

Serious incident to the Gulfstream G550 registered M-SAWO

on 10 September 2017

at Paris-Le Bourget (Seine-Saint-Denis)

⁽¹⁾Except where
otherwise indicated,
the times in this
report are in
local time.

Time	17:15 ⁽¹⁾
Operator	Avcon Jet AG
Type of flight	Own-account transport
Persons on board	Captain PM, co-pilot PF and six passengers
Consequences and damage	Aeroplane slightly damaged, runway lighting broken
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in December 2021. As accurate as the translation may be, the original text in French is the work of reference.	

Erroneous identification of the landing runway, path change at low height, activation of angle-of-attack protections, left wing strike with the runway right side lighting during the missed approach

1 - HISTORY OF THE FLIGHT

Note: the following information is principally based on the FDR, statements, radio communication recordings, radar data and observations on the aeroplane and on the site.

The crew carried out a flight between Vienna airport (Austria) and Paris-Le Bourget airport. They were cleared for a LOC A approach to runway 25. The approach was on a heading of 275° with a 26° offset in relation to the runway centreline. During the approach, in good meteorological conditions, the PF aligned on the disused former runway located between runways 27 and 25 at the airport (see [Figure 1](#)). The PF identified her error and turned right at a height of 250 ft to join runway 25.

The aeroplane overshot the runway centreline to the right, at very low height. The angle-of-attack protection was activated and the stick shaker was triggered. The PF initiated a go-around and followed the missed approach procedure. The crew made a second approach and landed normally on runway 25.

The inspection of the runway carried out immediately after the missed approach found a broken light to the right of the runway, 300 m before the displaced threshold. After the flight, damage was observed on the leading edge and the lower surface of the aeroplane's left wing.

2 - ADDITIONAL INFORMATION

2.1 Chronology of the flight

⁽²⁾The CVR equipping the aeroplane has a recording time of two hours.

After the incident, the aeroplane's electrical power supply was kept on: the voice recorder (CVR)⁽²⁾ continued to operate and the recordings corresponding to the incident were overwritten.

At 17:03:29, whilst the crew followed the approach path on heading 272°, the PM changed the altimeter setting from 1013 hPa to 1014 hPa on the LH altimeter. At 17:10:36, the PF made the same adjustment on the RH altimeter.

Note: the altimeter setting selected by the crew (1014 hPa) was incorrect: the actual QNH was 1004 hPa and that reported by the ATIS message was 1005 hPa. Consequently, the altitudes displayed were 280 ft higher than the day's pressure altitude. In the following paragraphs, the altitudes indicated are the pressure altitudes corrected with QNH 1004 hPa.

On flying through 2,600 ft, the PM announced they were established on the runway 25 localizer. The aeroplane descended at approximately -800 ft/min. The crew configured the aeroplane to land (landing gear and flaps extended).

