



Serious incident to the Boeing 777-200ER
registered **N777AS**
on 5 June 2016
at Paris - Le Bourget (Seine-Saint-Denis, France)

⁽¹⁾The times in this report are in Coordinated Universal Time (UTC). Two hours should be added to obtain the local time.

⁽²⁾Federal Aviation Regulation.

Time	10:37 ⁽¹⁾
Operator	Mid East Jet, Saudi Arabia
Type of flight	Commercial aviation under FAR ⁽²⁾ Part 125 rules, repositioning flight
Persons on board	Two pilots, a relief pilot and a flight engineer in the cockpit, five cabin crew
Consequences and damage	Aeroplane slightly damaged

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in December 2019. As accurate as the translation may be, the original text in French is the work of reference.

Non-stabilized approach, activation of GPWS warning, horizontal tail and wing strike with ground during go-around

1 - HISTORY OF THE FLIGHT

⁽³⁾Approach path at 275.

The crew were carrying out a repositioning flight between Riyadh airport (Saudi Arabia) and Le Bourget airport. They were cleared for a LOC A approach to runway 25. This approach is offset by 26° with respect to the runway centreline⁽³⁾.

⁽⁴⁾Pilot Flying.

When turning to align with the runway centreline, the aeroplane overshot it. The PF⁽⁴⁾ returned to the runway centreline while he was at a low height. The PF 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 - ADDITIONAL INFORMATION

2.1 Chronology of the flight

The chronology of the flight was produced using data from the aeroplane's flight data recorder.

Start of approach

At 10:31, the aeroplane was on approach in level flight at 3,000 ft QNH and at a speed⁽⁵⁾ of 180 kt. It was aligned on the localizer course of runway 25 with a magnetic heading of 276. The autopilot was engaged with the VNAV PATH longitudinal mode and the LOC lateral mode. The trend bars were displayed on both sides. The autothrottle was in "Speed" mode.

At 10:33, the landing gears were selected down and then the flap control was set to the 30° detent position.

At 10:34, the descent was started. The airspeed was stabilized at a speed close to the selected speed (143 kt). The tower controller informed the crew that the ceiling was situated at around 600 ft with a visibility of 4,400 m and a calm wind.

Disconnection of autopilot

The autopilot was disengaged by the crew just before flying through the MDA⁽⁶⁾ which was 800 ft (614 ft AAL⁽⁷⁾, see point ❶ of Figure 1 below).

The autothrottle remained engaged during all of the approach. The crew overrode the autothrottle inputs several times after flying through 300 ft AAL.

At around 300 ft AAL, the vertical speed was -900 ft/min and the thrust levers were rapidly retarded, from 49° to 34°, by the crew. The N1s were at 60 % and started to decrease.

At 270 ft AAL, the pitch was 0.4° and started to decrease following a slight nose-down input from the PF.

At 10:37:22, the aeroplane was at 200 ft RA⁽⁸⁾, on a heading of 275 at 1,100 m from the runway threshold. The PF started a left turn and gave a nose-up input. The pitch reached a minimum of -1.8° and then started to increase.

1st GPWS warning⁽⁹⁾

Two seconds later, the GPWS warning "SINK RATE, SINK RATE"⁽¹⁰⁾ was triggered ❷. The descent speed was then around -1,200 ft/min and the height around 150 ft RA. The N1s were at 38 % and decreasing. The PF increased his nose-up input. The thrust levers progressively moved forward.

⁽⁵⁾The speeds mentioned in the report are calibrated airspeeds.

⁽⁶⁾Minimum Descent Altitude.

⁽⁷⁾Above Aerodrome Level.

⁽⁸⁾Radio Altitude.

⁽⁹⁾Ground Proximity Warning System.

⁽¹⁰⁾The GPWS warnings are recorded but there is no information about the type of warning. Boeing confirmed, based on other flight parameters, that it was the "SINK RATE, SINK RATE" warning that was activated. The Boeing 777 QRH specifies that the "SINK RATE, SINK RATE" warning must lead to a correction of the path or configuration.

