

No. 7

SAGETA Airlines, SE 2010 Armagnac, F-BAVG, accident at Orly, France on 29 January 1957. Report released in the Journal officiel de la République française.

Circumstances

After a normal flight from Tunis the aircraft arrived at Paris at night and in weather conditions close to the operational minima and made an unsuccessful attempt to land using ILS monitored by GCA. The pilot-in-command then decided to land with GCA guidance. Lacking sufficient visual references to permit landing, the pilot applied full power at low altitude, in the immediate vicinity of the runway end. The aircraft, on a heading divergent from the landing runway, continued to lose altitude and struck the ground (at 1924 hours GMT) in a slightly nose-down position, banking to starboard. The right wing burned after separation from the fuselage and the rest of the aircraft turned over in a half-roll and broke up into four main parts. Of the 10 crew, 57 passengers and 3 infants aboard, one crew member and 35 passengers were injured.

Investigation and EvidenceAircraft and Crew

The investigation revealed that the aircraft had been properly equipped and maintained and its loading and distribution were in accordance with operational rules.

The aircraft carried navigation and radio equipment conforming to the standards for public transport aircraft but had no radio altimeter.

The pilot-in-command had logged 11 230 flight hours, of which 2 730 were on aircraft of the subject type. During the two months preceding the accident he had logged some 152 flight hours and had had two days' rest after his previous flight, Orly-Prague-Orly, on 26 January.

The co-pilot had logged 4 995 flight hours of which 2 971 had been on the subject type aircraft. During the two months preceding the accident he had logged some 139 flight hours.

Weather

No meteorological difficulties were experienced during the flight, and the sky had been almost clear all the way from Tunis. Although the alternate aerodromes of Lyon and Le Bourget were below limits, Marseille, also specified in the flight plan, was clear and so was Reims.

In the Paris area, a low stratus, touching the ground in places, created a ceiling generally between 50 and 100 m; the atmosphere was very foggy under the layer; there was a light south to southwest surface wind. These conditions were in accordance with the forecast and the aircraft was informed of them.

Because of the prevailing bad weather conditions, the meteorological observation at the main station of Orly aerodrome was duplicated by that of a special observer working from the station at the end of the runway in use. At the very moment of the accident, this observer was transmitting by teletypewriter a message containing his latest observations:

"Visibility: 1 100 m; Weather: fog;
Cloud base - 8/8 50 m ill-defined."

This information indicated a deterioration in the previously reported visibility conditions of more than 1 300 m.

The next observation made a quarter of an hour later at 1940 hours indicated visibility of only 500 m, and ceiling 40 to 50m,

ill-defined. This official information, together with evidence given by several other pilots, who had taken-off or landed during the relevant period, confirms that the ceiling over the approach area and the threshold of Runway 26 was ill-defined and certainly very low when F-BAVG came in. The ground visibility in this area was much lower than that in the centre of the aerodrome. This particular characteristic of Runway 26 is due to the proximity of the Seine and is frequently observed at Orly.

In addition, the pilot's slant visibility on breaking through this stratus with ill-defined base was considerably reduced and contrary to what occurs in ground fog, the visibility decreased with altitude.

This is proved by the remarkable differences in the estimates of visibility calculated by several observers close by, at different levels (aircraft cockpit - control tower - ground).

Marker visibility was in fact 1 100 m at ground level on the runway as announced, but to a pilot coming in to land, on approach to the runway and at a height of about 30 m, effective visibility cannot have exceeded a few hundred metres.

The surface wind of 10 knots was from the left with reference to the landing direction, at an angle of 60 to 80 degrees.

Landing Aids

An ordinary GCA and a complete ILS were at the pilot's disposal on Runway 26 at Orly Airport. Although there was no reference in the pilot's report to malfunction of ground equipment, a flight test was immediately made to check its operation and a favourable report resulted.

The approach lighting to Runway 26, which was checked for operation and found in order, has certain particular characteristics:

limited length of 556 m because of terrain;

lateral position, it being an extension of the left side of the runway.

SAGETA Operational Minima

The special landing minima of SAGETA for Orly aerodrome on Runways 03L and 26 are as follows:

	<u>Minimum height of cloud base</u>	<u>Critical height</u>	<u>Runway visual range</u>
For ILS radio guided landing	40 m	60 m	800 m
For ILS/GCA or GCA radio guided landing	40 m	60 m	800 m

Examination of the Wreckage

Examination of the wreckage and the marks on the ground revealed nothing to contradict the statements of the crew, except the position of the flaps, found to have been set at about 34° at the time of the crash.

The altimeter setting (30 inches) on both altimeters of the instrument panel corresponded exactly to the aerodrome's QFE at the time of impact.