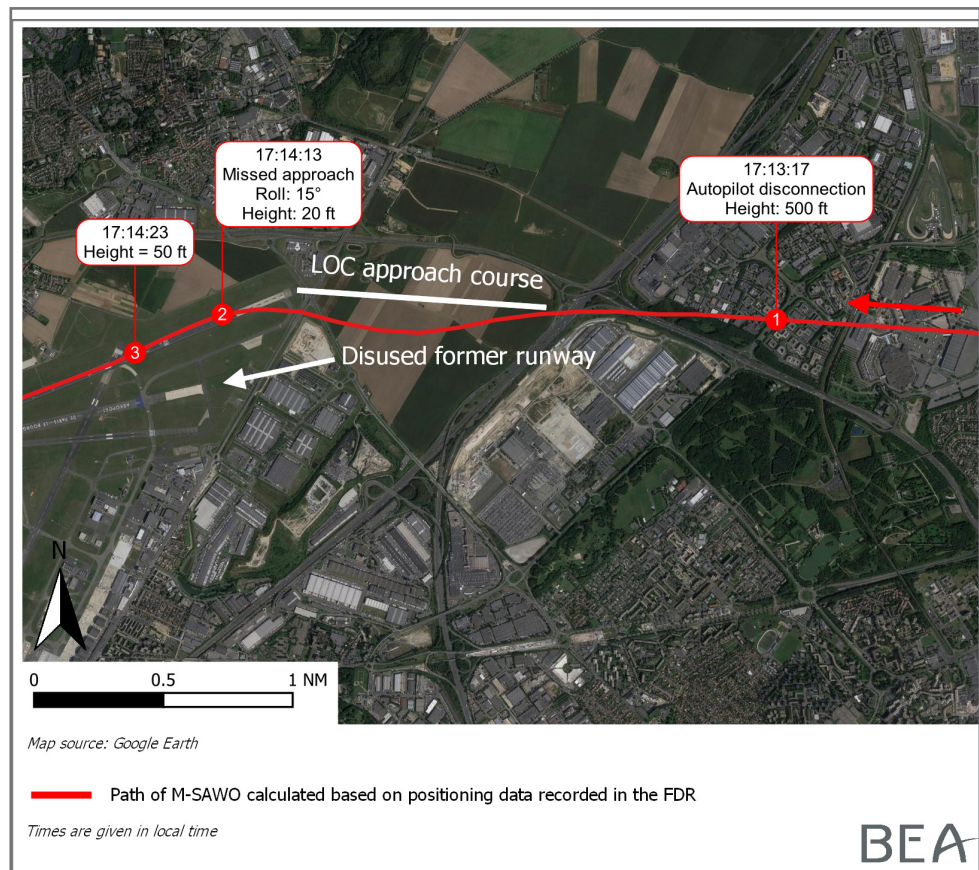


Figure 1: Approach path

At 17:13:17, the crew announced they had sight of the runway and disengaged the AutoPilot (AP) (see Figure 1, point ①). They were cleared to land. The radio-altimeter height was 500 ft and the altitude was slightly above 700 ft. Due to the QNH error, the altitude displayed in the aeroplane was around 1000 ft.

A few seconds later, the PF aligned on a disused former runway located between runways 27 and 25.

At a radio-altimeter height of 250 ft, the PF commanded a right turn towards runway 25.

At 17:14:07, the Calibrated AirSpeed (CAS) of 148 kt started to decrease. The PF then made and maintained a nose-up input. The pitch attitude of -3° started to increase.

At a radio-altimeter height of around 40 ft, the aeroplane overshot the centreline of runway 25, in a left turn with a bank angle of 20° . The engines were at idle. The aeroplane was approximately 600 m before the runway's displaced threshold. The recorded angle of attack increased from 9° to 29° , which activated the angle of attack protection. The stick shaker and the Master Warning were activated for six seconds.

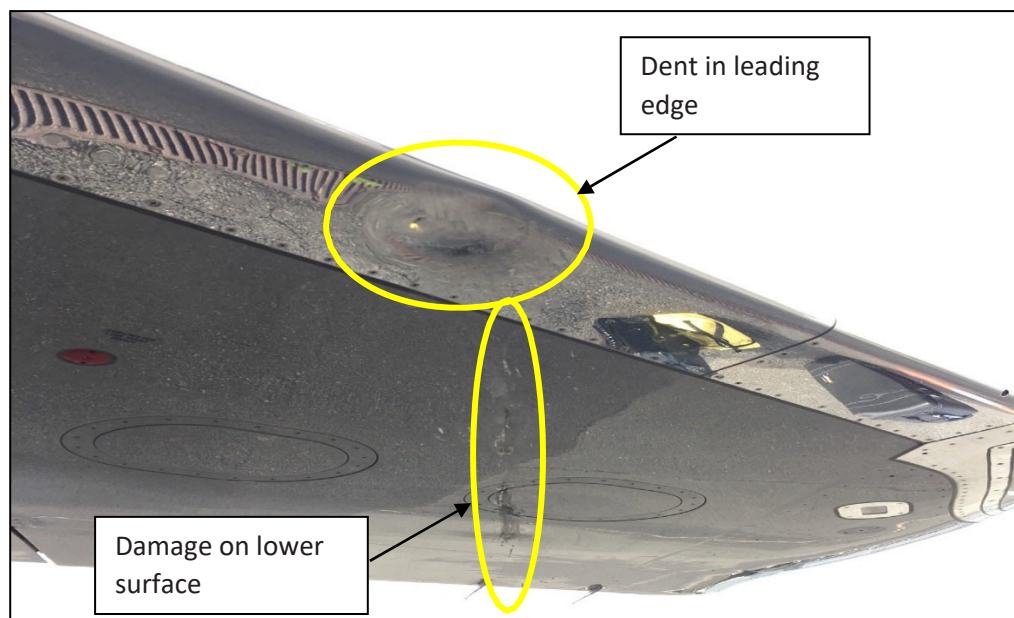
At 17:14:13, the PF aborted the approach (see [Figure 1](#), point ②) and made an input on the engine power control: maximum thrust was reached seven seconds later. The aeroplane was at a height of around 20 ft, offset by 35 m to the right of the runway centreline. The bank angle was 15° to the left.

