

CAUSE & CIRCUMSTANCE

Catching the Glideslope From the Top

An Air France A319 narrowly escapes disaster at the end of an unstabilized, hurried VMC approach.

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Air France Flight AF2184 departed Paris Charles de Gaulle (CDG) at 0653 on March 24, 2012, bound for Tunis-Carthage International Airport (TUN). The captain was the pilot flying (PF) and the copilot was the pilot monitoring (PM). Departure, climb and cruise phases for the Airbus A319 were routine and without incident. However, the arrival at Tunis almost ended tragically due to a hurried descent, a runway change, poor planning and a lack of basic CRM.

The good news is that no one was hurt and no metal was bent. The crew was able to save the situation in the last seconds. There is much to learn in this case and the story tells itself as we explore the investigation performed by France's Bureau d'Enquetes et d'Analyses pour la securite de l'aviation civile — the BEA. Here's what happened:

Nearing top of descent at FL 350, the captain prepared for landing at Tunis on Runway 29 in accordance with the information broadcast by the current ATIS. He selected the vertical speed mode (V/S) at 1,000 fpm down.

The crew contacted the Tunis en route control center controller who confirmed that Runway 29 was active. Six minutes later, the airplane passed above the theoretical glidepath of 3-deg. for Runway 29. And a minute after that, the Tunis approach controller announced that Runway 19 was active and requested that AF2184 plan for a direct approach.

The captain conducted a briefing for Runway 19, at the end of which he noticed that the autopilot was still in V/S mode at 1,000 fpm down.

The change of active runway from the ILS DME 29 approach to the Runway 19 approach shortened the arrival flight path by about 20 nm assuming that the crew wanted to conduct a 3-deg. descent from the FAF to touchdown. When the crew received the runway change, the aircraft was about 1,800 ft. above the theoretical 3-deg. glidepath to Runway 29. The new clearance meant that they were now 8,100 ft. above the 3-deg. intercept with the Runway 19 extended glidepath. Stated simply, they had to get down fast if they were to make the "direct" approach.

At this point, the captain engaged the OPEN DES mode, selected 300 kt. and extended the air brakes. (The OPEN DES mode simply commands the autothrottle system to pull the throttles back to idle and fly the selected speed.) The airplane was at FL 207 and 33 nm from the threshold of Runway 19 — about 10,000 ft. above the theoretical path of 3 deg., at a speed of 276 kt. The crew was cleared for the ILS 19 approach.

Vertical speed reached 5,000 fpm down as the captain attempted to make the quick descent. Approaching FL 120, about 20 nm from the runway threshold, the crew reduced speed by selecting 240 kt., which resulted in a reduced rate of descent.

The airplane descended through FL 100, when it was 13.5 nm from the threshold. The captain disconnected the autopilot,

expecting to obtain greater deployment of the air brakes. (Actually, this is not necessary for max air brake deployment in the Airbus 320 series.) He ordered the landing gear extended. The pilots now had the runway in sight.

The crew established on LOC at 6,000 ft. above the airport (elevation 11 ft.), some 8 nm from the runway and at about 250 kt. The airplane was now about 3,400 ft. above the glidepath.

The crew applied the procedure for interception from above and selected an altitude of 16,000 ft. (The Air France Operations Manual states that in case of intercept of the glidepath 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.)

This action caused a change in the flight director vertical mode (FD: OPEN DES to V/S) that, from then on, indicated a trajectory based on the real vertical speed at the time of the mode reversion — 4,400 fpm down. The Air France procedure for glideslope capture from above states that descent rate should not be above 2,500 fpm down. The FD vertical G/S* mode was engaged 5 sec. afterward. The airplane was then at 3,550 ft. — 1,700 ft. above the glidepath.

The copilot was focused at the time on the stabilization floor of 500 ft., defined by Air France for an approach in VMC. (In other words, the airplane must be stabilized in speed, descent rate, alignment and configuration at the stabilization floor or a go-around should be called.)

He radioed the controller that they were established on ILS 19. When he made this call, the airplane was at 2,640 ft. (about 1,000 ft. above the glidepath) and 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. and vertical speed was 4,400 fpm down. AFM approach speed (V_{APP}) for this day at the airplane's weight was about 132 kt.

The thrust levers were retarded manually to the idle position, which disconnected the autothrottle. The controller cleared Flight 2184 for landing. Eight seconds later, the copilot announced on the frequency that they were "a little above the path" and requested a 360-deg. turn to the right. The controller had him repeat this request.

