



## Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents from 17<sup>th</sup> December 2014 (OSITI), as of 1<sup>st</sup> February 2015 (SR 742.161), was carried out with regards to the following serious incident. This report was prepared to ensure that lessons can be learned from the incident in question.

<b>Aircraft type</b>	Cessna 525A	EC-KES	
<b>Operator</b>	Taespejo Portugal, Lda, Rua de Grivão, 12B, 7350-076 Elvas, Portugal		
<b>Owner</b>	Banco Santander, S.A., Rua de Grivão, 12B, 7350-076 Elvas, Portugal		
<b>Pilot</b>	Portuguese citizen, born 1967		
<b>Licence</b>	EASA (European Aviation Safety Agency) Commercial Pilot Licence Aeroplane (CPL(A)), issued by the Portuguese Civil Aviation Authority ( <i>Autoridade Nacional da Aviação Civil – ANAC</i> )		
<b>Flight hours</b>	<b>Total</b>	6,878 h	
	<b>During the last 90 days</b>	89:22 h	
	<b>On the aircraft type</b>	3,540 h	
	<b>During the last 90 days</b>	89:22 h	
<b>Co-pilot</b>	Spanish citizen, born 1985		
<b>Licence</b>	EASA CPL(A) issued by the Spanish Aviation Safety Agency ( <i>Agencia Estatal de Seguridad Aérea – AESA</i> )		
<b>Flight hours</b>	<b>Total</b>	1,001:25 h	
	<b>During the last 90 days</b>	78:48 h	
	<b>On the aircraft type</b>	274:27 h	
	<b>During the last 90 days</b>	78:48 h	
<b>Location</b>	Bern Airport (LSZB)		
<b>Coordinates</b>	---	<b>Altitude ---</b>	
<b>Date and time</b>	2 <sup>nd</sup> March 2018, 21:17 (LT = UTC + 1 h)		
<b>Type of operation</b>	Commercial		
<b>Flight rules</b>	Instrument Flight Rules (IFR)		
<b>Departing from</b>	Lille Airport (LFQQ), France		
<b>Destination</b>	Bern Airport (LSZB)		
<b>Flight phase</b>	Landing		
<b>Type of serious incident</b>	Aircraft running off the side of the runway		
<b>Injuries to persons</b>	<b>Crew members</b>	<b>Passengers</b>	<b>Third parties</b>
Minor	0	0	0
None	2	3	0
<b>Damage to aircraft</b>	Minor	Dents on the flaps and landing gear doors, mud deposits on the left engine	
<b>Third-party damage</b>	Several broken runway edge lights and taxiway lights		

## Factual information

### Background

This description of the history of the flight is based on statements made by the flight crew and on radar recordings. There was no Cockpit Voice Recorder (CVR) nor a Flight Data Recorder (FDR) installed in the twin-engine business aircraft, Cessna 525A "Citation Jet CJ2", registered as EC-KES. After all, this was not a requirement.

At midday on 2<sup>nd</sup> March 2018, the crew, consisting of a Pilot In Command (PIC) and a First Officer (FO), flew EC-KES from Geneva (LSGG) to Lille (LFQQ) in France with three passengers on board. Due to snowfall in the afternoon and a temporary closure of the runway in Geneva as a result, the return flight in the evening was planned to Bern (LSZB). Both the PIC and FO were already familiar with Bern Airport from previous flights. For the scheduled landing time, the Terminal Aerodrome Forecast (TAF) indicated light wind conditions with no precipitation as well as visibility at ground level of 5,000 m and a ceiling of 4,500 ft above airport elevation. The final approach speed calculated for the approach to Bern was 115 kt.

### History of the flight

At 20:15, EC-KES took off from Lille with ICAO flight number TES 202, carrying approximately 3,800 lb of fuel on board. The stipulated minimum amount of fuel for this flight was 2,713 lb, meaning that the aircraft was carrying extra fuel allowing for an additional 1:38 h of flying time. The FO was the Pilot Flying (PF), whilst the PIC was the Pilot Monitoring (PM). During the flight, the crew obtained information about the current weather in Bern. According to the Automatic Terminal Information System (ATIS) at 20:50, approx. 25 minutes before landing, visibility at ground level was 5,000 m with a variable wind of 2 kt and light cloud at 11,000 ft above airport elevation. In addition, shallow fog (MIFG) below 2 m and good braking action over the entire length of the damp runway were reported. The crew carried out an approach briefing, during which, as per their statements, they also addressed the runway lighting.