The left wing of the aeroplane came into contact with and damaged a light to the right of the runway. The aeroplane regained height and the PF levelled the wings (see [Figure 1](#), point ③). The CAS decreased to 131 kt before increasing again.

The PM reported the missed approach to the controller. The controller asked if everything was good and reminded the crew of the go-around path. He then stated that he thought that the aeroplane's wing tip had made contact with the runway.

At 17:16, the controller requested an inspection of runway 25. At 17:26, the team in charge of inspecting the runway confirmed the presence of glass debris before the displaced threshold.

The crew of M-SAWO made a second approach and landed on runway 25 at 17:43. In the parking area, a visual inspection revealed damage on the leading edge and the lower surface of the left wing, near the wing tip.



Source: BEA

Figure 2: Left wing of M-SAWO after the incident

2.2 Meteorological information

The information given in the ATIS message recorded at 16:45 mentioned a wind of 14 kt from 230°, visibility of more than 10 km, few clouds at 3,200 ft, a temperature of 18°C and a QNH of 1005 hPa.

At the time of the incident, the visibility conditions had not noticeably changed. The QNH was 1004 hPa.

2.3 Aircraft information

The information collected in the flight preparation file indicated that the weight and balance was within the limits defined by the manufacturer.

2.4 Crew information

2.4.1 Captain

The 42-year-old captain held a valid Airline Transport Pilot Licence (ATPL(A)) issued in 2010. He had logged 5,200 flight hours, nearly 1,000 hours of which on the Gulfstream 450/550. He held an instructor and examiner rating on type.

The flight was his first flight of the day; his previous flight had been made three days earlier.

2.4.2 Co-pilot

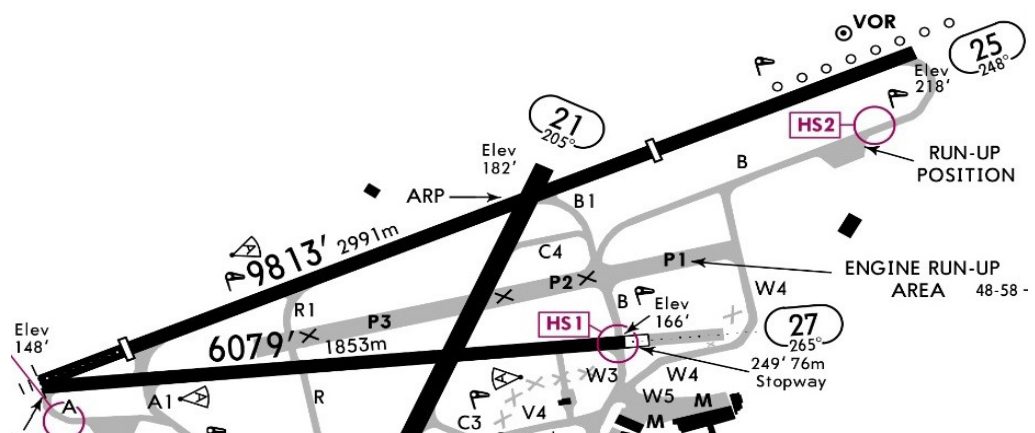
The 32-year-old co-pilot held a valid Airline Transport Pilot Licence (ATPL(A)) issued in 2013. She had logged 3,200 flight hours, more than 1,000 hours of which on the Gulfstream 450/550.

The incident flight was her first flight of the day.

