding the dynamic load caused by service. Thus, it resulted in a development where the horizontal longitudinal axis disengaged from the left-hand mounting angle flange and the structure of the nose landing gear leg broke under the weight of the aircraft.

2.2. Structure of the Nose Landing Gear Leg of the Aircraft

Upon analysing the consequences of the serious incident which occurred on 1 September 2020 due to the formation of the fracture in the left-hand mounting angle flange of the nose landing gear, and also in a similar incident with the modernised nose landing gear in Great Britain, it may be concluded that, upon modernising the structure of the nose landing gear of the aircraft Tecnam P2008 according to MOD2008/059 and SB-217-CS, the intended objective for improvement of the structure has not been achieved in full, therefore, improvement of flight safety has also not been achieved.

Side impact to the ground by the nose landing gear of the aircraft Tecnam P2008 results in transverse dynamic load which has effect on the nose landing gear leg being "hard" attached to the fuselage firewall of the aircraft, and this load results in the formation of bending stress in angle flanges and the occurrence of fatigue failure of the material of angle flanges (**2**) (Figure 15).

Therefore, the safety investigation institution (TAIIB) is of the opinion that, regardless of the improvements performed by the manufacturer of the aircraft Tecnam P2008 in the quality of welding seams of force elements of the nose landing gear structure of the aircraft, deficiencies in the landing gear structure occur in other attachment elements of the nose landing gear structure because the nose landing gear of the aircraft is not structurally able to withstand cyclic transverse impacts.

2.3. Aircraft Operation Analysis

The aircraft had been in intensive operated since 22 April 2019 by performing training of pilots in the period of approximately 900 flight hours in total, moreover, 420 of these hours – within the last five months before the serious incident. Therefore, it is possible that hard landings had occurred during flights due to the lack in practical experience of pilots or due to other reasons.

As the fatigue fracture of the left-hand angle flange of the nose landing gear attachment developed gradually, it is possible that the serious incident could have been promoted by several hard landings of the aircraft. It is visible in the video recording (see Paragraph 1.11) at the disposal of investigation that on 21 June 2020 the aircraft, upon performing landing with the left bank at aerodrome Ādaži, hit the surface of the ground with the nose landing gear, causing bending stress **P** in the angle flanges of the nose landing gear as a result of transverse impact (Figure 17). The structure of the nose landing gear attachment of the aircraft Tecnam P2008 allows to absorb shocks in vertical motion only, but the dynamic load of transverse impact **F** has an effect on both mounting angle flanges.