At 21:10, Bern's Aerodrome Control Officer (ADCO) informed the crew that patches of shallow fog had formed in the area between the start of runway 14 and Taxiway (TWY) A, and that the runway lighting had been set to maximum brightness.

At 21:13, the ADCO gave the crew of EC-KES clearance to land on runway 14 and said that there was no wind. The crew acknowledged this and added that they already had full view of runway 14. At this moment, the aircraft, which was flying at an altitude of 5,000 ft Above Mean Sea Level (AMSL), was already aligned to runway 14's Localiser (LOC) and still around 10 NM away from runway 14's threshold. Upon reaching the glideslope, approx. 7 NM before runway 14's threshold, the Ground Speed (GS) was approx. 205 kt. Whilst descending further along the glideslope, the GS remained roughly constant up to 3.5 NM before the runway threshold. The GS then steadily reduced until it reached around 160 kt at a distance of 2 NM from the runway threshold. At this moment, EC-KES was at a flying altitude of approx. 2,700 ft AMSL or 1,000 ft above airport elevation. Subsequently, a further decrease in GS was recorded; at the last data point at 20:15:27 UTC at a distance of 1.6 NM from the runway threshold, the GS was still 138 kt. At the time of approach, according to data from the meteorological service, there was light wind with a maximum wind speed of 3 kt between 4,000 ft AMSL and ground level.

Shortly before reaching the decision altitude, the FO switched off the autopilot and flew EC-KES manually until landing. After the flight, the crew stated that during this phase the aircraft had fallen slightly below the glideslope, but that this was corrected immediately by the FO. They stated that the entire approach was stabilised, the approach proceeded without any problems and the view of the runway was not restricted. According to statements made by the crew, the aircraft touched down at a normal rate of descent, perhaps slightly to the left of the middle of the runway. They stated that subsequently, the aircraft suddenly yawed slightly to the left around its vertical axis as if the runway was slippery and ended up on the left-hand

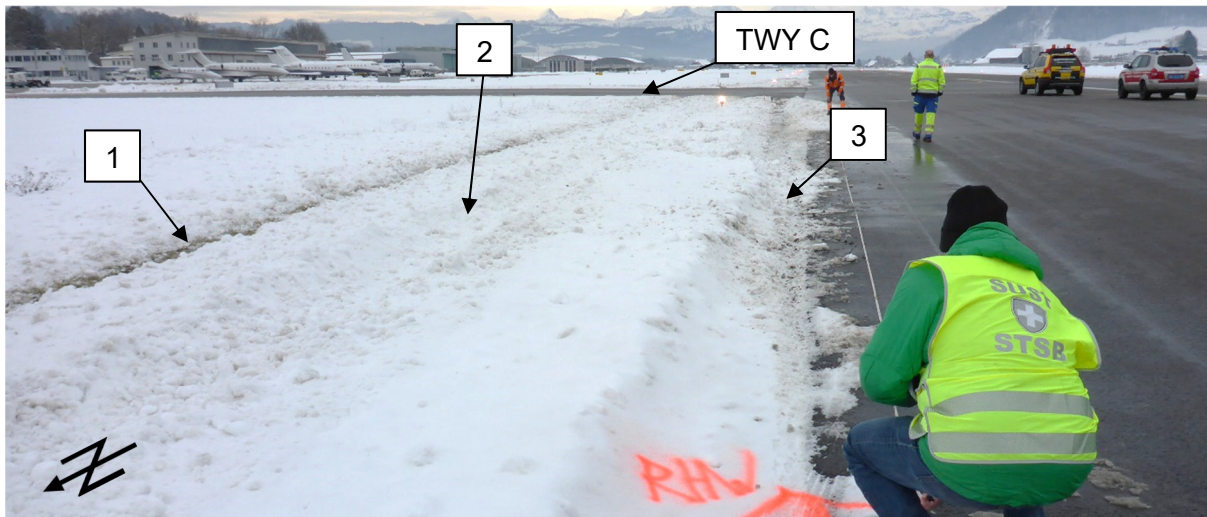
side of the runway, perhaps in the snow to the left of the runway. They said that the PIC then took over control and steered the aircraft back to the right, to the middle of the runway.

The aircraft left the runway and taxied to the parking position without any further problems. After parking the aircraft on the apron and the passengers had disembarked, the crew noticed that the doors of both main landing gears and the left flap were damaged. In addition, all of the wheels and the underside of the fuselage as well as of the wings were covered in mud and the left engine exhibited mud on the in- and outlet.

