

## Unstabilised approach, GPWS warnings, go-around

<b>Aircraft</b>	Airbus A319 registered F-GRHU
<b>Date and time</b>	24 March 2012 at about 8 h 45 <sup>(1)</sup>
<b>Operator</b>	Air France
<b>Place</b>	On approach to AD Tunis Carthage (Tunisia)
<b>Type of flight</b>	Scheduled public passenger transport
<b>Persons on board</b>	Captain (PF), Copilot (PNF)
<b>Consequences and damage</b>	None

<sup>(1)</sup> Unless otherwise specified, all times in this report are given in Universal Time Coordinated (UTC).

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

### HISTORY OF FLIGHT

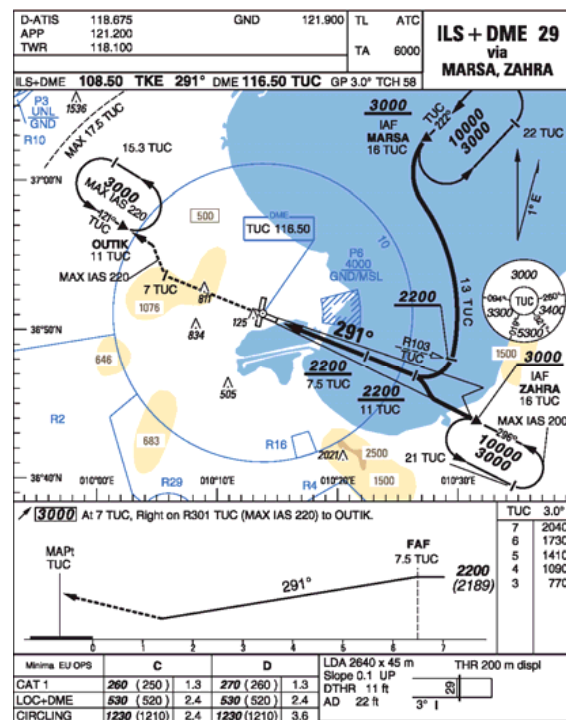
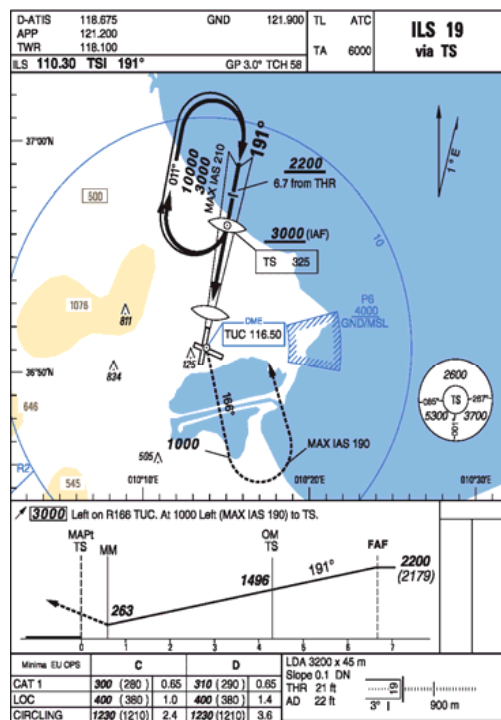
*Note: the following elements are drawn from recorded data from the Quick Access Recorder, from testimonies and from ATC communications. The cockpit voice recording was not available.*

The crew was undertaking flight AF2184 between Paris Charles de Gaulle (95) and Tunis Carthage. The briefing was carried out at 5 h 00, takeoff took place at 6 h 53 min. The Captain was Pilot Flying (PF).

In cruise at FL 350, the PF prepared an arrival for runway 29, in accordance with ATIS indications. On descent, in V/S mode, he adopted a low vertical speed (- 1,000 ft/ min). The crew contacted the Tunis en route control centre, which confirmed that runway 29 was active. Six minutes later, the aeroplane passed above the theoretical glide path of 3° for runway 29.

