

No. 6

Balkan-Bulgarian Airlines, IL-18, LZ-BEM, accident at Moskva/Sheremetievo, USSR, on 3 March 1973. Report not dated, released by the Deputy Minister of Civil Aviation of the USSR

1.- Investigation1.1 History of the flight

On 3 March 1973, IL-18 LZ-BEM, belonging to the Balkan-Bulgarian Airlines, was on a scheduled passenger flight No. 307 Sofia-Moscow/Sheremetievo. The aircraft took off from Sofia Airport at 0613 GMT.

Pre-flight service maintenance of the aircraft at Sofia Airport was performed by Balkan Airlines personnel in accordance with the current technical regulations of the airline. Pre-flight briefing of the crew took place at Sofia Airport in accordance with current airline regulations. All the necessary meteorological information and documents were supplied to the pilot-in-command. The flight plan and decision to take-off were signed by pilot-in-command. Pre-flight preparations were conducted under the supervision of the Deputy Detachment Commander. The meteorological conditions (forecast and present weather at intended destination), on the basis of which the crew decided to take-off, were within the prescribed aerodrome and airline operating minima.

The flight from Sofia to the vicinity of Sheremetievo Airport took place in accordance with the flight plan. At 1227:53.5 local time the crew made contact with the Sheremetievo controller. At 1228:34.0 the crew was given the landing conditions, which were within the official airport minima, although icing was noted in the clouds. The landing runway was in a normal state of serviceability. The coefficient of friction was 0.34. The radio and lighting systems, as well as the airport radiocommunications, were functioning in accordance with current regulations and no reports had been made on them on 3 March 1973.

At 1229:20.2 the crew was cleared for a straight-in approach to Runway 07, but owing to deviations from the glide path and course line a missed approach was carried out.

At 1244:03.3 contact was made with the Sheremetievo landing controller.

At 1244:5.13 the crew was given distance from runway 8.5 km by the controller and cleared to descend to 200 m at the outer marker.

At 1245:29.8 the controller reported to the crew that they were 5 km from the runway and 15 m below the glide path.

At 1245:39.0 contact with the crew was lost. The aircraft began to lose height rapidly, went into a nose dive, crashed to the ground, disintegrated and caught fire.

The accident occurred at 1245:50 local time (0945:50 GMT) in daylight flight conditions.

The aircraft struck the ground 4 330 m before the runway threshold and 70 m to the right of the extended centre line on a magnetic heading of 068°. The elevation of the accident site was 187.75 m (2.25 cm below the level of the runway).

### 1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	8	17	—
Non-fatal	—	—	—
None	—	—	

### 1.3 Damage to aircraft

First contact with the ground was made by the nose of the fuselage at an angle of 90°; complete disintegration followed and fire broke out.

ICAO Note: Paragraphs 1.4 to 1.16 not reproduced (the Foreword refers).

## 2.- Analysis and Conclusions

### 2.1 Analysis

On its first approach the aircraft entered the outer marker zone at an altitude of 250 m and the crew decided to execute a go-around. This fact was confirmed by the flight data recorder read-out and the radiocommunications between the crew and the TWR controller.

The second approach, executed in clouds, was normal up to a point about 5 km from the runway, with the landing gear extended, 30° of flaps and at speeds consistent with the actual landing weight.

On reaching the outer marker the aircraft was 50 m below the glide path and, in order to intercept the latter, the crew executed a manoeuvre which consisted in first increasing, and then reducing, the pitch angle. In the latter phase, the g-loading went down to 0.6 - 0.5. The elevator angle at the time was about 8° down.

Thereafter, the motion of the aircraft was characterized by a continuous increase in the negative pitch angle culminating in a steep nose-dive. In the course of 0.5 seconds, the elevator angle changed from 8° to full nose down (15°).

The motion of the aircraft during this phase was derived from:

- the parameters recorded by the flight data recorder;
- the mode of collision between the aircraft and the ground and the destruction of the former;
- mathematical calculations of the aircraft's actual flight path;
- the testimony of several witnesses who observed the aircraft after it had emerged from the cloud bank.

