

No. 9

Ceskoslovenské Aérolinie, Ilyushin 18, OK-OAD, accident northeast of Nürnberg, Germany on 28 March 1961. Report dated 22 March 1963 released by the Federal Republic of Germany.

Circumstances

The aircraft was on a scheduled flight from Prague to Bamako/Mali with intermediate stops at Zurich, Rabat, Dakar and Conakry. It disintegrated in the air and subsequently crashed in flames* while on the Prague-Zurich flight leg, at a point approximately 22 km northeast of Nürnberg. The 8 crew and 44 passengers on board the aircraft were killed in the accident. The last contact with the aircraft prior to the accident was at 2006 hours. The crash is believed to have occurred at about 2009 hours.**

Investigation and EvidenceThe Aircraft

An operating licence for the aircraft, issued on 13 June 1960, was valid at the time of the accident.

The aircraft was equipped with an automatic pilot but not with automatic elevator trim adjustment (trim servo). A 3-axes trim indicator for the automatic pilot was not installed. The elevator trim was adjusted manually. The aircraft was also equipped with an automatic signalling device which enabled the crew to ascertain whether the aircraft was properly trimmed. Rudder and aileron trim adjustment was electrical.

The aircraft was not equipped with a rapid fuel cut-off device. The fuel used was kerosene LRX 53.

The aircraft's weight and centre of gravity were within limits.

The Crew

The licences of all crew members were valid at the time of the accident, and their flying experience was considerable. The pilot-in-command had flown a total of 8 572 hours, 354 of which were on the Ilyushin 18. The co-pilot had flown a total of 11 019 hours including 179 on the Ilyushin 18.

Weather

The Nürnberg station of the German Meteorological Service gave the following report of local conditions at Nürnberg at 2011 hours:

wind 250/7 kt
clouds 7/8 sc in 5 000 ft, 8/8 cs
in 25 000 ft
visibility 20 km
QNH 2000 h 1021.5 mb
no precipitation (VFR weather)

The Flight

The aircraft left Prague at 1941 hours and climbed on a heading direct to the Rakovnik radio beacon which it crossed at 1949 hours at an altitude of 14 400 ft in climbing configuration. At 1951 hours the aircraft climbed further to 19 000 ft and estimated crossing the Eger radio beacon at 2001 hours. It was cleared by Prague area control to 20 000 ft and reached this

* based on statements of several eyewitnesses

** All times in this report are MEZ = Central European Time = GMT + one hour

altitude at 1952 hours. Because of damage to the antenna of the Prague area radar installation, which could not be repaired because of the strong wind, the flight was subsequently monitored by DF equipment. Thus, it was observed that the aircraft was slightly to the right of its course. According to the crew the DF was inaccurate. At 1956 hours the aircraft was observed on the radar scope for a short time and was on course. Four minutes later it reported that it would be crossing the Eger radio beacon at 1959 hours and gave the estimated time for crossing the Bayreuth radio beacon as 2005 hours. The aircraft was then transferred to the "Rhein-Control" upper control area.

In the German sector ATC radio communication was carried on with the aircraft by Rhein-Control until 2006 hours when the aircraft gave its estimated overflight of Nürnberg as 2010 hours. No further contacts were made.

At 2020 hours Nürnberg ATC received a telephone message that an aircraft had crashed and was burning some 20 km north-northeast of Nürnberg Airport.

At the Accident Site

The point of impact of the aircraft's fuselage was 510 m above sea level in open agricultural terrain. The angle of impact was about 60° at which a rotation around the transversal axis occurred. The fuselage section was so heavily damaged by the impact and ensuing fire that no reliable information could be obtained from the pieces of instrument found. The left wing, the right wing tip, parts of the tail assembly and the four engines were not found at the point of impact.

The four engines with their propellers lay south to east of the fuselage impact point at a distance of 150 to 600 m from the fuselage and were clustered closely together. The left wing with empty engine housing was found in a wood, 1.3 km ahead of the fuselage impact point. This wing was torn off on the inner side of

engine No. 2. Further to the rear, in the direction opposite to the flight direction, lay the right wing tip measuring some 4 m in length; parts of the tail, skin, upper side of the fuselage, a firewall and two large sections of the engine housing were found at a distance of up to 5 km from the fuselage impact point. The direction of dispersion of these fragments and the impact direction of the fuselage was approximately 285°. None of the fragments found outside of the fuselage impact point revealed traces of fire. According to the findings, the landing gear and landing flaps were retracted at the moment of impact.

Findings

The testimony of the witnesses, the position of the wreckage and the examination of the wreckage all indicated the following pattern of circumstances:

The aircraft, which was flying normally at flight level 200 (approximately 6 000 m), went into a steep descent (plunging flight path) during which the engine performance was apparently not reduced.

According to information furnished by the operator, the true airspeed in horizontal cruising flight was 635 km/hr. According to the documentation of the manufacturer, the equivalent airspeed at cruising was approximately 145 km/hr higher than the design manoeuvring speed for full rudder control (V_A approximately 325 km/hr EAS), approximately 180 km/hr higher than the design speed for maximum gust intensity (V_B approximately 290 km/hr EAS) and, at an ambient air temperature of -32°C, approximately 70 km/hr below the permissible Mach number $M_{NE} = 0.65$.

