

PRELIMINARY REPORT



SERIOUS INCIDENT 2022/2456

State Commission on Aircraft Accidents Investigation (PKBWL)

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PRELIMINARY REPORT

SERIOUS INCIDENT

OCCURRENCE NO – 2022/2456

AIRCRAFT – Airplane, Tecnam P2006T, SP-MMB

DATE AND PLACE OF OCCURENCE – 23 May, 2022, EPBC



The Report is a document presenting the position of the State Commission on Aircraft Accidents Investigation concerning circumstances of the air occurrence, its causes and safety recommendations. The Report was drawn up on the basis of information available on the date of its completion.

The investigation may be reopened if new information becomes available or new investigation techniques are applied, which may affect the wording related to the causes, circumstances and safety recommendations contained in the Report.

Investigation into air the occurrence was carried out in accordance with the applicable international, European Union and domestic legal provisions for prevention purposes only. The investigation was carried out without application of the legal evidential procedure, applicable for proceedings of other authorities required to take action in connection with an air occurrence.

The Commission does not apportion blame or liability.

In accordance with Article 5 paragraph 6 of the Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation [...] and Article 134 of the Act – Aviation Law, the wording used in this Report may not be considered as an indication of the guilty or responsible for the occurrence.

For the above reasons, any use of this Report for any purpose other than air accidents and incidents prevention can lead to wrong conclusions and interpretations.

This Report was drawn up in the Polish language. Other language versions may be drawn up for information purposes only.

WARSAW 2022

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General Information

Occurrence reference number:	2022/2456			
Type of occurrence:	SERIOUS INCIDENT			
Date of occurrence:	23 May, 2022			
Place of occurrence:	EPBC			
Type and model of aircraft:	Airplane, Tecnam P2006T			
Aircraft registration marks:	SP-MMB			
Aircraft user/operator:	Ventum Air Sp. z o.o.			
Aircraft Commander:	ATPL(A)			
Number of victims/injuries:	Fatal	Serious	Minor	None
	-	-	-	2
Domestic and international authorities informed about the occurrence:	ULC (Polish Civil Aviation Authority), EASA, EU, ANSV (Italy)			
Investigator-in-charge:	Krzysztof Błasiak			
Investigating authority:	State Commission of Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers:	Italian Accredited Representative (ACCREP) Technical Advisor to ACCREP			
Document containing results:	PRELIMINARY REPORT			
Safety recommendations:	YES			
Addressees of the recommendations:	Aircraft manufacturer - Costruzioni Aeronautiche Tecnam			

1. FACTUAL INFORMATION

1.1. History of the flight

On the day of the occurrence, the crew consisting of the student-pilot and the flight instructor performed a training flight. The take-off from the EPBC aerodrome took place at 13:05 hrs UTC and the planned flight time was 4 hours and 30 minutes. The flight was uneventful. After returning to EPBC, the crew started the landing gear extension procedure. Despite moving the landing gear lever to the lower position several times, the signal of the extended landing gear did not appear. In that situation, in accordance with "P2006T - Aircraft Flight Manual, Section 3 - Emergency procedures, LANDING GEAR SYSTEM FAILURES", the procedure "EMERGENCY CHECKLIST LDG GEAR" was executed, but it ended in failure. The crew reported emergency to the flight coordinator at EPBC, and then performed a low pass over the aerodrome. persons on the ground confirmed that the landing gear was not extended. After notifying the aerodrome services a fire assistance was provided and the crew landed with the landing gear retracted on the grass runway, damaging the lower fuselage skin.

1.2. Injuries to persons

Injuries	Crew	Passangers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	2	-	-	2

1.3. Damage to aircraft



Fig. 1. Tecnam P2006T aircraft at the occurrence site [source: PKBWL¹]

¹ Unless otherwise indicated the source is PKBWL.



Fig. 2. Tecnam P2006T aircraft at the occurrence site

As a result of the serious incident, the lower skin of the airframe, including the main landing gear nacelles, was damaged. After the occurrence, the plane was lifted the landing gear was extended and the aircraft was towed to an apron.

