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Summary Report

With regard to this serious incident, a summary investigation was carried out in accordance with Arti-kel 45 of the Ordinance on the Safety Investigation of Incidents in The Transport System of 17 December 2014 (VSZV), as of 1 February 2015 (SR 742.161). This report was prepared with the aim of learning something from this incident.

Aircraft Pacific Aerospace 750XL HB-TSA
Holder Paravia AG, Rathausstrasse 7, 6340 Baar
Owner Paravia AG, Rathausstrasse 7, 6340 Baar
Pilot Schweizer Bürger, Born 1995
License (*Private Pilot Licence Aeroplane – PPL(A)*) (*European Aviation Safety Agency – EASA*) issued by the Federal Office of Civil Aviation (FOCA)
Flying Hours
Total 594:40 h, during the last 90 days 187:49 h
...On the incident pattern 231:33 h, during the last 90 days 169:09 h
Date and time: 16 August 2018, 15:51 hr
Mode Private
Flight Rules Visual Flight Rules – VFR
Starting Point Luzern-Beromünster LSZO)
Destination Dübendorf (LSMD)
Flight Phase Take Off

Type of serious incident Loss of the right main landing gear

Injuries to persons No Injuries

Damage to the aircraft Slightly damaged Right wing

Third parties harm Nil

Facts

On 16 August 2018, the pilot carried out a series of flights to drop parachutists over Lucerne-Beromünster airfield with the Pacific Aerospace 750XL aircraft registered as HB-TSA. At 3:51 p.m., he took off with the HB-TSA stationed there on The Graspiste 33 with eleven skydivers on board for his sixth flight of the day. Its fuel supply was still equivalent to a maximum flight duration (endurance) of about 1:10 h.

After a take-off run of about 100 m, the right main landing gear detached from the aircraft, so that it suddenly tilted around its longitudinal axis to the right and hit the right wing on the runway. The landing gear still hanging from the brake line smashed through the right landing flap and then remained on the runway. The pilot continued the take-off process in an unaltered direction and took the aircraft off the runway.

During the initial ascent, the parachutists sitting on the plane told the pilot that a hole could be seen in the wing. From the ground, the pilot also received information via radio that he had lost a wheel. Subsequently, in consultation with the air traffic management, the pilot initially continued the climb flight in order to drop off the skydivers from an altitude of 1500 m above the Lucerne-Beromünster airfield.

The pilot told the air traffic control that he planned to land at Buochs (LSZC) airfield after dropping off the parachutists. The local fire brigade was then placed on heightened standby. Together with the air traffic management, a connection was also considered at the Airport Emmen (LSME). The pilot announced that he would be waiting before landing in order to land with the lowest possible fuel.

A Swiss Air Force aircraft listened to the radio traffic. It announced that emmen airfield was closed and offered to inspect the departure aircraft. After the two aircraft were merged by the air traffic control, it was confirmed that the main right landing gear was missing (see Figure 1). Together with the flight management, the pilot then decided to land at The Airfield in Dübendorf.



Figure 1: The HB-TSA with the landing gear stump without a wheel (yellow circle) after dropping the parachutists, taken from a Swiss Air Force aircraft.

The pilot planned and carried out a first approach to runway 29 of The Dübendorf airfield with a subsequent take-off. He then flew a few queues over the Greifensee as planned in

order to further reduce the fuel supply. On the second approach, he shut down the engine just before it was set up in order to prevent damage to the engine by touching the propeller on the ground and to minimize the risk of fire.

At 5 p.m., the HB-TSA took off on the runway. After lowering the right wing to the piste, it maintained its direction and came to a halt on the middle line of the piste (see Figure 2). Apart from damage in the area of the crease of the right wing and in the right landing flap, the aircraft had no other externally recognizable damage.



Figure 2: The HB-TSA after landing on runway 29 of Dübendorf airfield.

Meteorological data

Switzerland was under the influence of an Azores high. For the time of 15:50 o'clock the nearest commercial airport Zurich (LSZH) reported the following weather conditions: wind from variable direction with 4 knots, no cloud cover below 8000 ft above ground, visibility over 10 km, dew point 29°C, 10°C, air pressure (QNH) 1016 hPa, no significant change expected for the following two hours.

Findings

On the right main landing gear, the upper fastening bolt of the torque link (see red arrows in Figure 3) had been lost. As a result, the lower, movable part of the workleg, including the wheel, could fall out of the upper, immovable part when springing out. So-probably the lower as well as the upper part remained practically undamaged.