During these radio exchanges, the captain reengaged the autothrottle and the autopilot so that the latter could intercept the glidepath. A ground proximity warning system (GPWS) audio "Sink rate" warning was triggered. The G/S mode engaged, but the airplane passed through the glidepath. The airplane sank to a radio-height of 836 ft., at a speed of 220 kt., 2.8 nm from the runway threshold. Descent rate was 2,500 fpm. The GPWS "Pull up" warning was triggered, followed by the "Too low — terrain" warning.

The controller cleared the flight to make a 360-deg. turn to the left. The crew selected the flaps in position 1 for the

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go-around. The copilot read back the 360 deg. to the left.

The captain retracted the air brakes, disengaged the autopilot and made a pitch-up input. The airplane 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-deg. turn to the left.

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

Incident Investigation

Of course, the incident generated an investigation. The crew was well experienced. The captain had accumulated about 8,900 hr. of flight time, including 2,600 hr. on the Airbus A320 family, and 1,700 of that as captain.

The copilot had five years experience as a copilot and four years as a captain with another airline on different aircraft types. He had accumulated 1,700 hr. with Air France on the A320 family.

The captain explained his strategy for the Tunis approach to investigators. He said he was aware very early on of being above the glidepath and that the approach was compromised. He then set himself two targets: FL 100 to reduce the speed to 250 kt.; then the aim of stabilization at 500 ft. He did not inform the copilot of his plan of action.

Arriving at FL 100, he already had the runway in sight. The meteorological conditions were excellent; he decided to try and intercept the glidepath. 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 copilot.

The copilot told investigators that that he was aware that the approach was compromised as the airplane descended through FL 100, so he concentrated on the altimeter in order to call out the go-around at 500 ft.

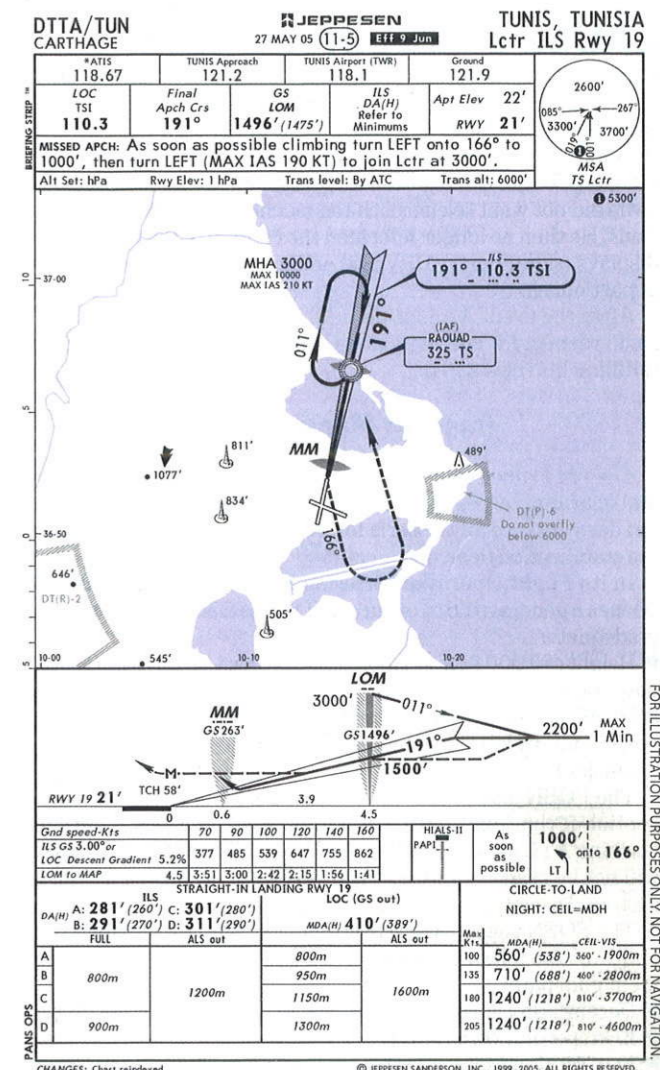
After FL 100, the attempt to intercept the glidepath at a high speed led to a work overload for the captain. He told investigators that he focused on this objective and that he had not seen that a stabilized approach was no longer possible.

At 2,000 ft., having not reached the desired configuration, the captain 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 copilot, who then requested a 360-deg. turn to the controller. The captain then ordered the go-around.