1.4. Other damage

Not found

1.5. Personnel information (crew data)

Flight instructor - male, aged 62, holder of ATPL(A) issued on 27 September 2006 with the following ratings:

- 1) SEP(L) valid until 29 February 2024,
- 2) MEP(L) valid until 31 October 2022,
- 3) IR valid until 31 October 2022,
- 4) FI valid until 31 October 2024,
- 5) TMG valid until 29 February 2024,
- 6) Cessna SET valid until 31 May 2023,
- 7) SEP(S) valid until 30 April 2023,
- 8) B777/787/IR valid until 30 November 2022,
- 9) Banner towing,
- 10) Glider towing,
- 11) Acrobatic flights.

On the day of the occurrence, the instructor had:

- total flight time - about 25 200 FH;
- over the last 90 days - 210 FH;
- over the last 24 hours prior to the occurrence - 10 FH;
- on the occurrence type:
 - total – about 250 FH; including
 - over the last 90 days - 9 FH; and

- over the last 24 hours prior to the occurrence - 4:40 FH.

Student-pilot - male, aged 26, holder of PPL(A) issued on 18 October 2016 with the following ratings:

- 1) SEP(L) valid until 30 September 2022,
- 2) MEP(L) valid until 30 April October 2023,
- 3) NF (night flights).

On the day of the occurrence, the student-pilot had:

- total flight time - about 221:10 FH;
- over the last 90 days – 28:53 FH; and
- over the last 24 hours prior to the occurrence - 4:15 FH;
- on the occurrence type:
 - total - 21:17 FH;
 - over the last 90 days - 13:04 FH ;
 - over the last 24 hours prior to the occurrence - 4:15 FH.

The above flight times include the serious incident flight time.

The flight instructor and the student-pilot had valid aero-medical certificates.

1.6. Aircraft information

Tecnam P2006T is a twin-engine, four-seat high-wing aircraft designed for training for multi-engine airplanes.

Table 1. Tecnam P2006T, SP-MMB, data

Type	Tecnam P2006T
Manufacturer	Costruzioni Aeronautiche Tecnam
Registration marks	SP-MMB
Serial number	188
Year of manufacture	2017
Registration certificate issue date	04 July 2017
Airworthiness review certificate validity date:	18 July 2022
Flight time since new	2609:48 FH
Number of flights since new	4334
Last maintenance date:	20 May 2022
Airworthiness certificate validity date:	28 June 2022

The mass and center of gravity of the aircraft were within permissible limits.

1.7. Meteorological information

The weather was appropriate to perform the flight and had no impact on the occurrence.

1.8. Aids to navigation

No concerns regarding aids to navigation were raised.

1.9. Communications

No concerns regarding communications were raised.

1.10. Aerodrome information

Warszawa-Babice aerodrome (EPBC) was the departure and planned destination aerodrome.

Table 2. EPBC aerodrome basic data. [source: <https://lotniska.dlapilota.pl>]

ICAO code	EPBC
Status	Aerodrome
Coordinates	N52°16'09.1" E20°54'26.0"
Radio	Babice-Information 119.180 MHz, Babice-Radio 122.305 MHz
Elevation	348 ft
RWY	1) 102/282 (10R/28L), 1301 x 90 m (concrete), 2) 102/282 (10L/28R), 1000 x 150 m (grass)
Comments	Flights above the aerodrome shall be conducted along the northern circuit at 1823 ft AMSL (1476 ft AGL).

1.11. Flight recorders

None.

1.12. Wreckage and impact information

Not applicable.

1.13. Medical and pathological information

No medical aspects were found that could have affected the course of the occurrence.

1.14. Fire

Fire did not occur.

1.15. Survival aspects

The crew did not suffer any injuries and the plane, despite gear up landing, was only slightly damaged. It resulted from the aircraft design: high wing with engines located significantly above the lower line of the fuselage, and the flat shape of its lower part. Wide experience and high skills of the flight instructor also had a positive impact on the landing.

1.16. Tests and research

The aircraft was inspected after the incident. In particular, the standard and alternate landing gear extension system, and the procedure for emergency landing issued by the aircraft manufacturer were checked. In cooperation with the maintenance organization, landing gear retraction and extension tests were carried out with the aircraft was lifted. Simultaneously measurement of the electric current consumed by the hydraulic pump of the landing gear retraction and extension system was measured. Electrical relays in the circuit supplying power to the electric motor of the landing gear hydraulic pump were examined using computer tomography.

1.17. Organizational and management information

The flight was performed as a part of a commercial training activity conducted by the aircraft user.

