

No. 39

Transavia Airlines, SM-102, I-NINI accident at Parete (Naples) Italy, 22 October 1961. Report of the Italian Accident Investigation Board, issued 28 December 1961 by the Directorate of Civil Aviation, Italy.

Circumstances

After unloading 500 kg of newspapers at Capodichino, the empty aircraft with a pilot and a flight mechanic aboard took off at 0850 hours local time for the return VFR flight to Ciampino Airport, Rome. The take-off and climb-out were normal. Twenty minutes later the pilot informed Capodichino tower that he was returning because the right engine had failed. At this time he was at 1 000 ft over Grazzanise. At 0914 the aircraft was on a heading of 120°, at 700 ft and maintaining altitude fairly well. Thereafter the flight did not respond to any calls. It crashed at approximately 0915 hours near Parete, 13 km to the west-northwest of the south end of the Capodichino runway. Both crew members were instantly killed, and the aircraft was destroyed. There was no fire following impact.

Investigation and EvidenceThe Aircraft

The aircraft's certificate of airworthiness was valid until 21 December 1961 and only if associated with Manual CA 754 "Description and Piloting Regulations for Pratt & Whitney R-985-AN-14B engines". The manual was not found in the aircraft.

Since manufacture the aircraft had flown a total of 695 hours. Since its last overhaul by the manufacturer and the last inspection by the Italian Aeronautical Registry it had flown 153 hours. The aircraft's log book showed 148:45 hours instead of the 153:05 hours as shown in the maintenance log book.

Several periodic inspections of the aircraft were carried out by Transavia in September 1961, and the aircraft was about due for the 150-hour inspection.

The right engine had been replaced on 19 August following an in-flight failure. Since that time the new engine had flown about 100 hours.

At the time of the accident the aircraft was empty and weighed 4 111 kg, i. e. approximately 80% of the maximum authorized (5 050 kg).

Its centre of gravity at the time of the accident was considerably forward of the permissible forward limit and approximately 30% beyond the optimum position.

Following the accident, the Board calculated how much ballast would have been required in the furthest tail compartment to bring the centre of gravity back to its mean position, or at least to the maximum forward position. Instead of the 20 kg on board, 291 or 113 kg respectively would have been required.

Crew information

The pilot of the aircraft held a pilot certificate and licence (third class) which was valid until 28 October 1961. The rating entered on his licence for the SM-102 was dated 2 August 1961. His total amount of flying experience amounted to 3 306 hours. On the subject aircraft type he had flown a total of 82 hours, all within the last 90 days.

The flight mechanic's licence was valid until 11 October 1962. He had had considerable military and civil experience

in this capacity. Transavia had hired him in June 1961 as flight mechanic for the company's SM-102's. His flying time totalled 695 hours which excluded his time flown prior to 1943, the record of which had been lost. During the last 90 days he had completed 105 flying hours on the SM-102.

He had recently been involved in an emergency landing while on a commercial flight from Milan to Rome during which he was aboard as a pilot in training. At that time he was carrying out the duties of first pilot. No technical investigation appears to have been made of this accident.

Both the pilot and the mechanic were considered to be highly competent airmen.

#### Weather conditions

On the morning of the accident it was clear and sunny with very little scattered cloud, no wind and perfect visibility. The pilot had filed a VFR flight plan and could not, therefore, fly higher than 1 000 ft (300 m) above the ground.

Fifteen minutes before the accident occurred the conditions of the air at Naples at ground level were as follows:

relative humidity	82%
temperature	12°
dew point	9°

As is generally known from the SM-102 manual and from the Pratt & Whitney Manual R-985-AN-1, there is a possibility of icing in the carburettor in the above conditions of humidity and temperature, and therefore the use of hot air is recommended as a precaution.

The pilot had noted the weather conditions and was familiar with them as he was returning to Rome from which he had just come.

#### Reconstruction of the flight

Based on the evidence available the flight was reconstructed as follows.

\* 26 km from Capodichino.

The aircraft took off at 0850 hours. Two minutes later it was en route to Ciampino and flying normally at 1 000 ft for approximately eleven minutes. It had flown about 14 km beyond Grazzanise airfield. At about 0903 hours the pilot noticed a decrease in power on the right engine and decided to return to Capodichino. He avoided a landing at Grazzanise Airport\* and passed over it at 0910 when he first made radio contact with Capodichino advising that the right engine had failed and that he would arrive over the airport at 0918. He continued the flight thereafter without feathering the right propeller or putting it on minimum pitch. At approximately 0913 - 0914 hours he again contacted Capodichino and reported that he was at 700 ft and maintaining height fairly well on a heading of 120°. Not more than one or two minutes later, at about 0915 - 1916 hours, the aircraft crashed to the ground in a dive angle of 30°, about 13 km from the south end of Capodichino runway.