The captain said the decision to not follow the published missed approach course was taken too quickly and again increased their workload.

The copilot told investigators that because of the work overload connected to this unusual situation as well as his focusing 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-deg. turn. He estimated that performing the published go-around path would have been more comfortable. In addition this would not then have caused the misunderstanding with the controller.

The captain stated that he only heard the GPWS "Sink rate" warning, but the copilot explained that he was so



focused on the 500-ft. limit, he never heard the 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 stabilization criteria.

Sterile Cockpit and CRM

In reviewing the day with investigators, the captain said that the morning departures from CDG 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, which was unfavorable to the correct planning of the descent. He said that during the descent, the cockpit was self-centered, that is to say that the captain 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

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that they were above the glidepath and called it out twice to the captain: once at the start of the descent then descending through FL 100. 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 his personal respect for authority and CRM, which stopped him from fulfilling his role as PNF.

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 stabilization floor.

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

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

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

The FOBN concerning power management during approach indicates the following deceleration possibilities on a 3-deg. descent glidepath:

- ▶ 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.

Sterile Cockpit

The BEA states that 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 crewmembers not directly linked to the conduct of the flight;
- ▶ FL 100 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 that could affect crew alertness and, therefore, flight safety. In the same way, a non-sterile cockpit above FL 100 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

A missed approach is often associated with a maneuver 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 unstabilized approach.

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

- ▶ The need to change the approach strategy should the instruments display significant deviations in comparison with the optimal flight path;
- ▶ The danger of taking the stabilization floor of 500 ft. as the only objective;
- ▶ The danger of continuing the approach even though the airplane 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 stabilization floor, nor did it propose any associated procedure.

The captain said the decision to not follow the published missed approach course was taken too quickly and again increased their workload.

PF's Actions and PNF's Participation

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

The PNF quickly noticed the deviations in relation to the glidepath, 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.

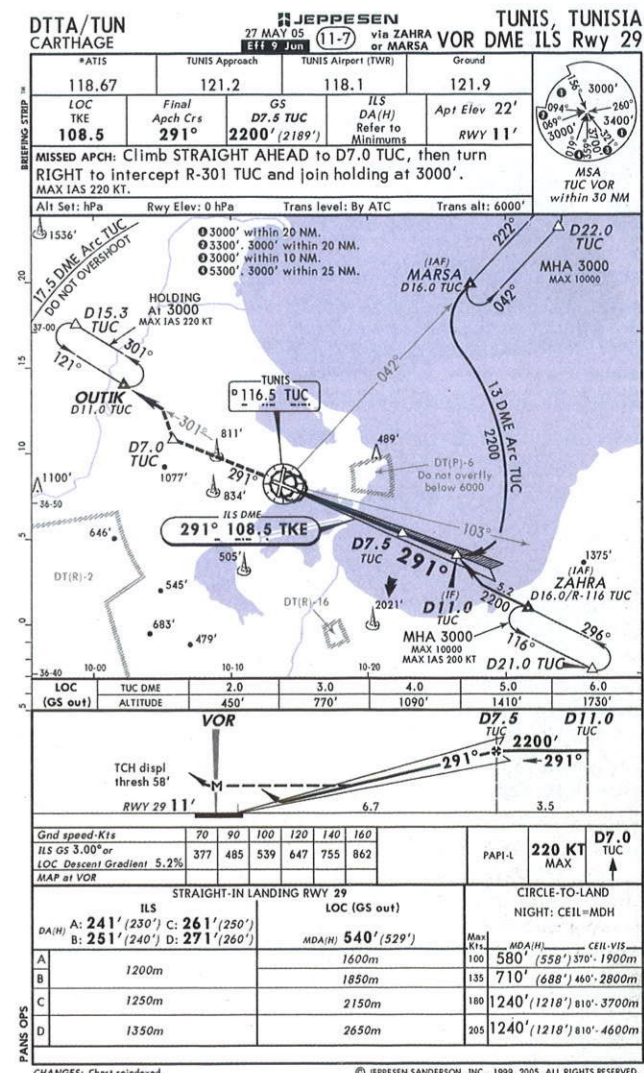
Conclusion

The BEA concluded the unstabilized approach was due to:

- ▶ The crew's decision to undertake and continue an approach that required a glidepath 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 and share sufficiently early the decision criteria for a missed approach.