2.5 Approach information

During the descent, the pilots were successively in contact with the approach controller at Paris-Charles de Gaulle airport and then with the tower controller at Paris-Le Bourget airport.

Paris-Le Bourget airport has three intersecting runways: 03-21, 07-25 and 09-27.



Source: Jeppesen

Figure 3: Extract from the chart showing the taxiways and parking areas

A disused former runway (P1, P2, P3), roughly oriented at 260° is located between runways 27 and 25. It measures 1,550 m long and 60 m wide. There are runway closed markings (white crosses 14.5 m wide and 36 m long) in sections P2 and P3. A white *AEROPORT DE PARIS LE BOURGET* marking stretching the length of the disused runway is also visible (see Figure 4).

The surface of the first section of this former runway is of a light colour concrete similar to the concrete surface before the displaced threshold of runway 25.



Source: Google Earth

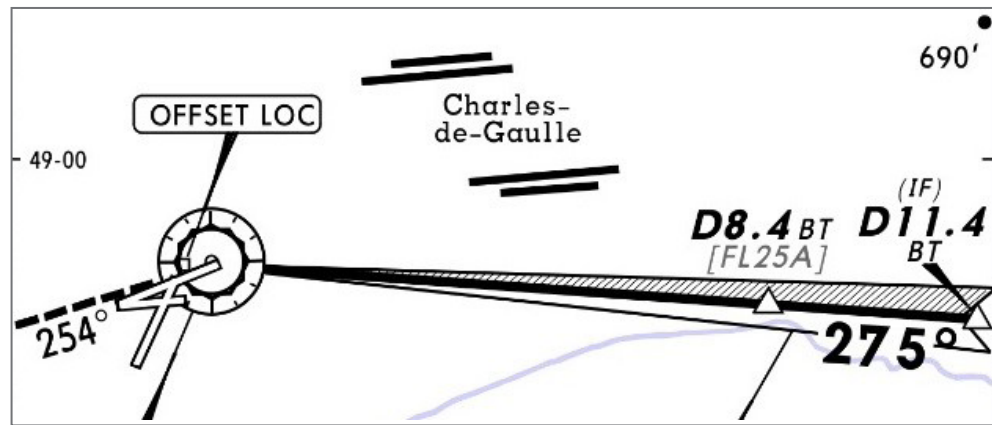
Figure 4: Aerial view of runways 25 and 27 as well as the disused former runway

On carrying out a west-facing approach, the most frequently used runway is 27 (Landing Distance Available (LDA) of 1,853 m), which has an Instrument Landing System (ILS). Runway 25 (LDA of 2,100 m) is not equipped with an ILS and has a displaced threshold of 891 m: it is notably used by heavy aeroplanes requiring a long runway. As with the disused former runway, the beginning of runway 25 has a light-coloured concrete surface, around 500 m before the displaced threshold.

In addition to the LOC A 25 approach, three instrument approaches are also available on runway 25: VOR 25, VPT 25 and RNAV 25.

To avoid interfering with the approach paths to Paris-Charles de Gaulle airport, the LOC A approach path to runway 25 is oriented at 275°, corresponding to a 26° offset in relation to the runway centreline (oriented at 249°).

The ATIS message recorded at 16:45 indicated that the approach in force was the LOC A 25, that the ILS 27 was out of use and that the QNH was 1,005 hPa.



Source: Jeppesen

Figure 5: Excerpt from runway 25 LOC A approach chart

2.6 Statements

2.6.1 Crew

⁽³⁾ It was not possible to determine their experience with using runway 25.

⁽⁴⁾ The Paris-Charles de Gaulle Approach frequency recordings were not analysed by the BEA: it was not possible to confirm or invalidate whether the QNH was read back by the crew and whether the QNH error was picked up by the controller.

⁽⁵⁾ The sampling rate of the recorded parameters and the available meteorological data cannot be used to confirm or invalidate the occurrence of a gust.

⁽⁶⁾ The FDR data indicates that maximum thrust was reached seven seconds after the input to increase thrust.

The two pilots had made numerous approaches to Paris-Le Bourget airport⁽³⁾. They stated that they had thoroughly prepared the approach and identified the particular characteristics of the LOC A 25 approach, in particular the presence of an offset approach path and of a displaced threshold.