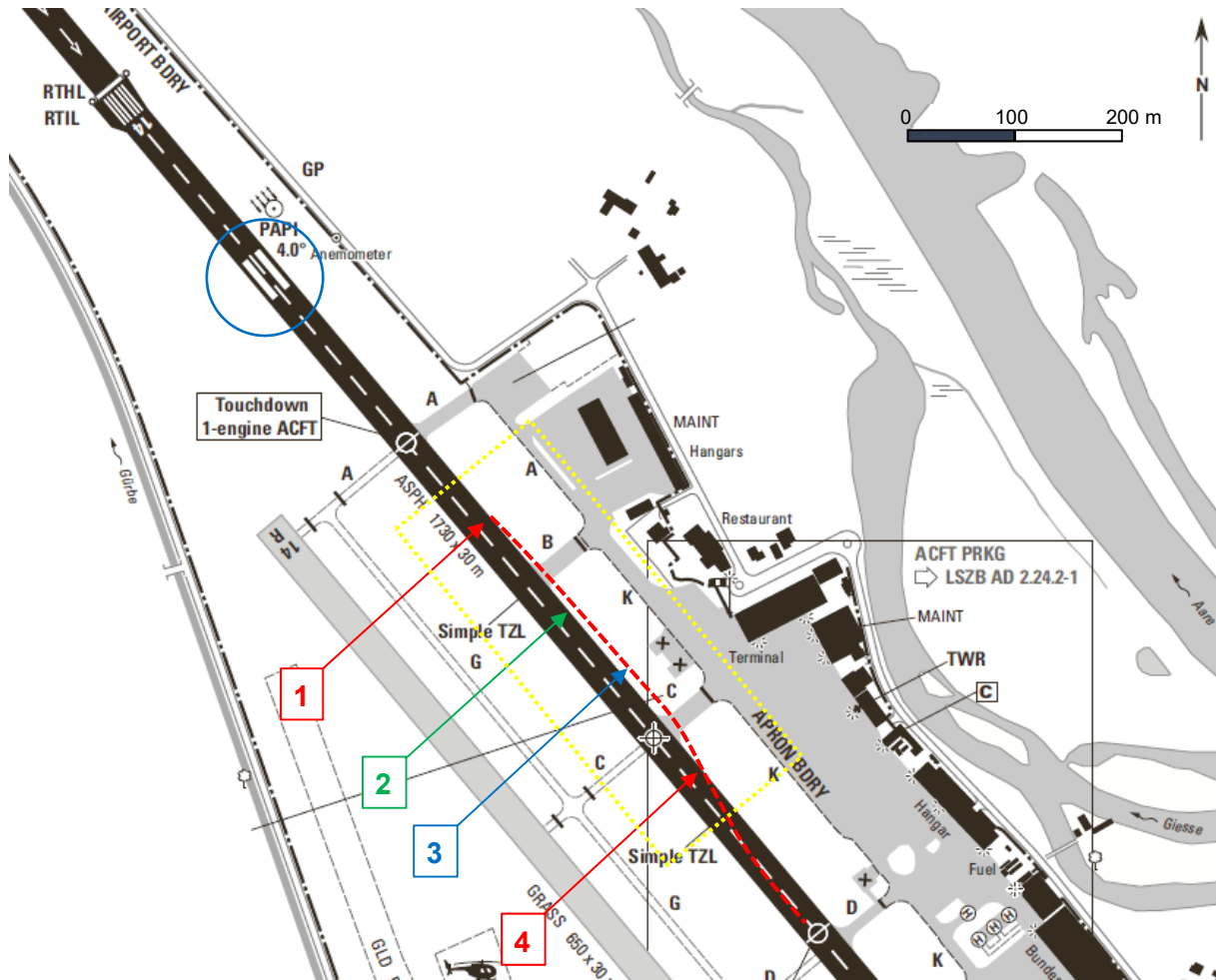
Immediately after the incident, an inspection of the runway was carried out and the friction coefficient (FC) was measured along the runway. The FC along the entire runway was around 0.7, which results in good braking action. During the inspection, wheel tracks were found in the snow to the left of the runway, along with mud on the runway, as well as several runway edge lights and taxiway lights that had broken off.