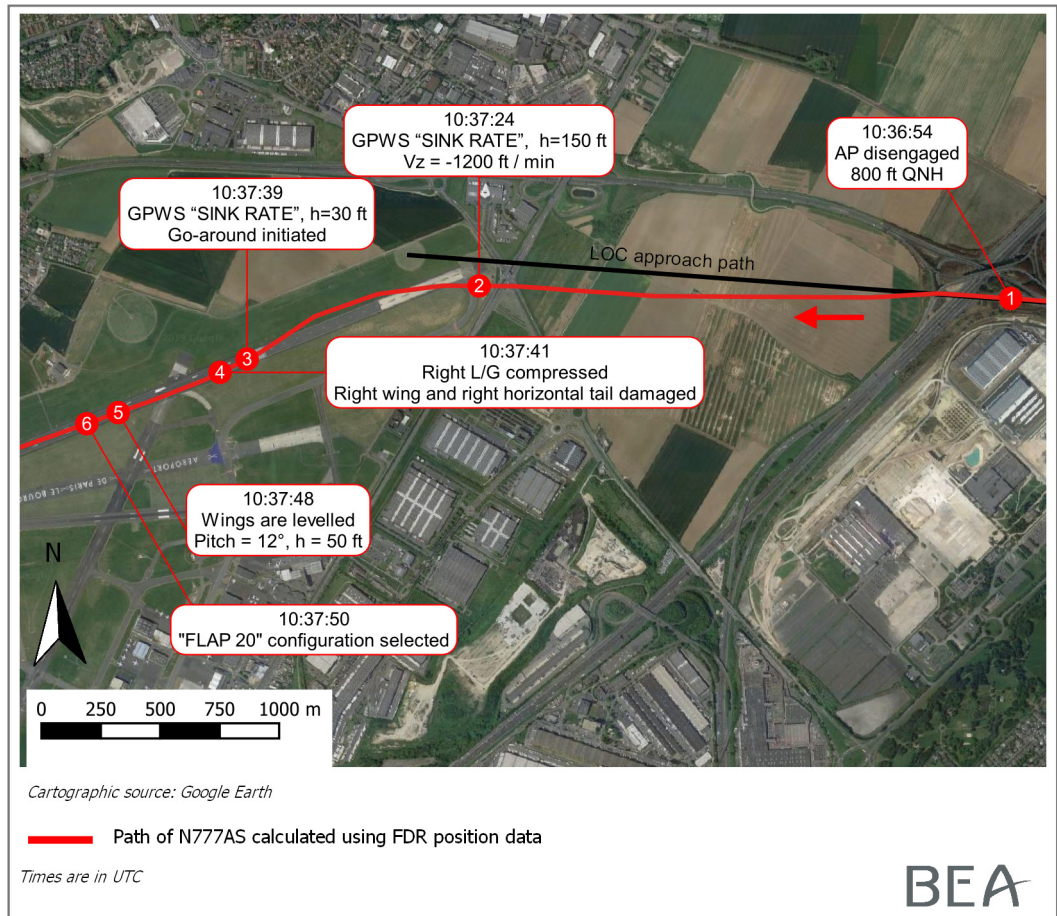


Figure 1: Final path of N777AS

At 10:37:27, the aeroplane overshot the runway centreline with a left bank angle of 19° and a height of around 100 ft RA. The speed was 137 kt and decreasing.

For a few seconds, the aeroplane flew along the right side of the runway, offset by around 50 m from the runway centreline at a stable height of around 100 ft RA and with a pitch between 5 and 7°. The PF then turned left to return to the runway and the aeroplane started to descend again.

2nd GPWS warning and aborted approach

At 10:37:38, the aeroplane flew over the threshold of runway 25 at 50 ft RA, with a right roll of 4° and a vertical speed of around -1,000 ft/min (17 ft/s). The pitch was stable at 2.6°.

One second later, a new GPWS warning “SINK RATE, SINK RATE” was triggered^③.

The nose-up input already present was increased and the thrust levers moved from around 36° to 70°, without the “TO/GA switch” being activated⁽¹¹⁾. The pitch and the N1s increased.

At 10:37:41, the right main landing gear was compressed^④. The maximum vertical acceleration recorded was 1.96 g. The pitch was 10° and the right roll around 16°.

⁽¹¹⁾The “TO/GA switch” parameter is not recorded by the Flight Data Recorder (FDR). However, its activation would have led to the transition to a “GO AROUND” flight phase and to the activation of the “GO AROUND” longitudinal and lateral modes which was not the case in the event.

At 10:37:43, the aeroplane took off again. The speed reached a minimum of 117 kt. The thrust levers were pushed forward to 82°. The autothrottle went into “Thrust Reference” mode. The autopilot went into “VNAV Speed” longitudinal mode.

At 10:37:48, the aeroplane flew through 50 ft RA with wings level⁵.