They explained that when they were in contact with the approach controller, they noted QNH 1014 hPa and input this figure in the parameters. They added that they read back this QNH but did not receive a correction from the controller⁽⁴⁾.

They stated that they identified the disused runway as being runway 25 and reported having the runway in sight to the controller. It was not until a few moments later that they realised that it was not runway 25, whilst the instruments indicated an altitude of around 700 ft (due to the QNH error, the aeroplane was then at a height of around 200 ft).

The PF attempted to correct the flight path to align with runway 25. She explained that she had felt a gust⁽⁵⁾ that had pushed the aeroplane to the right of the runway centreline. At a height of 50 ft, the autothrottle system automatically reduced the thrust of the engines. When the PF decided to abort the approach, the aeroplane continued to descend before the full thrust of the engines was actually available⁽⁶⁾.

Both pilots stated that they had heard a stall warning whilst the stick shaker was activated. They also stated that they had both simultaneously taken hold of the controls for a few moments.

They specified that they had not felt the aeroplane come into contact with the ground.

The captain became PF during the missed approach segment and continued the flight.

2.6.2 Tower controller

The tower controller explained that he saw the aeroplane follow an approach path to runway 25, which seemed normal to him. He suddenly saw the aeroplane steeply banked to the right and thought the pilot was aligning on the disused runway. When he saw the aeroplane turn left, it seemed too low and he had the impression that the left wing tip made contact with the ground. He immediately requested an inspection of the runway.

2.7 Operational procedure

The operator's standard operational procedures in force specify that the flight parameters (speed, profile and path) must be stabilised when the aeroplane reaches a height of 500 ft in VMC conditions (1000 ft in IMC). When the pilots realised that they were not aligned on the correct runway, they were at a height of approximately 250 ft.

2.8 Previous events

⁽⁷⁾ [Investigation report](#)

2.8.1 Serious incident to the Cessna 510 Citation "Mustang" registered F-GMTJ on 3 November 2014⁽⁷⁾

The pilot was cleared for a VOR 25 approach in daylight and good meteorological conditions. Having followed the approach path at 275°, he did not correctly identify runway 25, and aligned and landed on the disused runway located between runways 25 and 27 after flying over obstacles on it.

The pilot explained that, although he was based at Le Bourget airport, he was used to the ILS 27 approach and had very rarely made an approach to runway 25. He had mistaken the disused runway which he could see better for runway 25.

⁽⁸⁾ [Investigation report](#)

2.8.2 Serious incident to the Cessna 510 Citation "Mustang" registered F-GMTJ on 22 January 2019⁽⁸⁾

The same pilot at the controls of the same aeroplane was cleared for a VPT 25 approach, at night, in adverse meteorological conditions, with a cloud ceiling close to the minimum decision height and a runway recently cleared of snow. He initially expected to be cleared for the ILS 27 approach.

When he emerged from the cloud layer, he identified runway 25 but not the displaced threshold. He landed at the beginning of the paved surface, approximately 800 m before the displaced threshold and veered off the runway before this threshold.

The pilot explained that he had been surprised and dazzled by the brightness of the lights when he emerged from the cloud layer. He had then decided to make a very short landing, aware that the runway could be slippery, without having identified the displaced threshold.

2.8.3 Serious incident to the Boeing 777-200ER registered N777AS on 5 June 2016⁽⁹⁾

The crew were cleared for a LOC A 25 approach. The cloud ceiling was close to the minima for the aeroplane category. When turning to align with the runway centreline, the aeroplane overshot it. The PF returned to the runway centreline while he was at a low height thinking that he could still land. He then decided to abort the approach and increased the engine thrust. The right main landing gear touched the runway before the aeroplane gained height. The crew returned to land on runway 07.

When inspecting the aeroplane after the flight, damage was observed on the right wing and on the right horizontal tail. Rub marks were also observed on the runway.

2.8.4 Occurrence to Embraer 135BJ Legacy 650 registered D-AERO on 9 September 2017

The day before the incident to M-SAWO, at around 18:55, the crew of D-AERO were cleared for the LOC A 25 approach. On short final, the pilot aligned on the disused runway then decided to abort the approach. At the same time, the controller gave him the instruction to go around.