1.18. Additional information

The incident aircraft repeatedly had problems with retracting and extending the landing gear using the standard system. Each time, the cause of the problem was electrical relay in the power circuit of the hydraulic pump motor of the landing gear retraction and extension system. The relays installed in this type of aircraft experienced failures consisting in fusing of their contacts, which means that even after retracting the landing gear, the hydraulic pump motor was still powered, the pump worked and produced pressure, which in turn caused problems with the landing gear extension. The previous incident of this type occurred on the same aircraft on 27 February 2022 (PKBWL reference No: 2022/810), but at that time the landing gear was extended by the alternate system. After that occurrence, the relays in the system were replaced with new ones. Similar malfunctions also occurred on other aircraft of the same type - e.g. on 2 October 2021, on SP-ZNA (PKBWL reference No: 2021/3930).

1.19. Useful or effective investigation techniques

Standard investigation techniques were applied.

2. FINDINGS

Two electric relays are installed in the circuit supplying power to the motor of the hydraulic pump of the landing gear retraction and extension system (Fig. 3 and Fig. 4).

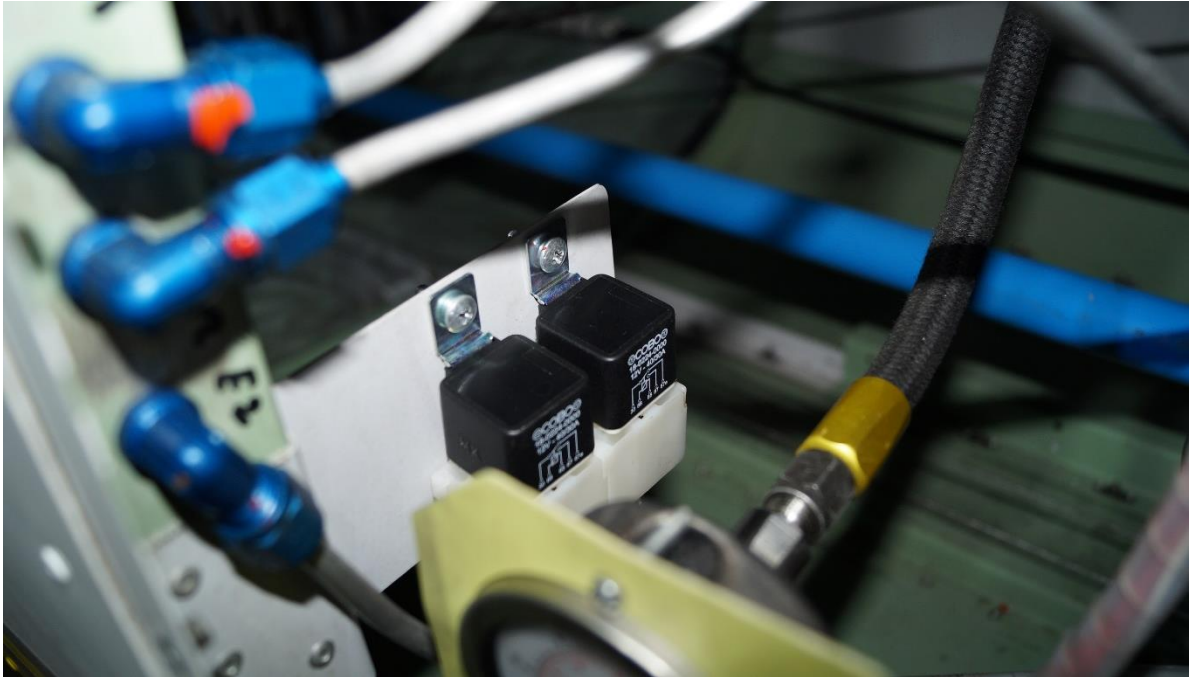


Fig. 3. Landing gear extension and retraction system electrical relays installed on Tecnam P2006T aircraft

