

No. 2

Japan Air Lines, DC-8-62, JA-8040, accident at Moskva/Sheremetievo, USSR, on 28 November 1972. Report not dated, released by the Deputy Minister of Civil Aviation of the USSR

1.- Investigation1.1 History of the flight

The DC-8-62 JA-8040 of the Company JAL was on flight JAL-446 Copenhagen - Moscow (Sheremetievo) - Tokyo on 28 November 1972.

At 1817 hours local time the aircraft landed at Sheremetievo airport.

Technical servicing of the aircraft at Sheremetievo prior to take-off was performed by the staff of JAL.

Pre-flight briefing of the crew in conformity with current JAL instructions took place on board the aircraft.

All the necessary weather data and meteorological documentation were obtained for the crew by JAL officials.

The flight plan for the route Moscow-Tokyo was signed by the Pilot-in-command.

The meteorological conditions (forecast and present weather), on the basis of which the crew decided to take-off from Sheremetievo, corresponded to the aerodrome minima and the crew minima prescribed by JAL.

The taxiways and runway were in a state of normal serviceability. The adherence factor was within the limits 0.32 - 0.37.

The radio aids, lighting facilities and communication systems at Sheremetievo airport, required for the flight, were functioning in accordance with current regulations and no observations were made concerning them on 27 November 1972.

At 1938 hours the crew requested start-up clearance. This was given together with the taxi sequence and take-off heading (248°).

At 1949:49 hours the crew was cleared to take-off position and received the take-off conditions.

At 1950:30 hours the aircraft started take-off roll and, after lifting off and climbing to approximately 100 m, lost height abruptly, collided with the ground, broke up and caught fire.

The accident to JAL DC-8-62 JA-8040 took place at 1951:42 hours Moscow time (1651:42 hours GMT) in night flight conditions.

The aircraft struck the ground at a point 150 m from the end of the runway and 50 m to the left of its extended centre line. Elevation above sea level at the accident site is 185 m.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	9	52	-
Non-fatal	5	10	-
None			

1.3 Damage to aircraft

The first contact with the ground was made with the tail part of the fuselage, the left landing gear, both left-side engines and the left wing tip.

In its further progress along the ground the aircraft broke up and caught fire.

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

2.- Analysis and Conclusions

2.1 Analysis

In the final stage of the flight the aircraft was at supercritical angles of attack. This was indicated by the following:

- the initial contact with the ground made by the tail section of the fuselage and the nature of the ensuing disintegration of the aircraft;
- the characteristics of the parameters recorded by the flight recorder (high-frequency g-load fluctuations, scatter of the height and air speed readings);
- testimony of witnesses on the flight concerning heavy vibration experienced in the air;
- computation of the recorded motion parameters of the aircraft, which point to a level of drag which could only arise in the presence of supercritical angles of attack.

The take-off roll and lift-off up to V_2 proceeded normally. The parameters of the take-off path were virtually identical with those that would be normal for the prevailing conditions.

In the portion of the flight subsequent to V_2 anomalies took place in the functioning of the engines. This was evidenced by:

- the statement captured by the voice recorder prior to the impact, in which a crew member reported irregularities in the functioning of No. 2 engine;

- the sounds captured by the voice recorder at the end of the flight which were suggestive of the typical noise of an engine surge;
- the testimony of an air hostess who saw a flame in the vicinity of the engines (No. 1 or No. 2) issuing from under the left wing;
- the testimony of passengers who felt the aircraft decelerate several times in flight;
- the presence of a dense layer of soot on the blades of the third stage turbine of No. 1 engine;
- the bending of the tips of three blades located in different sectors of the first stage fan of No. 4 engine, combined with the absence of any defects in the air intake and straightening devices.

Based on the results of research into the technical condition of the engines after dismantling, which showed that there was no damage, burn-holes or other flaws in the structural elements which might have caused outage of the engines in flight, and having regard to the nature of the damage to all the power plants, it can be assumed that total outage of one or more engines in flight did not take place.

The anomalies observed in the functioning of the engines could have been caused by stall phenomena accompanied by loss of thrust in one or more engines consequent upon ice formation on the engine intakes. Ice formation could have occurred in the prevailing weather conditions, since the valves of the de-icing system tubes to the engines and the intakes were closed during take-off. Moreover, the bends observed on the blades of No. 4 engine fan were characteristic of damage produced by the impact of ice particles.

Owing to the supercritical angle of attack of the aircraft during the final portion of the flight, engine surge may also have occurred. It is possible that the soot deposit on the third stage turbine of No. 1 engine was provoked by the leakage of flame into the turbine during engine surge or by flame-out and deposition of fuel on the hot blades.