The pilot explained that he had incorrectly identified runway 25 due to the sun being in his eyes: he had only seen runway 27 and the disused runway. He aborted the approach when he saw the closed runway markings on the ground. The occurrence was reported to the BEA several months after the incident to M-SAWO and no investigation was opened.

2.8.5 Occurrence to Gulfstream G550 registered B-8136 on 9 March 2020

The crew were cleared for the LOC A 25 approach and requested a visual approach to runway 27. The controller replied in the negative and asked the crew to go around. During the second LOC A 25 approach, the crew aligned with the disused runway. The controller spotted the alignment error and asked the crew to go around again.

This occurrence was not the subject of a safety investigation by the BEA.

2.9 Measures taken by airport operator

2.9.1 Lead-in line

To facilitate the visual approach, before 2009, runway 25 was equipped with a lead-in line⁽¹⁰⁾ comprising a succession of directional sequenced flashers. These white lights are located on the right edge of runway 25 before the displaced threshold and are intended to guide crews to the runway and avoid overshooting its centreline. They are lit day and night when runway 25 is in use, whatever the visibility conditions may be.

2.9.2 Markings on disused former runway

The disused former runway had been used as a taxiway for a while. Section P1 was transformed into an apron dedicated to engine run-ups while sections P2 and P3 were decommissioned and were marked with 9 m yellow crosses in compliance with the criteria of a closed taxiway.

⁽¹⁰⁾ Lead-in lights to runway.

The serious incident to F-GMTJ on 3 November 2014 (see paragraph [2.8.1](#)) brought to light the poor visibility of these markings on a 60 m-wide surface. In April 2015, the markings were replaced with more visible closed runway markings (14.5 m-wide and 36 m-long white crosses). The wording *AEROPORT DE PARIS LE BOURGET* was also marked in large letters in addition to the white crosses.

2.9.3 Runway 25 slope indicator

Following the serious incident to N777AS on 5 June 2016 (see paragraph [2.8.3](#)), a Precision Approach Path Indicator (PAPI) was installed in April 2017 to the north of runway 25, its axis being offset 5° to the south.

2.9.4 St. Andrew's Cross

Following the serious incident to F-GMTJ on 3 November 2014 (see paragraph [2.8.1](#)), a decision was made to place an illuminated St. Andrew's Cross on the centreline of the disused former runway. The cross is lit when landings are made facing west, in daylight, when visibility is greater than 3,000 m and the ceiling is higher than 500 ft. The cross is not lit in adverse meteorological conditions.

This St. Andrew's Cross was installed on 19 October 2017 and was therefore not operational when the serious incident to M-SAWO occurred (and when the occurrence to D-AERO occurred the day before (see paragraph [2.8.4](#))). Due to adverse meteorological conditions, the cross was not lit during the occurrence to B-8136 on 9 March 2020 (see paragraph [2.8.5](#)).

2.10 Measures taken by Avcon Jet

Following the serious incident to M-SAWO, the crew were asked to attend further training sessions in Crew Resource Management (CRM) and Standard Operating Procedures (SOP) with a specific focus on stabilisation criteria. Training on a simulator regarding the LOC A 25 approach at Le Bourget was also attended by the two pilots.

In addition, the operator's operations manual was revised regarding:

- stabilisation criteria;
- protecting FDR/CVR recordings in the event of a safety event;
- low height turns;
- the introduction of different CRM subjects;
 - the importance of an active response from the PM and the signalling of deviations;
 - the importance of a stabilised approach and not hesitating to abort an approach, missed approaches being encouraged by the operator;
- information to its crews via a special safety bulletin⁽¹¹⁾ devoted to the analysis of the incident.

⁽¹¹⁾ <https://aviation-safety.net/wikibase/199669>

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation. They are not intended to apportion blame or liability.

Scenario

The crew were cleared for a LOC A approach to runway 25 at Le Bourget airport, which is offset by 26° to the runway centreline. Following an altimeter setting error, the aeroplane was 280 ft lower than indicated on the altimeter.