At 10:37:50, the aeroplane flew through 100 ft RA and the speed was 133 kt. The flap control was set to the 20° detent position⁶.

As the aeroplane was taking off again, the controller informed the crew that she thought she saw the aeroplane touch the ground. She initiated a runway inspection during which no anomaly was found.

End of flight and inspections

At 11:05, the runway in use had changed and the aeroplane landed on runway 07.

After landing, the aeroplane remained energized; the recorders thus continued to operate and the cockpit voice recordings during the event were not preserved.

After the flight, the aeroplane inspection found rubbing marks on the tip of the right wing, on the leading edge of the right wing and on the tip of the right horizontal tail. One of the flap screw jack fairings of the right wing also had rubbing marks and one of its attachments was broken. The inspections carried out on the landing gears did not find any damage.

A detailed inspection of the runway found rubbing marks starting 161 m after the displaced threshold, over a distance of around 28 m, between 19 m and 22.5 m to the right of the runway centreline. These marks were close to the zone where the aeroplane had touched down on the runway, based on the flight data recorder data. It was not possible to identify the zone where the landing gear had come into contact with the runway because of the presence of numerous rubber marks.

2.2 Meteorological information

METAR for 10:30:

METAR LFPB 051030 AUTO VRB02KT 4300 BR OVC005 16/14 Q1019 BECMG 6000 NSW BKN020

The cloud cover measurements at the thresholds of runways 27 and 09 indicated that at the time of the event, the clouds were based at 623 ft above the ground, with slow improvement.

2.3 Aircraft information

Due to its approach speed, the aeroplane is classed as a category C aircraft (VAT⁽¹²⁾ between 121 and 140 kt). The Boeing 777-200ER is close to the upper limit of its landing category⁽¹³⁾.

The Boeing 777 is designed for a two-pilot crew. The wing span of the Boeing 777-200ER is 60.93 m. The horizontal tail span is 21.53 m.

⁽¹²⁾VAT = speed at threshold.

⁽¹³⁾The Boeing 777-300/300ER/200LRF is in category D (VAT between 141 and 165 kt).

⁽¹⁴⁾FAR Part 125 rules (https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afx/afs/afs800/afs820/part125_oper/) applies to large airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more, when common carriage is not involved.

⁽¹⁵⁾Pilot monitoring.

2.4 Operator information

Mid East Jet is a company based at Jeddah (Saudi Arabia). It operates VIP-configuration aircraft.

Since 2012, the company is no longer registered in Saudi Arabia but in the United States. It operates its aeroplanes in commercial aviation under FAR Part 125⁽¹⁴⁾ rules. In this respect, it was not obliged to have a safety management system and did not have one.

The company, contacted by the accredited representative of the Saudi Arabian investigation body, did not contribute to the investigation.

At the time of the event and based on the statements of the crew members, the company had an aircraft fleet composed of a Boeing 777-200ER, two Boeing 737s and a Bombardier Challenger CL-604.

According to the pilots, the Boeing 777-200ER N777AS is exclusively used by a sole beneficiary.

Within the company, a team of five pilots, all captains, operates the Boeing 777-200ER N777AS. They answer to a Lead Pilot. In addition, two flight engineers ensure the logistic aspects.

The usual composition of the flight crew is three pilots and a flight engineer. The pilot in the left seat ensures the role of Flight Captain (PF). The pilot in the right seat is the Reserve Captain (PM⁽¹⁵⁾). The third pilot, in the rear seat, is the Trip Captain who carries out administrative tasks not linked with piloting. These three pilots change roles on each new flight without any hierarchy existing between them. During flights, the flight engineer is often in the cockpit and was there during the event.

The pilots work six-week duty periods with six-week rest periods. During the duty periods, the crews are based at Riyadh at the disposal of the N777AS beneficiary.

The pilots were dismissed from the company in the days following the event.

2.5 Crew information

2.5.1 Flight Captain

The Flight Captain was an American citizen, aged 66. At the time of the serious incident, he held an Airline Transport Pilot Licence issued by the United States.

He had been a pilot for American Airlines from 1978 and had retired from the company in 2013.

He then flew on the Boeing 777 for Biman Bangladesh Airlines for nine months, for Ethiopian Airlines for nine months and then again for Biman Bangladesh Airlines for six months.

He had joined Mid East Jet 18 months before the event.

On leaving American Airlines, he had logged around 13,000 flight hours. Subsequently, he had not kept count of his flight hours.