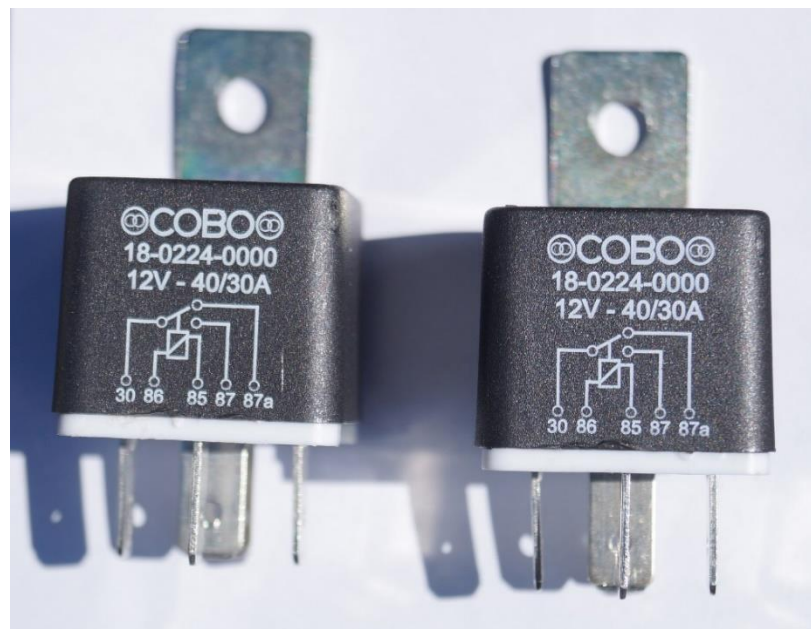


Fig. 4. Landing gear extension and retraction system electrical relays removed from the Tecnam P2006T aircraft

According to the marking on the housing of each relay, the maximum current load of the relays is 40/30A. SCAA, in cooperation with the Tecnam P2006T aircraft maintenance organization, measured the current flowing through the relay in the course of retraction and extension of the landing gear. The results of the

measurements show that the value of the current depends on several factors. During multiple landing gear extension and retraction in hangar conditions, the values of the maximum current fluctuated in the range of 20-30 A, however, several times reached the value of 38-39 A, and exceeded the value of 40 A twice. The highest current in the circuit occurred during the first landing gear retraction, after a few days' break in the operation of the aircraft. In subsequent cycles, the already operating system indicated lower values of the current of the hydraulic pump motor.



Fig. 5. Measurement of the current flowing through the landing gear extension and retraction system electric relays, photographed during the test

It should be noted that the landing gear tested in hangar conditions was not subjected to aerodynamic and inertial forces occurring in real flight conditions. Therefore, it can be assumed that these forces, creating additional resistance against retracting the landing gear in flight, causes an additional increase of the value of the current consumed by the hydraulic pump motor. In the described situation, the electric relays in the landing gear retraction and extension system are systematically overloaded, which results in their frequent failures.

The relays that failed on 23 May 2022 were tested using computer tomography. The tests revealed deep burns and deformation of the relay contacts. The images obtained during the tests are shown in Fig. 6 and Fig. 7.