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

The BEA has long been concerned with procedures for capturing the glideslope from above. This is why, in its report on a serious approach incident on March 13, 2012, involving an Airbus A340, the BEA recommended that the European Aviation Safety Agency's national authorities ensure that all operators define explicit operational limits in their documentation to assist pilots in their decision making before interception. **B&CA**



Accidents in Brief

Compiled by Jessica A. Salerno

Selected Accidents and Incidents in March 2014. The following NTSB information is preliminary.

▶ **March 18 — About 0740 PDT, a Eurocopter AS 350 B2 (N250FB) was destroyed when it crashed following takeoff from the KOMO TV Heliport (WN16), Seattle, Wash. The helicopter was registered to, and operated by Helicopters Inc., Cahokia, Ill. The commercial pilot and one passenger were fatally injured and one person, located in a stationary vehicle, was seriously injured. It was VFR and no flight plan was filed for the local repositioning flight that was originating**

at the time of the accident. The pilot's intended destination was the Renton Municipal Airport (RNT), Renton, Wash. Multiple witnesses located adjacent to the accident site reported observing the helicopter lift off from the helipad and begin a counterclockwise rotation. The witnesses stated that the helicopter pitched downward, while continuing the counterclockwise rotation, and descended into an occupied vehicle and terrain near the intersection of 4th Ave. and Broad St.; post-impact fire ensued. Preliminary review of three security camera recordings, provided by the Seattle Police Department, revealed that the helicopter initially landed at WN16. The videos depicted the helicopter stationary on the helipad for about 15 min. prior to takeoff. Further review revealed during the takeoff sequence, the helicopter began rotating counterclockwise and ascending slightly

in a near level attitude. The helicopter continued rotating counterclockwise for about 360 deg. of rotation before it pitched forward in a nose low attitude. The helicopter continued the counterclockwise rotation in a nose low attitude until it disappeared from the camera's field of view.

▶ **March 8 — About 1400 EST, a Cessna 172D (N2755U) operated by Gone Broke, LLC, was destroyed during a landing attempt and post-crash fire at H L Sonny Callahan Airport (CQF), Fairhope, Ala. The private pilot sustained serious injuries. The flight was operating VFR with no flight plan. According to several witnesses, a military helicopter had been operating in the pattern at CQF for about 10 min. During the maneuver the helicopter descended into a hover over the approach end of Runway 19, then**

transitioned into a takeoff and entered an initial climb about midfield. While the helicopter was ascending, the Cessna 172D was attempting to land on Runway 19. A witness reported the airplane was about 30 ft. above ground level when it suddenly rolled right in a right wing low attitude, leveled out and then impacted the ground flat in a level attitude forward of the runway threshold. Subsequently a post-impact fire ensued near the engine cowling. The FAA and the OEMs found no anomalies or malfunctions that would have precluded normal operation.

▶ **March 5 — About 1056 CDT, a Cessna 172R (N9417Z) was heavily damaged during a forced landing after a loss of engine power during an instrument approach at McKellar Sipes Regional Airport (MKL), Jackson, Tenn. According to the pilot, during the climb from MKL as**

he was at 6,500 ft. above MSL he noted that he was losing oil pressure rapidly. He immediately did a 180 degree turn and headed on a direct course back to MKL. A few miles from the airport, he asked for radar vectors for the "ILS RWY 2," and was vectored for the approach by air traffic control. Inbound on the ILS, he realized that he was too high, and executed a 360 degree descending turn to lose altitude. He then proceeded inbound on the ILS once again.

At approximately 2,100 ft. MSL, the glideslope was "hopping from the top peg to the bottom peg rapidly" and he never was able to get a "solid indication from the glideslope." He continued to descend and when he was at approximately 1,500 ft. MSL, and still had not captured the glideslope, he executed a missed approach. The pilot then climbed to 2,000 ft. MSL. There was now "zero oil pressure"

and the engine would only produce partial power. He then circled around again and re-established himself on the localizer. He still had no glideslope indication and the glideslope needle was still "hopping from top to bottom." At this time the engine had lost all power and the airplane began descending. He was on the localizer and he knew he was lined up with the runway. At approximately 400 ft. above the runway he still could not see the runway and the airplane was still descending with no engine power.

The airplane continued to travel to the north of the airport and when the airplane was about 150 ft. AGL, the pilot saw a field and then a road. He then made a "sharp" left turn, lined up with the road and touched down. During the rollout, the right wing made contact with a highway sign, veered to the right and entered a cornfield. **B&CA**