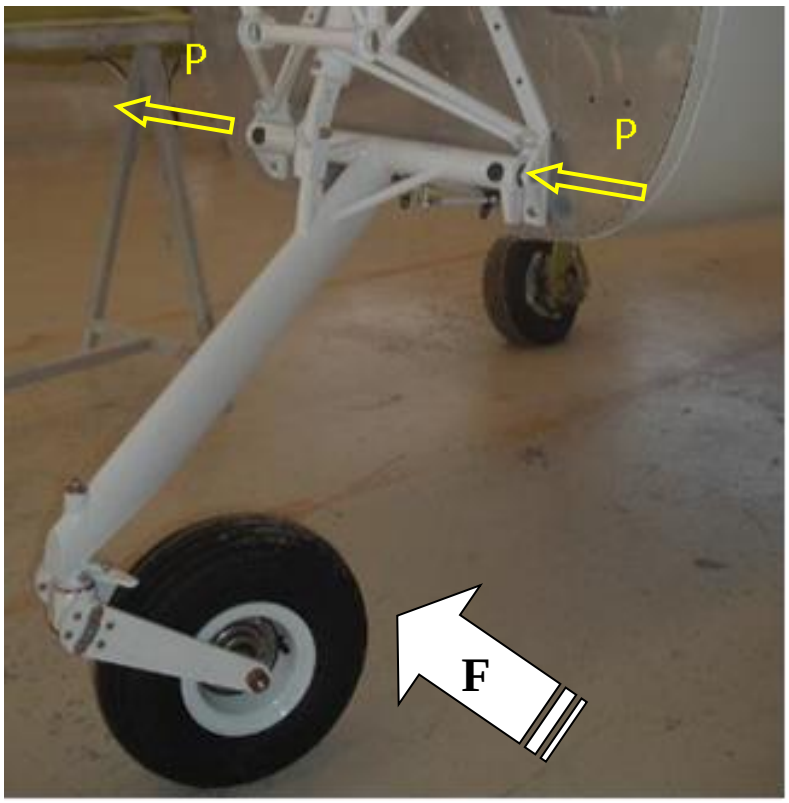

Figure 17. Effect of dynamic load in the structure of the nose landing gear

The aircraft operator [ERIVA ATO] received a safety report on the landing occurrence on the nose landing gear on 21 June 2020 from the pilot who had leased the aircraft for a private flight. Due to the incident, the aircraft operator turned to the maintenance organisation "AeroRestoration" Ltd. with a request to perform an inspection of the aircraft. A representative of the maintenance organisation performed inspection of the aircraft on site, i.e., at aerodrome Ādaži. As no damages and defects were detected during the inspection, the aircraft was recognised as safe for operation and continued the performance of flights.

The aircraft operator (i.e., the Flight School) had not inserted information on this occurrence in the mandatory reporting system, although, in accordance with Article 4(1)(a) "Mandatory Reporting" of Regulation (EU) No 376/2014, occurrences related to taking off and landing of aircraft during service must be included in the mandatory reporting system, but, in accordance with Sub-paragraph (12) of Paragraph 1.3 "Take-off and landing" of Regulation (EU) No 2015/2018 laying down a list classifying occurrences in civil aviation to be mandatorily reported according to Regulation (EU) No 376/2014 of the European Parliament and of the Council, reports on "Hard landing" should be made.

The aircraft operator [ERIVA ATO] did not inform the Continuing Airworthiness Management Organisation "Your Came Service" Ltd. of this occurrence which is related to landing of aircraft on the nose landing gear.

The aircraft operator/owner had not drawn up a Work Order in writing in relation to this occurrence for the maintenance organisation. In turn, Paragraph M.A.610 of Regulation (EU) No 1321/2014 provides for the possibility for the aircraft owner/operator to issue a written Work Order to the maintenance organisation or to make an entry in the aircraft logbook, indicating the defects to be eliminated during maintenance. The logbook for the aircraft Tecnam P2008 JC, registration No. YL-EVA, included data on the times of service of the aircraft, the crew, the flight routes, the flight hours of the aircraft, however, there were no entries in the logbook with indications towards any defects which had occurred during operation of the aircraft.

2.4. Aircraft Maintenance Analysis

The every 100FH hour maintenance of the aircraft was performed according to the Work Order YL-EVA-20 in which the amount of work performance and technical inspection was determined only according to the maintenance manual of the manufacturer because the Continuing Airworthiness Management Organisation (CAMO) had not been informed of the occurrence when the aircraft had landed on the nose landing gear (21 June 2020). Therefore, no additional inspections for the nose landing gear structure of the aircraft after the incident of hard landing were assigned in the section "Additional information, additional tasks" of the maintenance Work Order YL-EVA-20 for the aircraft, but the amount of inspection works of the nose landing gear of the aircraft was determined according to the Maintenance Manual [AMM] No. 2008/101 of the manufacturer for the aircraft Tecnam P2008 JC, Chapter 05-20 "Inspection Program", Table 4 "Planned inspections", Item 32 "Landing gear" [AMM, p. 83], providing for the following: "*To perform dedicated inspection for attachments of metal parts, cracks, metal deformations, any other condition that can cause stress concentrations for metal, covering (painting) of the surface of parts, welding seams, and rivet couplings, corrosion, and other obvious damages.*"

As a result of landing of the aircraft Tecnam P2008 JC, registration No. YL-EVA, on the nose landing gear at aerodrome Ādaži on 21 June 2020, the aircraft operator/owner turned to the maintenance organisation "Aero Restoration" Ltd. with a request to perform an inspection of the aircraft, but the work order for the abovementioned works was not drawn up in writing, therefore, the staff of the maintenance organisation, probably, were not able to fully assess the circumstances that a potentially dangerous or unsafe condition for the structure of the aircraft could exist, did not pay increased attention to the occurrence, resulting in not filling in the form of the report on technical incidents according to the requirements of Paragraph 2.18.2 of MOE and not reporting on the incident within 72 hours after its occurrence.