One minute later, during radio contact with Tunis approach, the controller announced that runway 19 was active at that time and requested that they plan for a direct approach. The PF carried out the briefing for runway 19, at the end of which he noticed that the autopilot was still in V/S mode at - 1,000 ft/min.

The change of active runway led to a shortening of the trajectory of about 20 NM in relation to the ILS DME 29 approach, and the gap above the theoretical path of 3° increased from 1,800 ft to about 8,100 ft.



(2)The threshold of runway 19 is at an altitude of 21 ft.

(3)OP DES mode maintains speed while piloting the aeroplane's pitch attitude.

(4)On the Airbus A319, this is not necessary to obtain maximum deployment in flight.

(5)The operator's operations manual states that in case of interception of the glide path from above, the vertical V/S mode must be engaged and an altitude higher than that at the time must be displayed on the FCU.

(6)The procedure mentions that the vertical speed of - 2,500 ft/min should not be exceeded during glide path interception from above.

(7)In the conditions on the day, the Vapp in flap 3 configuration is around 132 kt.

The PF then engaged the OPEN DES mode, selected a speed of 300 kt and extended the air brakes. The aeroplane was at FL 207 and 33 NM from the threshold of runway 19<sup>(2)</sup>, that is about 10,000 ft above the theoretical path of 3°, at a speed of 276 kt. The crew was cleared for ILS 19 approach. Vertical speed reached was - 5,000 ft/min.

Approaching FL 120, 20 NM from the runway threshold, the crew reduced speed by selecting 240 kt, which resulted in the rate of descent<sup>(3)</sup> being reduced.

Descending through FL 100, 13.5 NM from the threshold, the PF disconnected the autopilot, expecting to obtain greater deployment of the air brakes<sup>(4)</sup>. Landing gear extension was ordered. The crew had the runway in sight.

They established on LOC at 6,000 ft QNH about 8 NM from the runway and at about 250 kt. The aeroplane was about 3,400 ft above the glide path. The crew applied the procedure for interception from above and selected an altitude of 16,000 ft<sup>(5)</sup>. This action caused a change in the flight director vertical mode (FD: OPEN DES to V/S) which, from then onwards, indicated a trajectory based on the real vertical speed at the time of the mode reversion<sup>(6)</sup> (- 4,400 ft). The PNF explained that he was focused on the stabilisation floor of 500 ft, defined by the operator for an approach in VMC. The FD vertical G/S\* mode was engaged 5 seconds afterwards. The aeroplane was then at 3,550 ft, that is 1,700 ft above the glide path.

The PNF told the controller that they were established on ILS 19. The altitude was 2,640 ft (that is about 1,000 ft above the path), the distance from the threshold was about 5 NM. The flaps were retracted, the landing gear and air brakes were extended. The speed was 240 kt<sup>(7)</sup> and vertical speed was - 4,400 ft/min. The thrust levers were brought back to the idle position, which disconnected the A/THR. The controller cleared them for landing. Eight seconds later, the PNF announced on the frequency that they were "a little above the path" and requested a 360° turn to the right. The controller had him repeat this request.

<sup>(8)</sup>The GPWS warnings were recalculated from the QAR data.