⁽¹⁶⁾Line Proficiency Check.

⁽¹⁷⁾The regulations concerning experience requirements under FAR Part 125 rules specify that "No certificate holder may use any person, nor may any person serve, as a required pilot flight crewmember unless within the preceding 90 calendar days that person has made at least three takeoffs and landings in the type airplane in which that person is to serve."

At Mid East Jet, he had performed a total of 25 landings as PF in 2015 and four in 2016.

In January 2016, he carried out a LPC⁽¹⁶⁾ on a simulator. In February, he carried out two flights followed by a ferry flight in May.

He had only carried out one landing in the three months preceding the event⁽¹⁷⁾.

2.5.2 Reserve Captain

The Reserve Captain was an American citizen, aged 60. At the time of the serious incident, he held an Airline Transport Pilot Licence issued by the United States.

He was a pilot for Continental Airlines from 1983 to 2008 on the McDonnell Douglas DC-10 and on different Boeing types, including the 777.

From 2008 to 2011, he flew business aviation flights on the Cessna Citation II.

He then flew on the Boeing 757 and 767 for 18 months for OMNI Intl, and then on the Boeing 777 for 18 months for Qatar Airways and for 9 months for Jet Airways.

He had joined Mid East Jet a year before the event.

He had logged approximately 20,000 flight hours of which 2,000 hours on the Boeing 777.

2.5.3 Trip Captain

The Trip Captain was an American citizen, aged 69. At the time of the serious incident, he held an Airline Transport Pilot Licence issued by the United States.

In 1970, he became a US Navy pilot on the Phantom F4. From 1976, he was a pilot for American Airlines on the McDonnell Douglas MD-80 and on different Boeing types, including the 777.

After retiring from the company in 2006, he flew on the Cessna Citation X for a charter company before joining Mid East Jet in 2011.

He had logged more than 30,000 flight hours but no longer kept a count of his hours.

2.5.4 Flight Engineer

The Flight Engineer was an American citizen. He had previously worked in the maintenance department for Continental Airlines before joining Mid East Jet in 2010.

He was not a pilot but was frequently in the cockpit and was familiar with the flight procedures.

2.6 Approach information

Inbound pilots are in contact with the Paris-Charles de Gaulle airport approach controller and then with the Le Bourget tower controller.

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

When making a west facing approach, the runway most frequently used is the 27 (LDA⁽¹⁸⁾ of 1,853 m) which has an ILS⁽¹⁹⁾. Runway 25 (LDA of 2,100 m) is generally reserved for heavy aeroplanes but does not have an ILS. It has a threshold displaced by 891 m.

So as not to interfere with the approach paths of the Paris-Charles de Gaulle airport, the LOC A approach path of runway 25 is set at 275, offset by 26° with respect to the runway centreline which is set at 249. The FAF⁽²⁰⁾ is at an altitude of 3,000 ft. The MDA⁽²¹⁾ is 800 ft (614 ft AAL) for a category C aeroplane such as the N777AS.

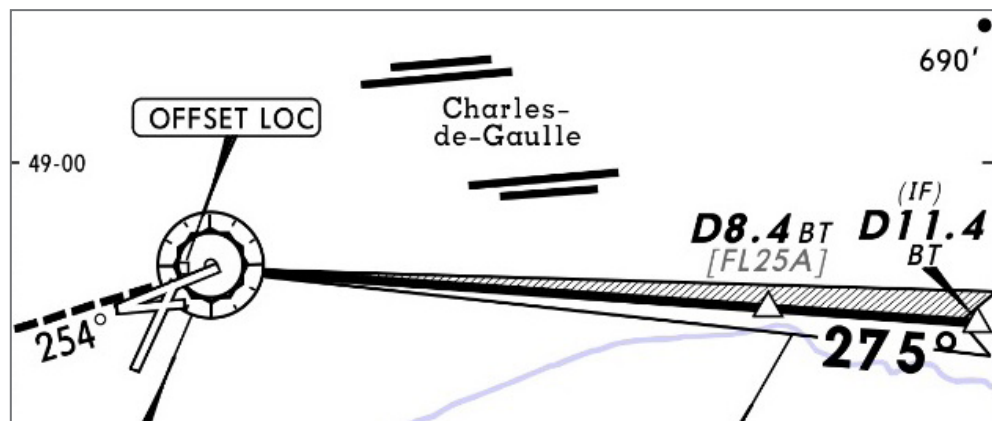


Figure 2 : Taken from Jeppesen chart used by crew for runway 25 LOC A approach

It should be noted that for a category-D aeroplane such as the Boeing 777-300 with characteristics not very different from those of the N777AS, the MDA is 890 ft QNH (704 ft AAL). For an aeroplane of this category and in the conditions of the day, the probability of acquiring the visual references at the decision altitude was low and would have in all likelihood led to an aborted approach.