At an altitude of presumably 2 000 to 2 500 m asl, the aircraft fell apart. All four power units were torn from their mounts in the engine housings on the upper side of the wing.

The deformation of the engine mounts indicated that a moment of forces to the right must have acted on the axis of the

power units (propellers turned counter-clockwise). The forces produced when the engines were wrenched out, as it appeared from the deformation of the engine mounts, were directed downwards in the case of engines 1 and 2, and in a more lateral direction towards the wing tip in the case of engines 3 and 4. From their position on the ground it was concluded that the four engines were wrenched out at approximately the same time. A propeller blade, presumably from No. 4 engine, struck the right wing on the outer side of No. 4 engine when the engine was torn off sideways and cut through its leading edge, two stringers and the forward beam. The wing, which had broken off in the air, had sustained between point of breakage and the wing tip, three additional cuts from propeller blades. On the left wing, on the inner side of engine housing 2, in the area of the inner fuel tank on the edge of the landing gear recess, there was a rather long break running in a straight line from front to rear. The wing broke off in a down-to-up direction (folding break). The rudder was destroyed by a force applied from left to right and was detached from the tail fin. The tail fin was broken off in the same direction while still in the air. The left elevator trim flap with the elevator had separated from the aircraft in a down-to-up direction. The trim flap and elevator were found at different points. No parts of the fuselage were found outside of its point of impact. It must, therefore, be concluded that the fuselage was still intact in the air. All four propellers, each with its four blades, were found on the corresponding engines. Examination of the engines and propellers gave no indication

as to the cause of the accident. All propeller blades were in the feathered or almost feathered position.* This is attributable to the built-in automatic control system. When fuel feed fails, the feathering mechanism automatically becomes operative.

With respect to the chronological sequence of events, it is difficult to reconstruct the breaking-up of the aircraft in the air. According to the reports of eye witnesses and ear witnesses and in view of the circumstance that all four engines were wrenched out at approximately the same time, it must be assumed that the aircraft was abruptly pulled up in the course of a dive at high speed and that it thereby broke up. Two pieces of the engine housings were found furthest from the fuselage impact point (opposite the flight direction), and then fragments were found of the tail assembly and skin. It can be concluded therefrom that the engines were wrenched out, and the left wing broke off first. The aircraft broke up evidently as a result and not as a cause of the dive.

The flight from take-off until the final dive was observed by a Czechoslovakian radar station on the radar scope. No other aircraft was observed in the vicinity of the aircraft at the time of the accident.

Witnesses were unanimous that the sound of the aircraft changed gradually from that of an aircraft flying at normal speed to that of an aircraft flying at high speed and that only at the end of the steep descent could detonations be heard at approximately the same time as the pulling-out noise.

* Comment by the State of Registry (Czechoslovak Socialist Republic)

"This contradicts our findings. The propeller feathering mechanism investigation proved the following positions of the propeller blades:

the first engine	-	angle of propeller setting	45°
the second engine	-	" " "	34° 30'
the third engine	-	" " "	38°
the fourth engine	-	" " "	47° 30'

As the angle of propeller setting in the feathered position is equivalent to 83°, the above verified setting of blades proves that the blades were in working position."

The steep descent was, therefore, most probably not the result of any explosion.

The Board of Inquiry carefully studied analyses by the aircraft's manufacturer of a number of flight incidents in which the flight movements were impaired after damage to various structural elements. It was also explained how damage to other parts of the aircraft would occur following destruction of the rudder assembly by an external force. It could not, however, consider the evidence submitted in support of the above hypothesis as admissible.

Probable Cause

In the light of the investigations undertaken, it is probable that the accident occurred in one of the following ways, although the possibility of other causes cannot be ruled out:

a) Forced descent causing the aircraft to exceed the structural stress factor in the approach manoeuvre or during the pull-out owing to:

- 1) the aircraft falling into an uncontrollable flight position because of a defect in an artificial horizon or an electronic instrument of equal importance. In air transport flight incidents throughout the world, where unintentional steep dives have occurred, such incidents can be explained by a defect in an artificial horizon.
- 2) an unnoticed overcontrol of the electrical rudder or aileron trim adjustment occurring when the automatic pilot was operating with flight movements resulting therefrom after the automatic pilot was disconnect-

ed. The automatic pilot was not equipped with a trim servo-indicator to give warning of excessive trim adjustment.

- 3) physical incapacity of one or both pilots.

b) Intentional descent owing to the presence of smoke, fire or similar emergency, during which the structural stress factor was exceeded in the approach manoeuvre or in the pull-out.

Further comments of the State of Registry

Para. a) 1/ We do not consider it probable that a defective artificial horizon would result in the aircraft's being placed in an uncontrollable flight position as the Il'yushin 18 is equipped with other instruments which would permit control of its attitude.

Para. b) In view of the statement that "None of the fragments found outside of the fuselage impact point revealed traces of fire", we do not consider the presence of smoke or fire on board the aircraft to be the probable cause of the 'intentional descent'. Insofar as a 'similar emergency' is concerned, this is a very general statement. We are convinced that the aircraft, which exchanged messages with Rhein Control up until the time of the accident, would have advised the latter if it intended to descend.