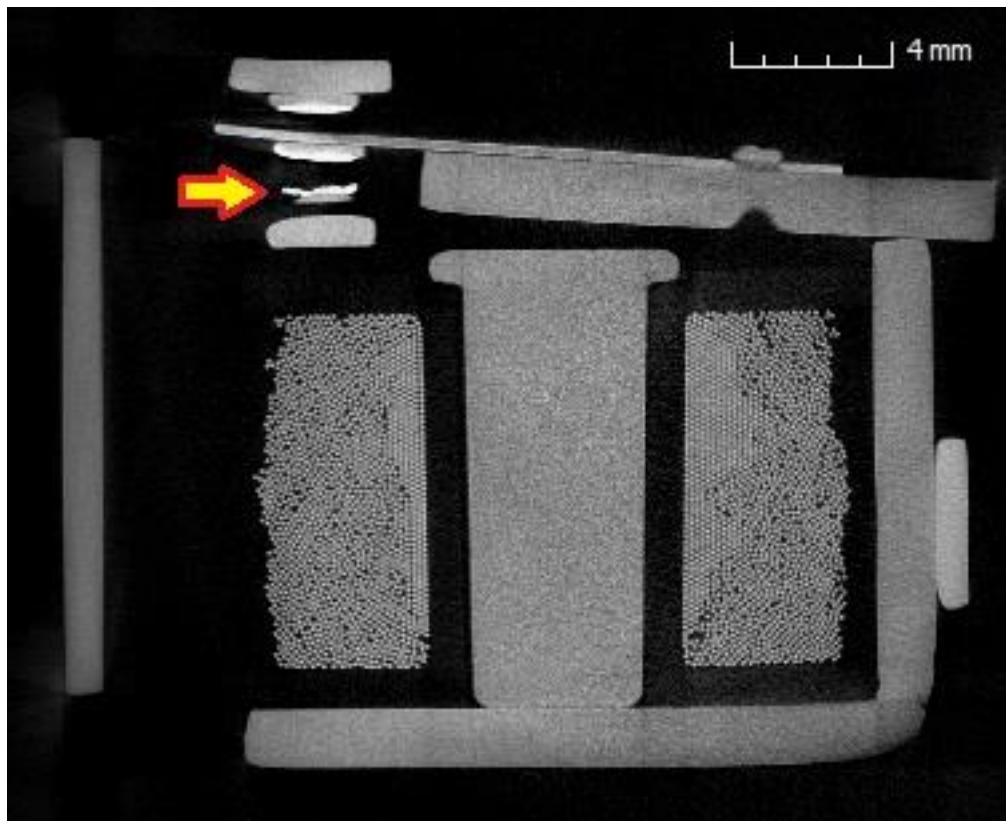


Fig. 6. Internal structure of one of the relays used in the electric circuit of the landing gear hydraulic pump motor. Visible deep burn is seen on the lower contact (marked with an arrow) [source: Warsaw University of Technology]

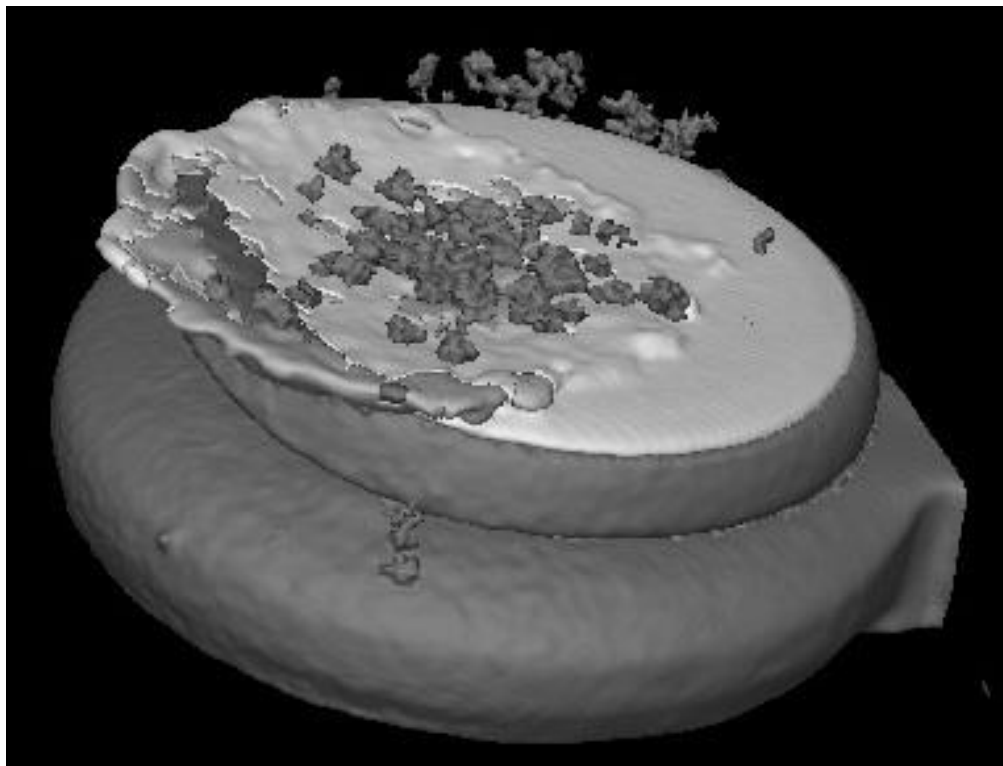


Fig. 7. Degraded contact surface of one of the relays used in the electric circuit of the landing gear hydraulic pump motor [source: Warsaw University of Technology]

A faulty relay (with fused contacts) causes the hydraulic pump motor to operate even when the landing gear extension lever is moved to the lower position.

The procedure of emergency landing gear extension in the Tecnam P2006T aircraft involves the use of two valves located near the legs of the pilot sitting on the left side. When the first (right) valve (marked "FIRST DISCHARGE") is opened, the pressure in the hydraulic system responsible for keeping the landing gear in the retracted position drops, and the landing gear may extend by gravity (under its own weight). Opening the second (left) valve (marked "THEN EMERGENCY") increases the pressure in the hydraulic system responsible for keeping the landing gear in the extended position.