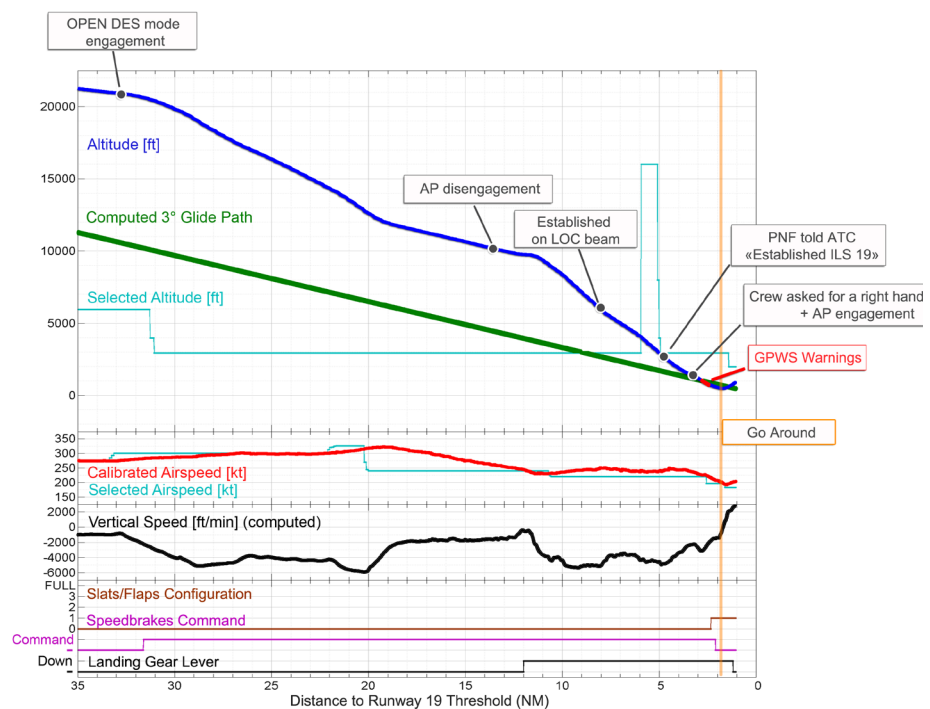
<sup>(9)</sup>In smooth configuration, the go-around mode does not engage.

During these radio exchanges, the PF reengaged the A/THR and the autopilot so that the latter could intercept the glide path. A GPWS<sup>(8)</sup> “sink rate” warning was triggered. The G/S mode engaged but the aeroplane passed through the glide path. The aeroplane was at a radio-height of 836 ft, at a speed of 220 kt, 2.8 NM from the runway threshold and descended to - 2,500 ft/min. The GPWS “pull up” warning was triggered, followed by the “too low terrain” warning.

The controller cleared them to carry out a 360° turn to the left. The crew extended the flaps in position 1 for the go-around<sup>(9)</sup>. The PNF read back the 360° to the left.

The PF retracted the air brakes, disengaged the autopilot and made a pitch-up input. The aeroplane was then at a radio-height of 428 ft. Two seconds later, the minimum height of 398 ft was recorded. The controller repeated the clearance for a 360° to the left.

The thrust levers were placed in the TO/GA position 13 seconds after selection of flaps 1. The crew carried out a left-hand aerodrome circuit at an altitude of 2,000 ft then a visual approach for runway 19 with ILS support. They landed without further problems.



## ADDITIONAL INFORMATION

### Personnel information

#### **Captain:**

The Captain had been a copilot for 11 years, on medium and long haul flights, then Captain on A320 since 2008. He totalled about 8,900 h flying hours including about 2,600 h on the A320 family and 1,700 h as Captain. He had performed 80 % of his flights from Paris Orly airport, to a limited number of destinations in metropolitan France.

#### **Copilot:**

The copilot had been a copilot for 5 years then Captain for 4 years with another airline, on different types of aeroplanes, before arriving at Air France. He totalled about 1,700 h flying hours with Air France on the A320 family.

### PF's strategy during approach

The PF explained that he was aware very early on of being above the glide path and that the approach was compromised. He then set himself two targets: FL100 to reduce the speed to 250 kt then the aim of stabilisation at 500 ft. He did not inform the PNF of his plan of action. Arriving at FL100, he already had the runway in sight. The meteorological conditions were excellent, he decided to try and intercept the glide path. He then set himself a new target: to reach 2,000 ft in configuration 2, landing gear extended and at 180 kt. He did not share this information with the PNF.

The PNF explained that descending to FL100, when he was aware that the approach was compromised, he focused on the altimeter in order to call out the go-around at 500 ft.