#### Eyewitnesses

The only eyewitnesses to the accident were two peasants who observed the aircraft during the last seconds of flight only, shortly before impact with the earth. They said that they looked up upon hearing the sound of the approaching aircraft, therefore at least one engine must have been functioning. They did not hear or were unable to distinguish backfiring or other irregularities in the operation of the engine or engines. They stated that the aircraft was approaching "as if it intended to dive", i. e. with its nose pointing towards the ground. The condition of the wreckage confirmed their statements.

#### Technical investigation

The aircraft, which was virtually intact, was found on a heading of 120° with its flaps and undercarriage retracted, near Parete in a clearing surrounded by trees. There were no traces of skidding or scraping on the soft ground. A number of tall trees (approximately 8 m) located 15 - 20 m behind the tail of the wreckage were not hit by the aircraft before it struck the ground. Also, a small tree (a little higher

than 1 m and less than 1/2 m from the right stabilizer) was not hit. This indicates that the aircraft, after striking the ground at a 30° angle, fell on its tail and rotated around the engines, which had struck the ground first and acted as a fulcrum. The occurrence of a downward couple, which caused the aircraft to settle on its tail, and of stresses causing buckling of the fuselage, indicated that at the time of impact the angle of incidence and hence the flight configuration were very close to the stall configuration.

The coincidence of the orientation of the longitudinal axis of the wreckage with the 120° approach heading to Capodichino, as radioed by the pilot, and the horizontal position of the wings at the time of impact indicated that the stall which occurred along this approach heading was a straight stall, or at least a stall that was corrected by the pilot's action on the rudder before the crash.

The extent and nature of the distortions of the left propeller blades indicated that the left engine was turning more rapidly than the right one. It was not possible to determine the rpm at impact. Indications were that at impact the propeller was on minimum pitch and was not capable of providing the necessary thrust to support the aircraft in flight.

The extent and direction of the distortion of the blades of the right propeller indicated that the right engine was not operating and that the propeller also struck the ground on minimum pitch. It may be assumed that the right propeller, far from providing any thrust, was on the contrary generating additional drag because it was on low pitch and windmilling.

The Board was unable to determine the number of rpm required for maintaining the SM-102 in flight on one engine, with propeller at minimum pitch.

No specific irregularity was found with respect to the aircraft, the engines and the propellers.

Examination of the wreckage did not reveal any failure in the control systems. The Board, however, admitted the possibility of a sudden increase of the minimum lift speed and controllability of the aircraft as a result of:

- a) asymmetric power configuration with right propeller drag;
- b) centre of gravity too far forward necessitating an unduly high excursion of the rudder, which could not be obtained unless the aircraft were moving forward at a certain minimum speed below which even "full stick back" could not raise the nose of the aircraft.

It was stated by the Chief Pilot, Transavia, that with the aircraft empty and the centre of gravity fully forward, the SM-102 had already flown without any difficulties and that even during landing the difficulty of settling the aircraft and the pressure on the wheels were not significant and, therefore, not considered dangerous. The fact remains that it is impossible to equate the landing performances with more or less power output and at a speed much higher than the stalling speed up to a few inches from touchdown (not to mention lowered flaps) with the performance corresponding to asymmetric power near the critical power requirement for sustained flight such as obtained at the time of the accident.

#### Carburettor icing

The Board gave careful consideration to the temperature and humidity conditions existing at the time of the accident which were conducive to carburettor icing.

It was determined that hot air was not supplied to the engine or that, if supplied, it was cut off before the aircraft fell. The actuating cylinders operating the hot air intake shutters were both found in the "closed" position. As it was a warm sunny day the pilot could easily have been led to disregard the danger of icing of the carburettor.

Discussion of evidence

Based on the following:

The aircraft crashed

- a) without sending any radio messages;
- b) with both the pilot and the mechanic not strapped in their seats;
- c) without the controls or fuel being cut off;
- d) without the flaps being lowered;

it was deduced that the loss of speed or stall occurred -

- a) at low altitude (not above 700 ft and probably around 500 ft QNH, i. e. 300 ft = 100 m above ground level)
- b) abruptly and violently
- c) at a sharp dive angle (30° or more)
- d) quite unexpectedly for the pilot
- e) with considerable loss of altitude
- f) which left the pilot with lateral control of the aircraft only, prior to ground impact.