If the relay contacts described above are fused, the hydraulic pump is still operating and keeps the landing gear in the retracted position, even if the first valve is opened. A similar situation may occur in the case of blocking (or breaking) the landing gear lever in the upper position.

The solution to this problem would be breaking the circuit of the hydraulic pump motor by pulling the circuit breaker labelled "LANDING GEAR". Unfortunately, such an action has not been included in the procedure „EMERGENCY CHECKLIST LDG GEAR”.



Fig. 8. The circuit breakers panel of the Tecnam P2006T aircraft with the marked "LANDING GEAR" circuit breaker

The circuit breaker "LANDING GEAR" should also be marked with a bright colour to avoid an error in a stressful emergency situation when pulling it out.

During the inspection some other elements of the electric system of the landing gear control circuit, such as wires and electrical connectors also raised concerns. The used components are not appropriate to the current load in this circuit. An example can be the electrical connector shown in Fig. 7 used on the electric motor of the landing gear hydraulic pump. The information obtained from the Tecnam P2006T aircraft maintenance organization shows that there have been cases of overheating and burning of this connector.

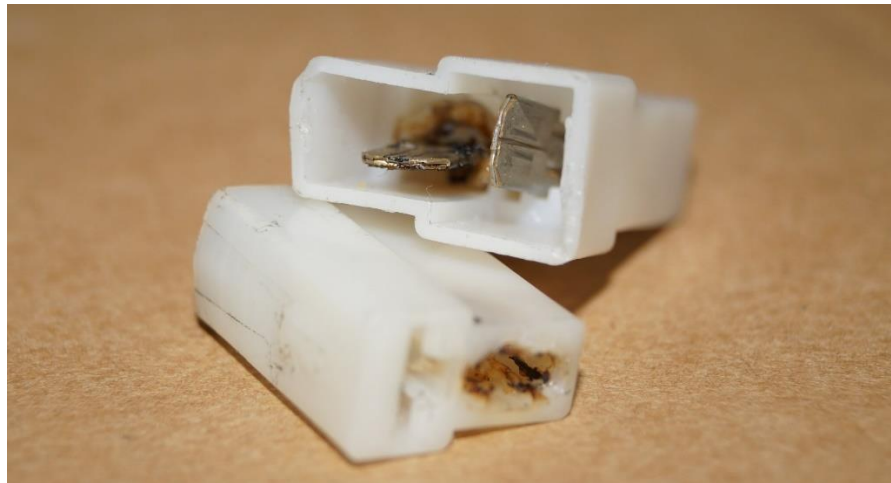


Fig. 9. Damaged electrical connector of the Tecnam P2006T airplane on the electric motor of the landing gear hydraulic pump

During the inspection of the emergency landing gear extension system of the aircraft, the design of mounting the right valve lever of this system (marked "FIRST DISCHARGE") also raised concerns of the PKBWL.