### Work overload

After FL100, the attempt to intercept the glide path at a high speed led to a considerable work overload for the PF. The latter explained that he focused on this objective and that he had not seen that stabilisation was no longer possible.

At 2,000 ft, not having reached the desired configuration, he decided to make a runway circuit. He explained that he had not envisaged the published trajectory of a go-around as he was looking for an alternative enabling him to position himself again quickly on final. He added that he could not explain his idea clearly to the PNF, who then requested a 360° to the controller. The PF then ordered the go-around.

He indicated that the decision to not follow the published missed approach trajectory was taken too quickly and again increased their work load.

The PNF explained that because of the work overload connected to this unusual situation as well as his focussing on the 500 ft marker, he did not think of suggesting missing the approach before this. Nor did he have the presence of mind to propose a standard go-around rather than a 360°. He estimated that performing the published go-around trajectory would have been more comfortable. In addition this would not then have caused the misunderstanding with the controller.

## Sterile Cockpit and Crew Resource Management (CRM)

The Captain explained that the morning departures from Paris Roissy involved a particularly early wake-up. He added that he had been preoccupied during the flight with personal worries, a meeting concerning the airline's future and difficulties during boarding of a deported passenger.

He stated that during cruise, discussions on the airline's situation with the copilot and a last-minute cockpit visit just before the descent contributed to establishing a non-sterile cockpit, unfavourable to the correct planning of the descent. He stated that during the descent, the cockpit was self-centred, that is to say that the PF was absorbed by his workload, had not informed the copilot of his plan of action and did not listen to the latter's comments.

The copilot explained that a discussion with the Captain about the airline's situation occupied them throughout the cruise. The cockpit visit was a little late. They began the descent before carrying out the briefing. During the descent, the copilot noticed that they were above the glide path and called it out twice to the Captain: once at the start of the descent then descending through FL100. Having been a Captain himself, he did not insist as he did not want to encroach too much on his colleague's decisions. He then no longer informed the Captain of the instrument displays (significant VDEV and amber rate-of-climb indicator, in particular).

After the event, he considered that he had confused fellow-feeling and CRM, which stopped him from fulfilling his role as PNF.

## Regulation and documents on the sterile cockpit principle

In 1981, the FAA implemented a regulation<sup>(10)</sup> prohibiting crews from undertaking any activity other than that linked to conduct of flight in complete safety during critical phases. Critical flight phases are defined as the flight phases below 10,000 ft as well as all phases on the ground. Examples of prohibited activities are given: non-essential conversations between flight crew, non-essential conversations between flight crew and cabin crew, meals and reading publications that are not associated with the conduct of flight.

In Europe, the Part-ORO makes it mandatory to establish operational procedures relating to the sterile cockpit principle for the critical phases of flight. These critical phases, for aeroplanes, are defined as being the acceleration on takeoff, the take off trajectory, final approach, missed approach, landing including taxiing, as well as all the flight phases determined by the PF or the Captain.

In the Air France operations manual, the principle of the sterile cockpit is described as all behaviour protecting the flight crew from errors associated with task interruptions and distractions. It is stated that this principle must be followed on the ground and in flight, below a height of 10,000 ft. In its April 2012 issue of the publication "Sûrvol<sup>(11)</sup>", the sterile cockpit theme is developed by Air France. Among the possible cockpit disruptions, worries of a personal nature are identified.

<sup>(10)</sup>FAR 121.542 - Flight Crew Member Duties and FAR 135.100.

<sup>(11)</sup>In-house publication relating to flight safety.

<sup>(12)</sup>It is recognised that in a situation of attentional tunnelling, hearing is the first sense that can be lost.

<sup>(13)</sup>Publication available on the Airbus website.

## Procedures

### Procedures in the event of GPWS warning

The Captain stated that he only heard the GPWS “sink rate” warning. The copilot explained that, focusing on the 500 ft limit, he never heard the GPWS<sup>(12)</sup> warnings.