Approximately 11 seconds after V_2 had been reached the voice recorder captured the words "spoiler" (or the Japanese expression for "what was that?") followed by "I am sorry" spoken by a crew member at a time when the computations of the investigators showed a marked increase in the aircraft drag.

Supercritical angles of attack could have been caused by a malfunction of the pitch control system. This, however, is precluded inasmuch as:

- no evidence of failure was discovered when the surviving components of the aircraft control system were examined;
- at the time of impact the stabilizer was in the normal take-off position;
- the cockpit voice recorder did not record any conversation between the crew that might suggest defects or difficulties in controlling the aircraft.

A substantial rise in drag could result from an inadvertent extension of the spoilers. At the time of impact with the ground the spoilers were almost completely retracted. However, even brief extension of the spoilers would suffice to explain the abrupt rise in drag and create a possibility of a stall situation arising as a result of the sudden decrease in lift at relatively small take-off speeds.

Malfunctioning of the engines and the accompanying loss of thrust could lead the pilots to try and maintain the climb-out regime by pulling on the control column: this would result in the aircraft assuming angles of attack characteristic of the so-called second flight regime, with a resultant increase in drag, followed by a loss of vertical speed. Irregularities of this sort in the piloting of the aircraft, which was already complicated by the night-time conditions, could lead to the assumption of large angles of attack, loss of air speed and stall.

To say unequivocally which of the two possibilities referred to in 2.1.6 and 2.1.7 led to the supercritical angles of attack was not possible owing to the limited information provided by the aircraft's flight recorder (4-track tape).

The conversations of the crew, as recorded by the cockpit voice recorder before the start of roll, during the roll and in the air, showed that none of the crew lost his capacity to act prior to the moment of impact.

2.2 Conclusions

a) Findings

The preparation, training and flying experience of the pilot-in-command and other crew members, the crews' qualifications and capacity to execute flights on the DC-8-62, particularly on the Moscow - Tokyo route, satisfied the requirements of the Japanese Government and the JAL Company for this type of aircraft.

The medical fitness of the crew, their duty and rest periods accorded with the current requirements of the Japanese Government and the JAL Company and should not have had an adverse influence on the course of the flight.

Aircraft JA-8040 was airworthy and its technical condition prior to the flight, as well as its certification, cannot be cited as grounds for the accident.

The take-off weight and centre of gravity of the aircraft were within the prescribed limits.

The aircraft was serviceable prior to flight, according to its technical documents. Ground servicing prior to the flight, including refuelling at Sheremetievo airport, took place in conformity with current requirements.

The meteorological conditions in the area of Sheremetievo airport at the time of take-off corresponded to the airport minima and the crew minima prescribed by JAL.

The take-off runway and taxiways were in normal operating condition.

The radio and lighting aids for the flight, as well as the airport communication systems, were functioning correctly in accordance with current regulations.

There was no fire, explosion or damage to the aircraft during ground roll or in the air prior to impact.

No member of the crew lost his capacity to act during the flight up to the moment of impact.

The take-off took place in an ambient air temperature of -5°C , with 96 per cent relative humidity and with the engine de-icing systems switched off.

The ground roll and take-off up to V_2 took place normally.

After V_2 , anomalies occurred in the functioning of No. 1 or No. 2 engine.

In the initial climb-out the aircraft assumed supercritical angles of attack, after which it began to lose speed and height until it struck the ground.

Neither the technical investigation nor the analysis of conversations which took place on the flight deck revealed any signs of failure or malfunctioning of the pilot's instruments or aircraft control system.

Up to the time of impact the aircraft was in take-off configuration, with the landing gear extended and all engines functioning.

After the accident occurred, all the essential action was immediately taken to rescue those on board the aircraft. All the survivors were immediately admitted to hospital.

b) Cause or
Probable cause(s)

The cause of the disaster to aircraft DC-8-62 JA-8040 resided in the fact that, during take-off and following attainment of the safety speed V_2 , the crew put the aircraft into a supercritical angle of attack, which resulted in loss of speed and altitude.

The aircraft's assumption of supercritical angles of attack was the consequence of one of the following circumstances:

- a) inadvertent extension of the spoilers in flight, leading to a fall in the maximum value of the lift ratio and an increase in drag;
- b) loss of control of the aircraft by the crew in conditions associated with malfunctioning of the No. 1 or No. 2 engine consequent upon possible ice formation on the engine intake at a time when the de-icing system was switched off.

The anomalies in the functioning of the engines observed by the crew and other witnesses may have arisen after the aircraft had assumed a supercritical angle of attack with the spoilers extended.

3.- Recommendations

The Commission recommends to Japan Airlines and the Flight Safety Service of the Japanese Ministry of Transport that steps be taken to enhance the safety of flights with special reference to strict observance by crews of the prescribed rules of operating aircraft systems.

The Commission asks to be informed of the steps taken pursuant to the foregoing.