## Findings

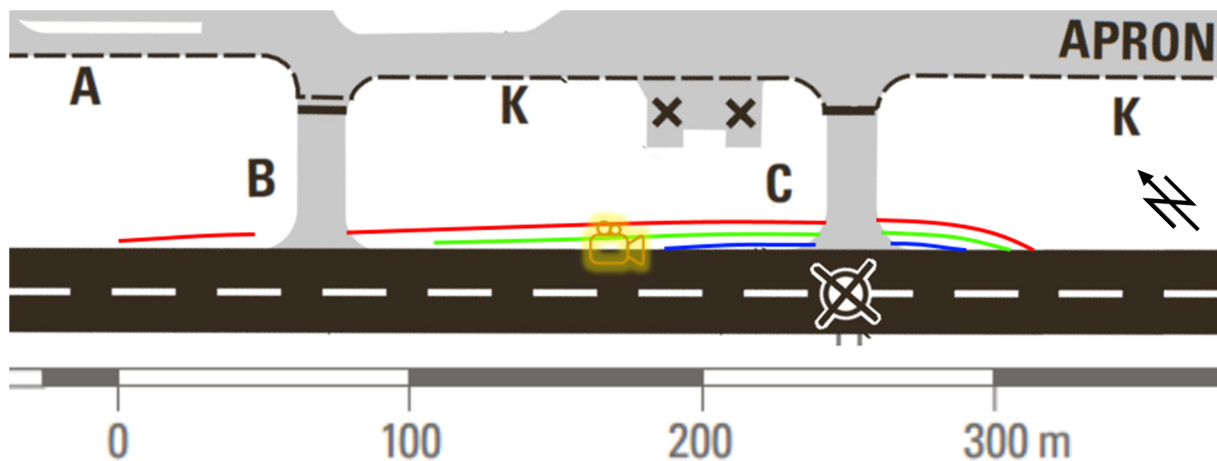
The wheel tracks in the snow were measured on the same night and a second time the following day. The first wheel track, which due to the course of the track (see image 2 and image 3) could be attributed to the left-hand-side main landing gear, started with a slight imprint in the snow around 0.5 m to the left of the runway boundary and around 65 m before TWY B, and ended approx. 2 m to the left of the runway boundary and approx. 27 m before TWY B. Immediately after TWY B, the track made by the left-hand-side main landing gear started again, this time with an imprint down to the frozen ground under the snow. Approx. 42 m after TWY B and approx. 1 m to the left of the runway boundary, the wheel track in the snow made by the nose landing gear started, which only left a slight imprint in the snow as it continued. Approx. 60 m before TWY C, the wheel track made by the right-hand-side main landing gear also ran into the snow to the left of the runway boundary (see image 1). After TWY C, the wheel tracks clearly bent to the right, back onto the runway, where they ended approx. 75 m after TWY C.



**Image 1:** South-easterly view along the left-hand boundary of the runway, approx. 60 m before TWY C: the wheel track made by the left-hand-side main landing gear is visible on the left (1), to its right is the slight imprint of the wheel track made by the nose landing gear (2), and the wheel track made by the right-hand-side main landing gear can be seen on the right (3, orange arrowhead containing the letters 'RHW').



**Image 2:** Section of the aerodrome chart from Bern Airport (LSZB) showing the path on which EC-KES rolled after landing (red dotted line). The red arrow (1) shows where the left-hand-side main landing gear first touched down in the snow to the left of the left-hand boundary of the runway. The green arrow (2) shows where the nose landing gear touched down. The blue arrow (3) shows where the right-hand-side main landing gear also rolled into the snow to the left of the runway. The second red arrow (4) shows where the aircraft returned to the runway. The blue circle indicates runway 14’s aiming point marking, the yellow-dotted rectangle marks the section shown in image 3.



**Image 3:** Enlarged section of the runway showing taxiways A, B and C with the tracks made by the three landing gears of EC-KES (red = left-hand-side main landing gear, green = nose landing gear, blue = right-hand-side main landing gear). The camera symbol marks the position from which image 1 was taken.

The distance between the two outer wheel tracks in the snow was around 4.9 m, which corresponds to the distance between the wheels of the main landing gear of a Cessna 525A. In the area between TWY B and the end of the wheel tracks in the snow after TWY C, six runway edge and taxiway lights were damaged or in places completely torn off.

The day after the flight, the crew stated that they had set the flaps as usual during the approach, that the landing lights were switched on during landing and that the wheel brakes had reacted and worked as expected on the ground.

### **Airport information**

Air traffic at Bern Airport is primarily handled on the concrete runway 14-32. The two south-westerly grass runways are usually only used by light aircraft and gliders.