The Air France operations manual specifies that any GPWS or EGPWS warning requires an immediate reaction from the pilots. It states that in the event of a “pull up” warning in daytime VMC, of the “too low...” and “sink rate” type, a flight path correction must be undertaken to cancel the warning, while following the stabilisation criteria.

### Descent management

The Air France operations documentation describes the normal operating procedures for managing descent and approach, but does not give any criteria for missed ILS approaches before the stabilisation floor.

In its Flight Operation Briefing Note<sup>(13)</sup> (FOBN), Airbus describes a general rule, to ensure that the descent profile followed is adequate:

- Height of 9,000 ft in relation to the aerodrome, 30 NM from touchdown point;
- Height of 3,000 ft in relation to the aerodrome, 15 NM from touchdown point (taking into account deceleration and slat and flap extension).

The FOBN also proposes solutions enabling glide path interception if the flight path is too high. It specifically mentions warning ATC as soon as it has been identified that the glide path will not be reached and, as a last resort, to perform a 360° on descent.

The FOBN concerning power management during approach indicates the following deceleration possibilities on a 3° descent glide path:

- Deceleration normally impossible in smooth configuration;
- 10 kt per NM with flaps 1;
- 10 to 20 kt per NM with flaps in landing position and the landing gear extended.

## LESSONS LEARNED

### Sterile cockpit

All the existing references agree on:

- A definition of a non-sterile cockpit being the whole of the external disruptions to the crew or discussions between flight crew members not directly linked to the conduct of the flight;
- FL100 as the limit below which the sterile cockpit principle must be followed.

This incident shows that personal preoccupations may also be considered as a disruption which may also affect crew alertness, and therefore the conduct of flight in complete safety. In the same way, a non-sterile cockpit above FL100 may lead to errors in managing the start of descent and disrupt the continuation of the descent as well as the approach.

### Missed approach decision criteria before the stabilisation floor

A missed approach is often associated with a manoeuvre at a low height. This incident showed that an approach could be compromised at a high altitude. During this event, however, the crew's decision to undertake a direct approach after the change of active runway was not compatible with the height to be lost. It led to a high workload and to performing an unstabilised approach.

Too high a workload in this kind of situation can mask:

- The need to change the approach strategy, even if the instruments display significant deviations in comparison with the optimal flight path;
- The danger of taking the stabilisation floor of 500 ft as the only objective;
- The danger of continuing the approach even though the aeroplane is not configured and vertical and horizontal speeds remain high.
- The perception of aural warnings.

At the time of the event, the documentation supplied to crews did not contain any information that would make it possible to determine whether an approach was possible from above the stabilisation floor, nor did it propose any associated procedure.

### PF's actions and PNF's participation

The PF focused on his objective of stabilisation at 500 ft, which prevented him from sharing his approach strategy with the PNF.

The PNF quickly noticed the deviations in relation to the glide path, informed the PF several times but then gave up trying to propose any alternative to him. His respect of the Captain's position took priority over his monitoring and support role.

### CONCLUSION

The unstabilised approach was due to:

- The crew's decision to undertake and continue an approach that required a glide path interception from above in conditions that did not offer a high chance of success;
- Sloppy CRM in terms of planning and cooperation, after a change of runway that made it impossible for the crew to:
  - define and apply a strategy that would make it possible to adapt the flight path in an appropriate manner;
  - share sufficiently early the decision criteria for a missed approach.

The Air France documentation does not define operational limits for intercepting the glide path from above. Such limits would make it possible for crews to have sufficient criteria to decide on whether to continue the approach or not.

This is why, in its report on the serious incident on approach on 13 March 2012 to the Airbus A340 registered F-GLZU<sup>(14)</sup>, the BEA recommended that:

- **EASA ensure that the national authorities ensure that all operators define explicit operational limits in their documentation providing pilots with assistance in the decision before intercepting the glide path from above. [Recommendation FRAN-2013-005]**

<sup>(14)</sup> See: <http://www.bea.aero/docs/2012/f-zu120313/pdf/f-zu120313.en.pdf>