During the investigation, the Commission considered the following hypotheses for the steep dive assumed by the aircraft. After careful study they were rejected:

a) Disintegration of the aircraft in flight

Despite careful inspection of the area overflown by the aircraft prior to the collision with the ground, no aircraft parts were found on the ground. The state of destruction of the aircraft components points to the absence of any damage prior to impact.

b) Failure of pitch control

Investigation of the pitch control system components broken by the impact, taken in conjunction with the analysis of the flight parameters recorded by the flight data recorder, precluded the possibility of linking the cause of the accident to any anomaly in the pitch control system.

c) Failure of the powerplant accompanied by negative thrust in the propellers

This hypothesis is precluded by the following:

- the flight data recorder read-out did not show any marks of negative thrust or anomalies in the propeller control system which would appear in such cases.
- at impact, all engines were working with 38° positive thrust on the fuel lever position indicator, as was established from investigation of the powerplant.

d) Spontaneous or inadvertent switching on of the autopilot

The flight data recorder read-out showed that the crew disconnected the autopilot prior to let-down and that it remained disconnected thereafter.

The disconnexion of the servo-units, discovered during investigation of the autopilot components, can only be explained as action undertaken by the crew in an effort to extricate themselves from the prevailing emergency.

e) Violent, deliberate manoeuvre of the aircraft to avoid a bird strike

According to the findings of an expert of the Academy of Sciences of the USSR, there were no concentrations of migratory birds in the cloud cover, in the area and at the flight level of the aircraft.

At the time of the aircraft's manoeuvres in the vicinity of Sheremetievo Airport icing prevailed in the clouds.

This is clear from:

- analysis of the atmospheric data;
- the weather forecast issued to the airport ground services;
- the testimony of flight crews who had flown in the vicinity of Sheremetievo Airport around the time of the accident.

The results of numerous flight tests and investigations of the IL-18 submitted to the Commission showed that the aircraft's stability and controllability characteristics ensure a reliable margin of safety in all flight regimes and all deviations from normal conditions compatible with those that can occur in actual operation.

To maintain these characteristics in flight with the stabilizer iced up (to cater for outage for the stabilizer de-icing mechanism), the aircraft operating manual provides for partial extension of the flaps during approach (15°).

These recommendations are confirmed by the results of flight tests in natural icing conditions and with simulated ice on the stabilizer.

The nature of the fluctuations in the aircraft motion parameters and piloting characteristics recorded by the flight data recorder warrants the belief that these flight parameters could occur in the presence of an adverse combination of pitch manoeuvre and full (30°) flaps, provided that ice was present on the stabilizer leading edge.

## 2.2 Conclusions

### a) Findings

The flight training and experience of the pilot-in-command and other crew members and their qualifications and ratings for IL-18 operations, particularly on the Sofia-Moscow route, satisfied the requirements of Balkan Airlines.

Their medical fitness and duty/rest schedule also satisfied the current requirements of Balkan Airlines and could not have had an adverse effect on the flight.

The aircraft was airworthy and neither its technical status nor its flight documentation could have been a reason for the accident.

The aircraft's load and trim were within prescribed limits.

The atmospheric conditions in the vicinity of Sheremetievo Airport at the time of the aircraft's arrival accorded with the aerodrome minima and the crew minima established by Balkan Airlines.

The radio and lighting aids to landing and radiocommunications facilities at Sheremetievo Airport were functioning correctly, in accordance with current regulations.

ATC had duly supplied the crew with all the necessary information concerning approach conditions, including the presence of icing in the clouds, as well as the necessary operational data concerning the circuit and descent-to-land flight path parameters.

No fire, explosion or disintegration of the aircraft in flight occurred prior to collision with the ground.

The second approach was performed normally up to a point approximately 5 km from the runway, after which the aircraft went into a steep dive.

Up to the time of impact with the ground the aircraft's configuration was characterized by extended landing gear, 30° flaps, all engines functioning.

The accident was not the consequence of failure of pitch control, engine outage or spontaneous or inadvertent switching on of the autopilot.

It is unlikely that the accident resulted from a manoeuvre to avoid a bird strike.

After the accident occurred, all emergency measures at the disaster site were taken.

b) Cause or  
Probable cause(s)

The accident occurred during a second approach when the aircraft was descending along the glide path.

The Commission considered that the most probable cause of accident was an adverse combination of the following factors:

- icing of the stabilizer (probably due to lack of heating in the leading edge);
- a pitch manoeuvre executed to correct a deviation from the glide path which resulted in a g-loading of 0.6-0.5;
- extension of the flaps to the full landing setting, which had the effect of degrading the airflow over the lower surface of the stabilizer and, consequently, of producing loads on the control column which promoted a further increase in the negative g-loading and prevented recovery of the aircraft from the developing nosedive.

Owing to the destruction of the aircraft it was not possible to check the actual functioning of the stabilizer de-icing system.