The concrete runway is 30 m wide and in runway direction 14, its Landing Distance Available (LDA) is 1,530 m. It is equipped with an Instrument Landing System (ILS) with a glideslope of 4 degrees in runway direction 14. The lighting consists of 660-m-long precision approach lighting, a Precision Approach Path Indicator (PAPI) with 4 degrees, Runway Threshold Identification Lights (RTIL) and Runway Edge Lights (REL).

### **Operating procedures**

The Standard Operating Procedures (SOP) of aviation company Taespejo for Cessna 525 aircraft, revision 0, issued on 1<sup>st</sup> August 2016, includes the following information:

- The recommended final approach speed equates to the reference speed plus 10 kt (VREF + 10 kt).
- Under visual flight rules conditions, an instrument approach can be flown at a higher speed. Here, the Final Approach Fix (FAF) or the descent point when reaching the glideslope should be crossed with the flaps in approach position and at an Indicated Airspeed (IAS) of less than 170 kt. The flaps should be brought into a landing position approx. 4 NM from the runway threshold and the speed reduced to the recommended final approach speed.

### **Analysis**

Upon reaching the ILS glideslope, the GS of EC-KES was still around 205 kt. Taking into consideration the prevailing light wind conditions, this resulted in an IAS of around 193 kt, which correlated with the data transmitted by the Mode S transponder. This is considerably higher than the speed of 170 kt specified in the aviation company's SOP. When descending further, the GS and thus also the IAS remained virtually constant until 3.5 NM before the runway threshold. Around 2 NM from the runway threshold at a flying altitude of 1,000 ft above ground, the IAS was still 158 kt. This was still 43 kt higher than the recommended final approach speed of 115 kt, to which the speed should have been reduced 4 NM before the runway threshold according to the SOP. The delay in reducing the speed clearly indicates that the crew deviated from the stabilised final approach principle, which carries risks.

Due to the steep approach angle of 4 degrees to runway 14 in Bern, the crew may not have realised that the speed would reduce more slowly than usual and therefore initiated this reduction in speed too late.

According to meteorological information, there was light ground fog in the landing zone at the time of landing. In ground fog, it is possible to clearly see an illuminated runway during the entire approach, particularly at night. When flying into the ground fog, however, visual indications of runway edge lights further away that are required as directional information during landing can get lost.

The first section of the wheel track made by the left-hand-side main landing gear between TWY A and TWY B only left a slight imprint in the snow. This indicates that, in this phase, the aircraft was still completing a landing flare and did not fully touch down until reaching the area

of TWY B. The distance from the aiming point marking to the start of the wheel track in the snow was approx. 300 m. According to their statements, the crew did not realise that the aircraft had landed on the left-hand boundary of the runway and rolled for approx. another 300 m along this runway boundary in snow-covered meadowland. The following possible conclusions can be drawn from this:

- The crew mistook the left-hand runway edge lights as the Runway Centreline Lights (RCL) and, when landing, aligned the aircraft with what they believed to be the RCL. No RCL are installed on the runway in Bern.
- Important visual indications and thus directional information that the crew needed for landing got lost when flying into the ground fog. This resulted in the PF failing to notice the lateral deviation to the left and landing the aircraft on the left-hand boundary of the runway.

From the distinct turn to the right, back onto the runway, initiated after TWY C, it can be inferred that by this moment at the latest the crew realised they had landed on the runway edge lights down the left-hand side and were rolling along them.

### Conclusions

During the investigation, it was not possible to determine as to why the aircraft had touched down next to the runway on the runway edge lights down the left-hand side. The following facts are however confirmed:

- The crew executed the instrument approach at a considerably excessive speed and only reduced the speed very late. At a distance of 2 NM before the runway threshold and at a flying altitude of 1,000 ft above ground, the IAS was still 43 kt above the recommended final approach speed. In doing so, the crew clearly deviated from the stabilised final approach principle.
- Following a normal flare, the aircraft touched down in the snow to the left of the runway and rolled for approx. 300 m along the left-hand edge of the runway, before making an abrupt turn to the right, back onto the runway.
- There was shallow fog in the landing zone.
- The surface of the runway was damp. The friction coefficient (FC) along the entire runway was such that good braking action could be achieved.

As no additional useful findings are expected from further investigations, the STSB concludes the investigation with this summary report based on article 45, paragraph 1 of the OSITI.

The German version of this report constitutes the original and is therefore definitive.

Bern, 24<sup>th</sup> May 2018

Swiss Transportation Safety Investigation Board