2.7 Witnesses

2.7.1 Controllers

The controller on the Le Bourget tower frequency explained that the weather conditions were “very poor” but slowly improving.

Changing runways at Le Bourget airport is a complex process, carried out in consultation with the control unit at Paris-Charles de Gaulle airport and requires around 20 minutes. It was because of this time factor and in order not to delay N777AS that the approach was maintained to LOC A 25. The approach had decided to change to runway 07 just after it had landed.

⁽¹⁸⁾Landing Distance Available.

⁽¹⁹⁾Instrument Landing System.

⁽²⁰⁾Final Approach Fix.

⁽²¹⁾Minimum Descent Altitude.

The tower controller only had the aeroplane in view at a late stage. It was off the runway centreline and carried out a manoeuvre to return to it. During the landing, it seemed to her that the aeroplane rubbed the ground and she was just about to start the emergency procedure when she heard the crew calmly announce a go-around.

After the aeroplane had taken off, she requested an inspection of the runway and was then rapidly relieved.

On the aeroplane returning, the tower manager activated a stand-by level alert so that the fire fighting services were present. In the meantime, an initial inspection of the runway had not revealed any anomaly.

2.7.2 Crew

The three pilots said that they were used to working together and that there was no hierarchy. All the briefings were carried out in the cockpit. They all explained that the organization of the company meant that they carried out a very low number of flights compared with an airline company's activity.

The pilots said that they came to Le Bourget airport around five to six times a year. They had rarely or never followed the LOC A 25 approach. They were more familiar with the ILS 07 or ILS 27 approach followed by a visual manoeuvre to runway 25, but this procedure required better weather conditions.

The pilots explained that the training sessions were carried out at the Boeing training centre in Miami. The simulated approaches were generally those to Washington, never to Paris. They considered that the simulation sessions did not match the specific operational environment of their activity.

On the departure of the flight, the crew were counting on the forecast improvement in weather conditions in order to be able to carry out the approach. They kept themselves regularly informed of the changes in these weather conditions during the flight. As the improvement was slower than expected, they envisaged diverting to Paris-Charles de Gaulle, Paris-Orly or Lyon airports. The two Parisian airports posed handling problems and their company refused a diversion to Lyon.

The Trip Captain specified that the company's operations department was often on the radio giving instructions. These calls did not take into account the pilots' operational constraints. They were nearly continuous during the approach and he had to ask the flight engineer to stop them.

The aeroplane had taken a full fuel load on departure. As they had a large quantity of fuel, the pilots decided to continue the approach to Le Bourget and keep the possibility of holding for an improvement in weather conditions. After the approach briefing, none of the three pilots considered the weather conditions as a threat.

At the beginning of the approach, the crew requested ILS 27 but the Approach controller did not approve the request and cleared them for the LOC A 25 approach. The crew had programmed this approach in the FMS.

The three pilots explained that they had sight of the runway and heard the automatic minimum decision altitude call out at almost the same time. The Reserve Captain (PM) and the Trip Captain were surprised by the proximity of the runway on coming out of the clouds.

The Flight Captain (PF) explained that when he saw the runway, he called out "Continue". He heard the "SINK RATE, SINK RATE" warning. Although he had overshot the runway centreline, he considered that he could continue the approach. At no time did he hear one of the other crew members request a go-around.

The Reserve Captain and the Trip Captain both declared that they asked for a go-around when they saw that the aeroplane had overshot the runway centreline. They both specified that they heard each other make the same call.

It was when the Flight Captain considered that the correction to the path was not satisfactory that he decided to abort the approach. Shortly afterwards he felt the landing gear touch the runway. Neither the pilots nor the flight engineer felt the aeroplane structure touch the ground.

3 - LESSONS LEARNED AND CONCLUSION

3.1 Crew performance

Flying

Unlike ILS approaches which are used the most in operation, the LOC A 25 approach at Le Bourget airport requires a significant alignment manoeuvre of 26° on the final path at low height while maintaining a continuous glidepath.