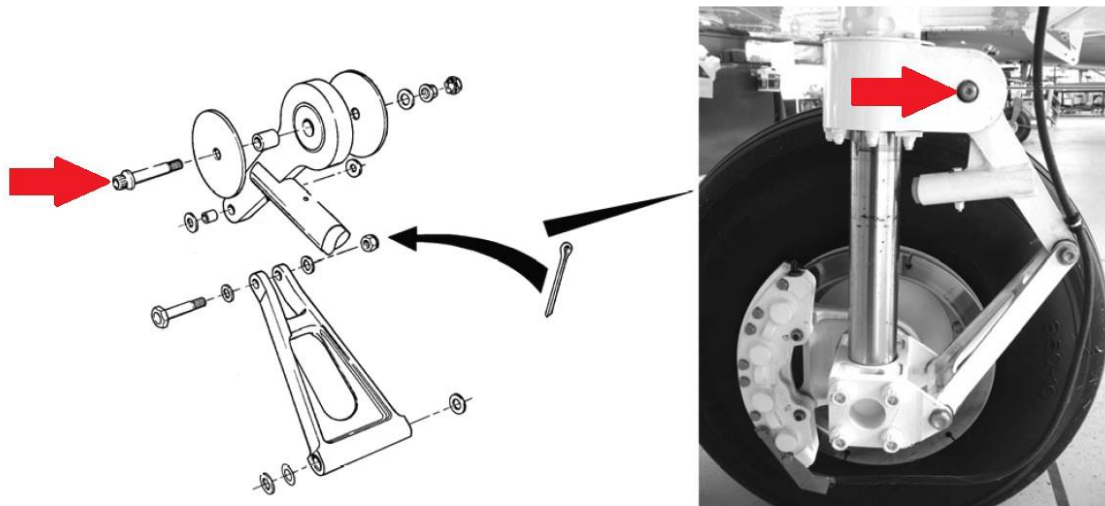


Figure 3: Right main landing gear leg with an exploded drawing of the torque link, whose above-right fastening bolt (red arrows) was lost (figure from the maintenance manual of the aircraft manufacturer).

The fastening bolt could be secured on the runway of the take-off airfield. It was broken on the thread side and had strong corrosion suppreses, especially in the fracture area (see Figure 4). A trace examination concluded that the bolt had sufficient material quality, but was broken due to fatigue. The vibrational cracks leading to this fatigue fracture had been initiated by the corro-sion.



Figure 4: Broken fastening bolt with a conspicuously snarling surface in the fracture area.

It was also found that the lubricating nipple of the affected joint was missing from the upper arm of the torque link and that this joint was in an unlubricated state. The traces found indicate that the lubricating nipple must have been broken off a long time ago and that the remaining and surviving part of the torque link must have been processed with a file (see red arrow in Figure 5).



Figure 5: Upper arm of the torque link with an intact lubricating nipple (left green arrow) and the broken and file-processed lubricating nipple of the affected joint (right red arrow).

Maintenance work

The manufacturer requires the joints of the landing gear to be lubricated every 150 hours of operation or after 1500 landings. Every 300 operating hours or after 3000 landings, the joints must be disassembled and the individual parts checked for wear. In the present case, the aircraft had flown approximately 94 hours of operation at the time of the accident since the last 300-hour inspection carried out in June 2018.

Measures taken

The manufacturer announced an update of the Maintenance Manual (AMM) of the 750XL type in September 2019, which would improve the inspection requirement of the 300 h control, in particular the torque link of the main landing gear.

Analysis

Technical aspects

The fastening bolt suffered a fatigue fracture and went away. This fatigue fracture arose from a highly advanced corrosion of this bolt. The corrosion was caused by its lack of lubrication. It must be assumed that the head of the lubricating nipple in question was torn off during tightening a long time ago and instead of a repair the remaining piece of the lubricating nipple was reworked.

Two months before the accident, a 300-hour check was carried out, in which the affected bolt had to be removed and inspected. Its corrosion damage was not objected to, even though these must have been caused over a long period of time. In addition, this control also included the lubrication of the affected joint, which was not possible due to the broken lubricating nipple and was also not objected to.

Operational aspects

The grass runway of Lucerne-Beromünster airfield has a rough surface. On the one hand, this favoured the development of the fatigue fracture, because the main landing gear springs out several times and abruptly to the stop during each start-up process. On the other hand, these unevennesses also made it possible in the present case that the lower part of the right landing gear was able to detach from the aircraft at an early take-off stage.

The ground contact of the right wing at full engine power and just before the necessary lifting speed was a considerable risk for the occupants. It is due to the geometry of the articulated wings and the attachments mounted below the creases that the underside of the wing hardly touched the ground, because these attachments acted as a skid, thus enabling a continuation of the take-off run and a trouble-free landing (see Abbildung 2).

The pilot's decision to continue the climb and drop the skydivers over the take-off airfield was safety-conscious. The decision-making process for the operation in Dübendorf, in cooperation with the air traffic control and the air force aircraft, for setting up with a minimum fuel supply and with a standing engine, also testifies to a prudent approach of the pilot.

Conclusions

The accident is due to the break age of a bolt on the right main landing gear. This was corroded and unlubricated, which was not recognized or detected in the periodic maintenance work, but was not corrected.

Since it is not to be expected that further investigative acts would provide additional useful findings, further investigative acts are waived on the basis of Article 45(1) of the VSZV.