On impact, all four engines were running and at high power, and the landing gear was still down.

Reconstruction of the flight

The flight from Tunis to Paris was carried out in normal conditions and at 1857 hours the aircraft established contact with Orly approach control, giving its heading as 270°, abeam the W-E marker (located on the extended centre line of Runway 26L, about 10 km from the threshold), at an altitude of 4 000 feet.

Control gave the aircraft number one to land, cleared it to descend to 1 600 feet in the holding pattern and transmitted the meteorological report:

"Wind 200°, 5 to 10 knots - visibility 1 400 m, ceiling ill-defined 8/8 - 50 to 60 m - QNH 1 027 mb, QFE 1 016 mb."

At 1858 hours the pilot signified his intention to make a GCA monitored ILS approach and at the same time Viscount F-BGNN arrived from Geneva and received number two to land.

The pilot of F-BAVG made his first landing attempt, interrupted at 1909 hours by applying power, as the aircraft was too far left of the centre line and visibility was insufficient.

After applying normal overshoot procedure after missed approach, and while F-BGNN was landing on ILS, the F-BAVG pilot requested permission to make a second attempt with GCA alone and was cleared by control at 1911 hours.

Shortly after 1924 hours the second attempt ended with a second application of power, and the aircraft stalled and crashed.

Discussion of Evidence

The first attempt to land was discontinued at an altitude of 200 feet when the pilot sighted the approach lighting, but "in such a glare that it was reasonably impossible to place the aircraft on the runway centre line by visual reference."

It is possible, by examining the final approach and attempting to reconstruct the path followed by the aircraft during the final phase, to recreate the circumstances and to point out the different factors in the accident.

The following were given particular attention:

- a complete recording of communications with time injection;
- the pilot's statements;
- the statements of other crew members, especially the radio operator;
- the statements of the GCA operator.

Study of these documents leads to the following conclusions:

Reconstruction of final approach up to the accident

From the start of descent up to one and a half miles from the runway threshold, the approach of the aircraft was completely normal.

Even at one and a quarter miles, GCA only raised a minor point on altitude: "above glide path 20 feet".

At this point the aircraft drifted left and GCA gave heading 264° (for QFU 262°) when it was one mile from the runway threshold.

In the vicinity of the ILS middle marker (between three quarters and half a mile from the runway threshold), while flying about 50 m to the left of the runway centre line, the pilot sighted the first approach lights. GCA then gave him a heading of 265°.

But the pilot, by visual reference, made a "jog" on his own initiative to place himself to the right of the lights.

Noting the aircraft's very rapid move towards the runway centre line and supposing this to be the result of its last indication, GCA immediately corrected by sending "Turn left 2 degrees".

At a distance of one half to one quarter of a mile from the runway threshold, the aircraft had returned very close

to the centre line and was still on the glide path, as noted by GCA: "On glide path, heading is good 263⁰⁰".

But, the aircraft, flying visual for 3 or 4 seconds and parallel to the runway centre line up to the 300 metre cross-bar, again moved to the left (towards the approach lights) following a sudden decrease in visibility. GCA warned the pilot: "Left of centre line - I do not consider you to be in correct landing configuration - pull up immediately".

The pilot, now far over to the left and no longer seeing the lights below, interrupted his descent and awaited the appearance of the green bars; he estimates having waited for a second, but, in fact, chronological reconstruction as well as the radar operator's precise recollections prove that the aircraft must have flared out for some 10 seconds.

While transmitting the instruction to pull up, the GCA operator noted on his screen that the aircraft was in level flight (or slightly ascending), from which he concluded that power had already been applied. However, the pilot applied power only at the time he received GCA's instruction and after slightly changing his heading to the right, in order to regain sight of the lost marker lights.

During the level flight, prior to applying power, the aircraft's speed gradually decreased. The aircraft stalled just as the pilot was manoeuvring to change heading and gain altitude and was ordering an increase in power.

Comments on the final approach phase

Alignment

Up to the visual break-through mentioned by the pilot-in-command, the aircraft was properly positioned on the glide path.

Break-through Conditions

First visual contact with the ground was established in the vicinity of the ILS middle markers.

Evidence given by the pilot-in-command and the radio navigator, although somewhat at variance, indicates that break-through was made with a ceiling slightly above 60 m and a visibility of some 700 to 800 m (nearing the limit values of SAGETA's special operational minima).

The well known phenomenon of instability became apparent just as the pilot sighted the first approach lights on his right, and at this particular moment the "jog" was made to bring the aircraft back over the runway centre line.

It should be pointed out that movement to the left had been observed by GCA and the pilot was informed; the indication observed at this time corresponded to the position of the aircraft with reference to the approach lights, as stated by members of the crew.