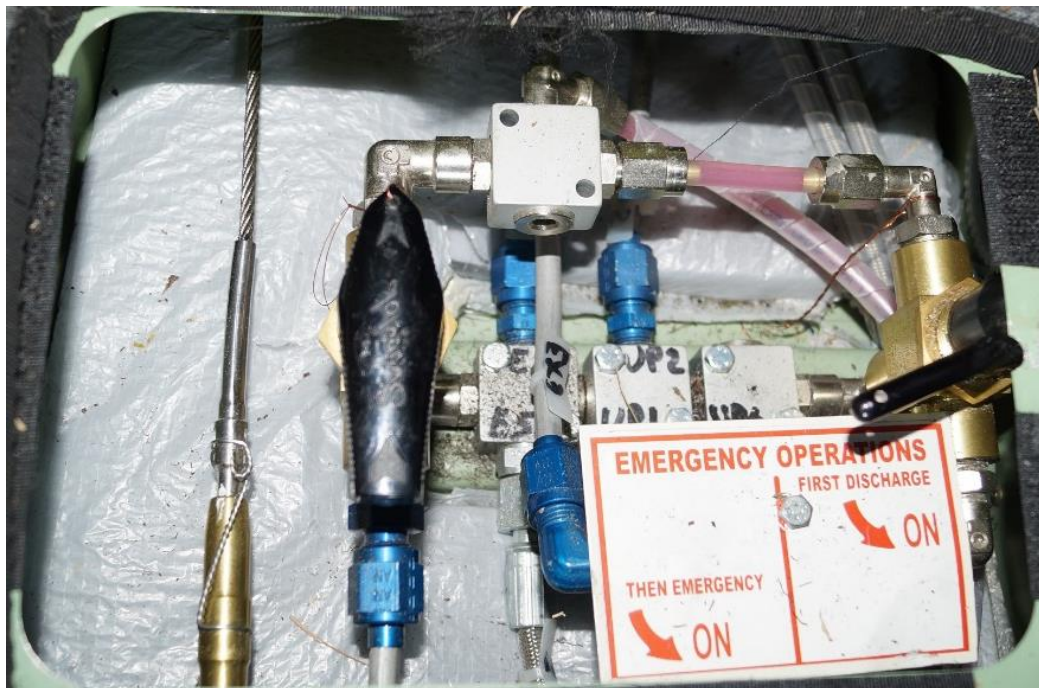


Fig. 10. Valves of the emergency landing gear extension system in the Tecnam P2006T airplane

The lever mounted on the valve shaft has been secured by a single grub screw. If this screw is loosened by just half of turn, the valve remains closed despite the lever movement, which prevents the landing gear from being extended in an emergency. In the opinion of the PKBWL, the connection of the lever with the valve shaft should be changed so that they cannot be accidentally disconnected during operation of the aircraft.



Fig. 11. Connection of the lever with the right-hand valve of the emergency landing gear extension system. The arrow marks the grub screw that prevents the free rotation of the lever on the valve shaft

3. AD HOC SAFETY RECOMMENDATIONS

During the investigation of the occurrence, the PKBWL determined that the technical solutions used in the landing gear extension and retraction system of Tecnam P2006T aircraft create hazards to the flight safety and, therefore, should be immediately modified as described below in the detailed recommendations.

1) Recommendation 2022/2456/1

The value of the current of the hydraulic pump motor of the landing gear in some situations exceeds the value of the rated current of the components used in this circuit, which causes fusing of the relay contacts and overheating of the connector on the hydraulic pump motor.

Therefore, SCAAI recommends that the manufacturer of the Tecnam P2006T airplanes analyses the parameters of the components used in the landing gear retraction and extension system, and then replaces all system components whose load is higher than their rated currents values.

2) Recommendation 2022/2456/2

During the investigation the PKBWL determined that if during aircraft operation, the relay contacts in the circuit of the landing gear hydraulic pump motor are fused, or the landing gear lever is blocked in the upper position, the hydraulic pump works and maintains the pressure in the system (despite opening the FIRST DISCHARGE valve), which prevents the landing gear from being extended in an emergency. In such case, the pressure can be reduced only by pulling out the "LANDING GEAR" circuit breaker.

For the above reasons PKBWL proposes that the manufacturer of Tecnam P2006T airplanes considers a modification of the alternate landing gear extension procedure by adding a provision that in such a need the LANDING GEAR circuit breaker must be pulled out and that the abovementioned circuit breaker must be appropriately marked.

3) Recommendation 2022/2456/3

During the investigation PKBWL determined that the lever mounted on the shaft of the FIRST DISCHARGE valve is insufficiently secured against spontaneous loosening. This fact was revealed on the serious incident aircraft. Loosening of the lever allows for its free rotation around the valve shaft, which prevents the valve opening and reduction of the pressure in the system prior to opening THEN EMERGENCY valve.

Therefore PKBWL recommends that the manufacturer of the Tecnam P2006T aircraft modifies the connection of the FIRST DISCHARGE valve lever with the valve shaft so that it is not possible to loosen it spontaneously during operation of the aircraft airplane (e.g. use a splined joint).

4) Recommendation 2022/2456/4

Implementation of recommendations **2022/2456/1**, **2022/2456/2** and **2022/2456/3** requires time, but irregularities found during the investigation may result in the inability to extend the landing gear via alternate system, which poses a real hazard to flight safety.

Therefore, PKBWL recommends that the manufacturer of the Tecnam P2006T aircraft, issues a service letter/bulletin informing aircraft users about the above problems and defining a temporary solutions, until the above recommendations will have been implemented.

THE END

Investigator-in-Charge

Signature on original

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