On flying through 1,000 ft indicated, the co-pilot (PF) disconnected the AP and used the external visual references. She mistook the disused former runway whose centreline crossed her flight path, for runway 25. The PF aligned with the former runway and, when she realised her mistake, tried to join the end of runway 25 at low height. The aiming point was then close to the separation between the light section and the dark section of the runway.

The aeroplane overshot the centreline of runway 25, the angle of attack protection was triggered and the stick shaker was activated. The PF aborted the approach whilst the aeroplane was at a height of approximately 20 ft, with a 15° bank angle. With full thrust only being available after a few seconds, the aeroplane initially continued to descend and its left wing struck a light located on the right side of the runway, 300 m before the runway's displaced threshold.

Contributing factors

The following factors contributed to the activation of the aeroplane's angle of attack protection systems on final approach and then to the aeroplane's left wing colliding with the runway right side lighting:

- ❑ The late decision to attempt to intercept the centreline of runway 25 when the aeroplane had been previously aligned on a disused former runway. This manoeuvre substantially increased the angle of attack and the bank angle at a low height whilst the thrust of the engines was automatically reduced on descending below the height of 50 ft.
- ❑ The presence of a concrete surface section at the beginning of runway 25, located 500 m before the displaced threshold. The separation between this light-coloured section and the remainder of the runway may have been mistakenly taken for the displaced threshold and caused the PF to hurry the centreline interception manoeuvre.
- ❑ The crew's late decision to initiate a go-around whilst the aeroplane was at a low height and the approach was no longer stabilised.
- ❑ The crew not detecting the altimeter setting error, which may have contributed to a representation bias and delayed the decision to abort the approach.

This same representation bias may have incited the crew to align with the disused runway and then to try to intercept the centreline for runway 25.

The presence of specific markings on the disused runway, the presence of a PAPI on runway 25 and the lead-in line comprising a succession of white directional sequenced flashers were not sufficient to enable the crew to differentiate the disused runway from runway 25.

Safety lessons

Specificities of approaches to runway 25 at Paris-Le Bourget airport

When making a west facing approach to Paris-Le Bourget airport, the runway most frequently used is the 27 (LDA of 1,853 m) which has an ILS. Runway 25 (LDA of 2,100 m) is not equipped with an ILS and is usually reserved for heavy aeroplanes requiring a longer runway; it is generally only proposed to flight crews of lighter aeroplanes in degraded situations, such as runway 27 not being available.

Paris-Le Bourget airport is mainly used by business jets, which are usually relatively light and do not require a long runway. The crews of these aeroplanes rarely, if ever, land on runway 25.

The specificities of the approaches to runway 25 at Paris-Le-Bourget airport are:

- ❑ An approach path offset by 26°, in the case of LOC A 25, in relation to the runway centreline, in order to separate the Paris-Charles de Gaulle and Paris-Le-Bourget approach paths.
- ❑ The presence of a disused former runway located between runways 27 and 25 and whose centreline crosses the flight path to join the threshold of runway 25.
- ❑ The presence of a concrete surface section at the beginning of the disused runway that is lighter in colour than the remainder of the runway and very visible. When visually looking for the threshold of runway 25, pilots can mistake and interpret this strip of light-coloured concrete as the displaced threshold of runway 25.
- ❑ Little practice in approaches to runway 25 for most pilots due to the more frequent use of runway 27.

These specificities do not contravene any regulatory provision. However, combined, they make carrying out approaches to runway 25 tricky.

CASH sheet

CASH (Collaborative Aerodrome Safety Highlights) is a collective safety initiative designed to draw the attention of commercial and general aviation pilots to the aeronautical context and main threats related to an aerodrome.

The identification of these threats is the result of collaborative work between platform operators (airlines, airport operators, air navigation service providers, flying clubs, French met office, etc.). All the CASH sheets are available on line⁽¹²⁾.

The CASH sheet⁽¹³⁾ for Paris-Le Bourget airport indicates the risk of visual confusion with the PAPA 1 engine run-up area (which corresponds to a disused former runway).

⁽¹²⁾ <https://www.ecologie.gouv.fr/en/node/967>

⁽¹³⁾ https://www.ecologie.gouv.fr/sites/default/files/CASH_LFPB_en.pdf