According to Paragraph 2.18.3 of MOE, Occurrence to be Reports also includes: "*Damage to a Principal Structural Element (PSE) that has not been qualified as damage tolerant (life limited element). Principal Structural Elements are those which contribute significantly to carrying flight, ground, and pressurisation loads, and whose failure could result in a catastrophic failure of the aircraft.*"

Investigation assumes that it is possible that inadequate assessment of the specific nature of operation of the aircraft in the Flight School could have been a reason for not paying additional attention to inspection of the nose landing gear of the aircraft when performing 100FH hour maintenance.

Metallurgical expert-examination proves that metal fatigue of the left-hand angle flange of the nose landing gear attachment formed gradually and the cycle when the fatigue fracture of the flange formed occurred during operation of the aircraft, therefore, flaking of enamel paint in the place where a crack was forming could have occurred and it could have potentially been noticed when surveying, during maintenance, the place where the fracture occurred (Figure 18).

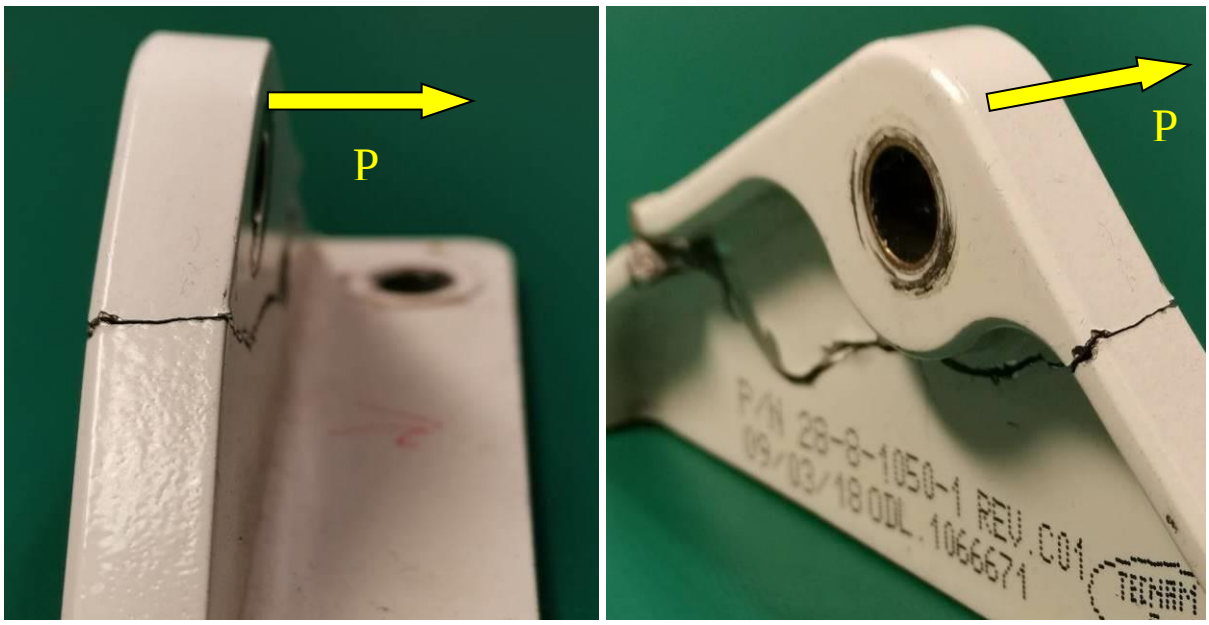

Figure 18. View of the broken angle flange and the direction in which force P operated

There are no signatures of the mechanic, inspector, and Double Check in section “Work Report” of the maintenance Work Order YL-EVA-20 regarding carrying out of the task, but there is a note with a Part-145 stamp where the inspector should be indicated. Therefore, it may be assumed that the section “Work Report” of the maintenance Work Order YL-EVA-20 and the Certificate Release to Service was drawn up and signed by the same person and the Double Check of the works performed does not conform to the requirements of Paragraphs 2.22 and 2.23 of the Maintenance Organisation Exposition [AeroRestoration Ltd. MOE].