The day of the event, the aeroplane came out of the cloud layer at a height close to the MDA. The Flight Captain (PF) started turning towards the beginning of the paved strip. The alignment segment was not sufficient which meant that the aeroplane overshot the runway 25 centreline. The inertia of an aircraft of this category made any correction to bring the aeroplane back onto the centreline difficult.

Decision process

In the absence of the CVR, it was difficult to assess with certitude the crew's decision process:

- however, according to the crew, the acquisition of the visual references was simultaneous with flying through the MDA;
- the PF decided to continue the landing although the aeroplane was not stabilized after the turn and the corrections to be made were too great to guarantee a safe landing.

It was not possible to determine with certainty, the role of the Reserve Captain (PM) or the Trip Captain in this process, nor to confirm if and at what moment, the go-around calls were made before wheel touch-down.

3.2 Recent experience

The regulations impose a minimum number of three landings within the previous 90 days in order to be able to carry out a flight. This is the strict regulatory minimum. Airlines operating comparable aircraft fix a required minimum activity level for their crews. Some operators require a minimum of 20 legs per year on long-haul and 70 on medium-haul flights in order to ensure an appropriate piloting level to guarantee flight safety.

The way the work is organized in the company with a six-week duty period - sometimes without flying - and a six-week rest period is probably incompatible with maintaining appropriate flying abilities. Regular simulator training would enable these abilities to be kept up to date.

It is probable that the PF, despite his general experience, had not sufficiently flown in the last months or in the last year to stay sufficiently at ease when flying a specific approach such as the Le Bourget LOC A 25.

3.3 Crew and company safety culture

Neither the pilot nor his company had checked for compliance with the recency of experience requirements. This indicates that recency of experience was not taken into consideration in operational risk management.

Under the regulations, it is the pilots who are responsible for ensuring compliance with the recency of experience requirements. In commercial air transport, the airline companies also share this responsibility and carry out checks. It is probable that the company had not set up a suitable crew follow-up system which would have allowed specific simulator training or flight training with an instructor to be programmed in order to reestablish recency of experience.

Lastly, the crew said in their statements that the recurrent training, following standard programmes, is outsourced and carried out in the United States. Le Bourget LOC A 25 type approaches are not incorporated in the programme.

The pilot statements show that the company operations department contacted the crew regularly and with insistence, during the various flight phases, including the approach phase, which indicates ignorance or even, insufficient respect for operational constraints. The crew's statements also showed that the company did not have a safety management system encouraging feedback. These elements, combined with the dismissal of the pilots shortly after the event, show an insufficient safety culture within the company and in particular the absence of a just culture.

Regulation (EU) No 376/2014⁽²²⁾ defines the just culture as *"a culture in which front-line operators or other persons are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but in which gross negligence, wilful violations and destructive acts are not tolerated."* In establishing an environment based on confidence, the just culture aims, in particular, to create favourable conditions for notifying occurrences and thus contribute to effective management of air safety.

⁽²²⁾ Regulation of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation.

⁽²³⁾Precision Approach
Path Indicator.

3.4 Measures examined by airport operator following serious incident

Following this serious incident and other previous occurrences, Le Bourget airport management examined the setting up of two PAPIs⁽²³⁾ in order to provide assistance with following the glideslope for all of the visual segment of the flight procedure.

The first PAPI would be situated to the north of runway 25 while the second, to the south, would be offset with respect to the former. A similar system has already been implemented at the Ronald Reagan Washington airport in the United States; it will require a derogation and/or special condition to be certified under European regulations.

Without waiting for the certification of the complete system, the airport management has set up the first PAPI for QFU 25. A study is in progress to permit the certification of the second PAPI to cover the VPT⁽²⁴⁾ from LOC QFU 27.

It should be noted that this system concerns vertical positioning and does not provide assistance for lateral positioning. Likewise, it does not provide assistance in degraded visibility conditions.

Furthermore, the airport management is in discussions with the French civil aviation safety directorate (DSAC) about the operating conditions for runway 25 and its accessibility.

⁽²⁴⁾Visual pattern with
Prescribed Tracks.

3.5 Causes of serious incident

The serious incident was due to the late aborting of a non-stabilized approach.

Contributing to the serious incident were:

- no stabilization objective in either the crew's flight management or in the operator's operating procedures;
- little recent PF experience with respect to a specific, little performed approach;
- a crew without a hierarchy, not conducive to effective CRM⁽²⁵⁾;
- a company without a safety management system and with practices which are not conducive to a safety culture.

⁽²⁵⁾Crew Resource
Management.