The evidence showed that there was not a complete loss of power in the left engine. Even in the case of an improbable failure of the left engine, it would not by itself explain the sudden, violent and steep stall of the aircraft.

In normal stall conditions the SM-102 shows definite and distinct tail vibrations which call for prompt recovery action

through a slight increase in the angle of attack. (At impact the angle of attack was approximately 15 - 18°.)

The pilot's experience was such that, faced with this loss of power, and hearing the stall vibrations, he would have taken immediate corrective action, i. e. he would have put the aircraft into a dive and lowered the flaps as close to touchdown as possible.

The fact that the centre of gravity position was beyond the permissible forward limit, and the aircraft was flying under asymmetric power, contributed to raising the stalling speed and to provoking the abrupt and violent stall which caught the pilot by surprise. The Board could not determine to what extent this minimum speed was increased and the stall aggravated.

Probable Causes

Having considered various hypotheses as to the cause of the accident the Board concluded that it was caused by a cumulative effect of various factors.

The weather conditions conducive to carburettor icing were such as to escape the attention of the pilot and thus explain his failure to take preventive or corrective action.

Power reduction had occurred initially in the right engine as a result of carburettor icing.

Subsequent loss of power in the left engine was also due to carburettor icing, or overheating as a result of operation at increased power to compensate for the failure of the right engine or again because of the deliberate action by the pilot to counter incipient overheating.

The pilot failed to foresee the possibility of carburettor icing, to consider the desirability of feathering the right engine, to assess the significance of the increase in minimum speed caused by the trim of the aircraft and its asymmetric power and to appreciate the stall characteristics in such conditions.

The low altitude at which the aircraft was flying precluded prompt recovery from an involuntary and severe stall.

The pilot and mechanic had not strapped themselves into their seats with the result that they suffered fatal skull fractures.

There may have been psychological reactions, difficult to evaluate, which were due to the fact that the mechanic had only recently been hired and that he had been involved in another accident on 6 September, which had nearly cost him his job. Therefore, he might have been more inclined to display ability to the point of recklessness rather than to be over-cautious (failure to land at Grazzanise).

#### Recommendations

The Board pointed out that the following recommendations, suggested by this accident, are not necessarily related to the accident as cause to effect.

#### Safety equipment for crew members

All flight crew members should be urged or obliged to use seat belts and shoulder harnesses and to unfasten them only when absolutely necessary to perform duties on board.

All civil air carriers engaged in cargo transport (without passengers) should be urged or obliged

- a) to install shoulder harnesses in addition to lap belts in all the seats normally used by flight crew members;
- b) to carry parachutes on board since the practical and psychological reasons for not carrying this equipment in the case of passenger flights do not apply in the case of cargo flights.

The carriage of this equipment is all the more justified in the case of aircraft such

as I-NINI, which are "authorized to fly by night and under IFR except in icing conditions".

#### Warm air to the carburettor

Pilots should be reminded of the need to supply hot air to the carburettors, within and outside of clouds, even as a preventive measure and on the sole basis of the thermometric indications, whenever there is suspicion of extreme air humidity.

It should be ensured that the regulations for the supply of hot air to the carburettors are actually included with the necessary explanations and emphasis:

- a) in the pilot's training manual for the aircraft and in the pilots' check list;
- b) in the examination programmes for the aircraft type rating.

#### Balancing of aircraft

It is recommended that:

- a) Certificates of Airworthiness and other aircraft documents such as Pilot Manuals and Check Lists should specifically emphasize, even at the cost of repetition, the need for carrying ballast in the tail of those transport aircraft (passengers or cargo), whose centre of gravity position may be too far forward from the specific or desirable limits when flying empty;
- b) The examinations for pilots' aircraft type ratings, and the regulations concerning approval of the load and trim sheet by the airport authorities should stress not only the hazards of aft loading, but also the hazards of fore loading.

#### Asymmetric flight at reduced power

It was also recommended that:

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| a) the operating rules (Aircraft Flight Manual and Pilot Check Lists) be checked and completed as regards asymmetric flight with reduced power - SM-102; | b) the theoretical and practical tests and examinations for the SM-102 type rating, particularly as regards asymmetric flight with reduced power, be reviewed and supplemented. |
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