3. CONCLUSIONS

3.1. Findings

- the aircraft had a valid Certificate of Registration and Airworthiness Review Certificate;
- the qualification marks, flight skill tests, and periods of validity of the pilot conform to the current requirements of the regulatory documents of civil aviation;
- the actual takeoff weight of the aircraft did not exceed the maximum takeoff weight specified in the technical documentation of the manufacturer;
- small admixtures or structural defects which had occurred during the manufacturing process were detected in the metal of the angle flange;
- the nose landing gear of the aircraft is structurally unable to withhold cyclic transverse shocks;
- regardless of the modernisation of the nose landing gear structure of the aircraft performed by the manufacturer of the aircraft Tecnam P2008, deficiencies in the structure of the landing gear occur in attachment elements of the nose landing gear structure;
- the aircraft was operated intensively in the Flight School, carrying out regular training of pilots;

- one case of hard landing of the aircraft on the nose landing gear has been proven documentarily;

- after landing the aircraft on the nose landing gear, the maintenance organisation performed inspection of the aircraft without a Work Order;

- complete notification regarding occurrences involving the aircraft during service in accordance with the list of Regulation 2015/1018 was not ensured in the mandatory reporting system created by the Flight School;

- the Continuing Airworthiness Management Organisation (CAMO) was not informed of the occurrence of hard landing;

- there are no entries in the logbook with indications towards defects which have occurred during operation of the aircraft;

- additional inspection for the nose landing gear of the aircraft was not specified in the Work Order of the maintenance of the aircraft;

- it was not necessary to perform an inspection of the nose landing gear structure of the aircraft after every 25 flight hours because the aircraft was equipped with the modernised landing gear leg according to MOD2008/059 and SB-217-CS;

- the fracture of the nose landing gear leg attachment formed gradually during intensive operation of the aircraft;

- the fracture in the left-hand angle flange occurred during operation of the aircraft due to the impact of transverse shocks in relation to the specific structural features of the nose landing gear of the aircraft;

- the formation process of the fracture in the left-hand angle flange had started before the performance of the last 100 flight hour maintenance;

- it is possible that the signs of the left-hand angle flange (flaking of the paint) were not noticed during maintenance of the aircraft;

- it is possible that during maintenance sufficient attention was not paid to the nose landing gear structure of the aircraft according to the maintenance manual of the manufacturer of the aircraft Tecnam P2008 JC (see Paragraph 2.4);

- the reference documentation of the last 100 flight hour maintenance of the aircraft was drawn up with violations (see Paragraph 2.4).

3.2. Causes:

3.2.1. Proximate Cause

Fracture in the left-hand angle of the nose landing gear leg attachment of the aircraft.

3.2.2. Root Cause

Gradual fatigue failure of the material of angle flanges under impact of bending stress from transverse dynamic load.

3.2.3. Contributing Causes

- The aircraft landing on the nose landing gear;
- Insufficient attention from the operator and the maintenance organisation to the occurrence when the aircraft landed on the nose landing gear;
- Not informing of the Continuing Airworthiness Management Organisation of landing on the nose landing gear.

3.2.4. Primary Cause

Inability of the nose landing gear structure of the aircraft to withstand cyclic transverse shocks.

4. SAFETY RECOMMENDATIONS

1. Several non-conformities in the activities of the maintenance organisation "AeroRestoration" Ltd. were detected during the investigation, such as:

   - insufficient attention to inspection of the nose landing gear structure of the aircraft during the scheduled maintenance according to the maintenance manual of the manufacturer of the aircraft Tecnam P2008 JC;
   - in double check procedures of the performance of works according to the Maintenance Organisation Exposition.

   In order to improve the quality of the performance of maintenance works in the aircraft maintenance process, the Transport Accident and Incident Investigation Bureau is addressing the following flight safety recommendation to the CAA:

   Recommendation LV2021001

   To conduct a quality audit of the performance of aircraft maintenance works by the maintenance organisation "AeroRestoration" Ltd.

2. Due to deficiencies in fulfilling the requirements of the mandatory reporting system discovered during the investigation in accordance with Regulation (EU) 2015/1018 laying down a list classifying occurrences in civil aviation to be mandatorily reported according to Regulation (EU) No 376/2014 of the European Parliament and of the Council, in order to improve the procedure for reporting on incidents during service of aircraft, the Transport Accident and Incident Investigation Bureau is addressing the following flight safety recommendation to the CAA:

   Recommendation LV2021002

   To conduct an audit of the system of the Flight School for reporting on occurrences in civil aviation.