Visual Flight Manoeuvres

According to his own statement, the pilot brought the aircraft close to the centre line by a sharp change of heading of some 10 degrees to the right, followed immediately by a 10 degree turn to the left, and for some seconds flew parallel to the line of approach lights visible on his left.

After passing the cross-bar, which he had sighted clearly, the pilot lost sight of the next approach lights and diverged to the left. He missed the green runway threshold lights, probably because they passed on his right, out of his field of vision.

It is not known whether the co-pilot saw these lights as he does not recall anything; it is very likely that they were crossed just as the order to apply power was given, and the co-pilot was probably busy taking necessary action. Or possibly his attention was focused on the airspeed indicator, which was indicating deceleration (the aircraft had ceased to descend a few seconds earlier).

Finally, it is likely that, after passing the cross-bar, the pilot operated the flaps to the 35° pre-set position (where they were found after impact) causing an increase in drag and consequent loss of speed.

Re-application of power

Quite clearly the instruction to apply power was given by GCA and carried out by the pilot only very near the runway threshold.

According to the radio navigator's testimony, the aircraft was maintained in level flight (possibly in a slight climb) at an altitude of 30 to 40 m, from one quarter of a mile before the runway entry to 200 to 300 m beyond it.

Although it is not possible to calculate the exact time necessary for application of power, it appears that full power was re-applied on an aircraft which had been in level flight for 10 seconds, with engines set for descent, consequently the airspeed was very low;* this full power, in such a brief period of time, could not prevent the accident.

Final Crash

After apparently attempting a last-minute change of heading some degrees to the right, the pilot felt his aircraft go into a bank without attempting (or being unable) to recover because of loss of flight speed.

At the stall, the nose gear, the right wing and right wheel of the undercarriage touched ground almost simultaneously 650 m from the runway threshold, after which the aircraft crashed and broke up 280 m to the right.

GCA Guidance

Two remarks should be made on the guidance provided by GCA in the approach which ended in the accident:

1) The first involves operational principles: the radar operator states that he observed the aircraft halt its descent and continue in level flight - or even slight ascent - about one half or one quarter of a mile short of the runway threshold, by his estimate. However, no such information was transmitted to the pilot, as the radar operator apparently interpreted what he saw on his scope as the result of re-application of power;

2) The second remark concerns the standard phraseology used: certain words intended for the pilot's information lack precision and explicitness. In this connection, the sentence preceding the order to apply power is most noteworthy: "I do not consider you to be in correct landing configuration".

Meteorology

It seems certain that upon reaching an altitude of some 30 m to which he had descended, the pilot of F-BAVG did not encounter the visibility of 1 100 m as measured by the observer at the end of the runway. The ceiling given as 50 m ill-defined existed at that moment in the true sense of the word: Atmospheric transparency did not present any abrupt discontinuity at a given height (when the descending aircraft broke through the ceiling) but only a gradual increase from there on, which could extend over some 10 m or more, perhaps even to the ground.

* Contrary to the pilot's statement giving a speed of 125 knots, which is incompatible with actual events.

This classical situation (just like the inverse situation of increasing horizontal visibility with height in the case of ground fog) has for a long time posed the problem of information on "slant visibility".

However, whereas with ground fog, the value measured by the meteorological observer at the end of the runway - always lower than the pilot's slant visibility - constitutes a warning of final difficulty, with a low ceiling this same value is deceptive, since it is far higher than the slant visibility on final approach, the actual value being encountered only on touchdown.

Landing of Viscount F-BGNN

Although the approach carried out by a Viscount cannot be paralleled to that of an Armagnac, it was considered desirable to study the landing performed by Viscount, F-BGNN, which touched down ten minutes prior to the accident to F-BAVG and in almost identical weather conditions.

The Viscount pilot broke through in sight of the first lights and before any sign of instability in his ILS approach. Thereafter he experienced no difficulty in visual flight, thanks to a slightly premature descent below the glide path, which placed F-BGNN in a layer of better visibility,

contrary to F-BAVG which remained 100 feet higher and consequently did not emerge from the ill-defined base of the low stratus.

Nevertheless, the procedure of premature descent to just above the approach lights is not to be recommended in the case of heavy public transport aircraft in view of their considerable inertia.

Probable Cause

The immediate cause of the accident was as follows:

- stalling as a result of delayed application of power with a heavy aircraft in final approach configuration and inadequate control of heading, airspeeds and altitude after the visual break-through.

The following contributing factors are noteworthy:

- deterioration in weather conditions in the immediate vicinity of the runway threshold;
- absence of radio altimeter;
- faulty application of landing techniques by both ground and flight personnel.