3. It was detected during the investigation that the main cause of the serious incident is the inability of the nose landing gear structure of the aircraft to withstand cyclic transverse shocks. During the use of the aircraft fatigue failure of the material of angle flanges under impact of bending stress from transverse dynamic load is gradually occurring. In order to eliminate the preconditions for incidents and to improve the safety of the use of such type of aircraft in the future, the Transport Accident and Incident Investigation Bureau is addressing

the following safety recommendation to the manufacturer of the aircraft type Costruzioni Aeronautiche TECNAM S.r.l:

Recommendation LV2021003

To find the possibility for carrying out measures for improvement of the structure of the nose landing gear leg attachment of the aircraft P2008 JC in order to reduce gradual fatigue failure of the material of angle flanges under impact of bending stress from transverse dynamic load.

Riga, 5 July 2021

Investigator-in-Charge

Aviation Accident and Incident Investigator Vilis Ķipurs

COSTRUZIONI AERONAUTICHE TECNAM
TECNAM S.r.l

SERVICE BULLETIN

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MANDATORY by the AD No. yyyy-xxxx ☐ **May become MANDATORY after EASA evaluation** ☐

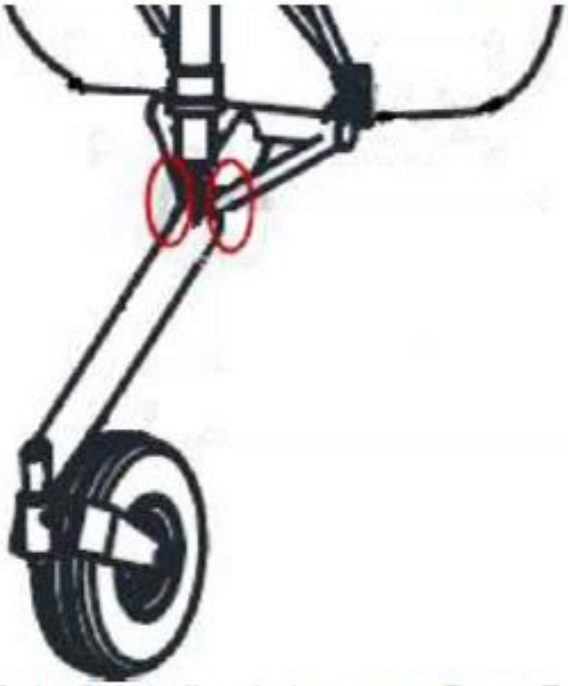
RECOMMENDED ..... ☒ **INFORMATION** ..... ☐

SUBJECT:	P2008 JC NLG legs inspection
SCOPE:	After an occurrence received on the NLG, Tecnam recommends to perform a dedicate inspection on the NLG leg with particular attention on welding points (refer to the instructions included at end of this document).
APPLICABILITY:	Tecnam P2008 JC aircraft, up to S/N 1055.
TIME OF COMPLIANCE:	The first inspection must be performed within the next 5 flight hours and then the inspection must be performed each 25hrs flight hours At same time, Tecnam in order to remove this inspection task recommends the installation of improved NLG leg (as per MOD2008/059 and SB-217-CS)
MANPOWER:	2 man-hours.
REQUIRED MATERIAL:	Nil.
TOOLING:	Nil.
WEIGHT AND BALANCE:	Nil.
REFERENCES:	P2008 JC AMM (Aircraft Maintenance Manual) – last issue.
PUB. AFFECTED:	Nil.

For further information please contact TECNAM:
Tel:
- *0039 0823 622297 – Kit order*
- *0039 0823 997538 – Technical Support*

E-mail:
- l.russo@tecnam.com
- technical.support@tecnam.com

MOD. PD-006-03 rev.2 date 18/11/13

N	Accomplishment Instructions
1	Parking the airplane in safe area;
2	Master Switch OFF and Parking brake ON;
3	Remove the cowling according to the instruction included in the AMM;
4	Perform the visual inspection on NLG, with particular attention of the welded points high-lighted in the picture below where is needed to remove the paint in order to identify better eventually cracks and deformation and use a torch light and/or mirrors, if needed; 
5	If a crack is found, no further flight is allowed, please contact Tecnam Technical Support for corrective action and fill the occurrence report (included in the AMM) and send it to Tecnam. Otherwise reinstall the engine cowling.