No. 21

Czechoslovakia State Airlines, Ilyushin IL-18D, OK-WAI, accident at Gander International Airport, Newfoundland, Canada, on 5 September 1967. Accident Report Serial No. F-462, not dated, released by the Aircraft Accident Investigation Division, Civil Aviation Branch, Department of Transport, Canada

1.- Investigation

1.1 History of the flight

Flight 523 was a scheduled international flight from Prague, Czechoslovakia to Havana, Cuba, via Shannon, Ireland, and Gander, Newfoundland. It departed Prague at 1649 hours GMT on 4 September and proceeded to Shannon where it arrived at 2020 hours for a routine servicing stop. It departed Shannon at 2131 hours arriving at Gander at 0326 hours on 5 September following an uneventful flight. The crew which had flown the aircraft from Prague disembarked at Gander and was replaced by a crew which had been off duty in Gander from 3 September. At Gander the aircraft was serviced and refuelled under the supervision of the flight engineer of the outgoing flight.

A flight plan to Havana was filed at about 0405 hours and at 0504 hours the aircraft began taxiing to the threshold of runway 14. It was cleared to take-off at 0508 hours. The length of the ground roll was normal, the undercarriage and flaps were retracted, but the angle of climb was abnormally shallow. At 0509 hours the flight advised the tower controller that the aircraft was airborne, the tower controller acknowledged the transmission and advised the flight to contact Air Traffic Control Centre on a frequency of 119.7 MHz. Whilst the radio operator was changing frequency the aircraft struck the ground about 4 000 feet beyond the end of the runway (Lat. 48°57' N, Long. 54°34' W). The accident occurred at 0510 hours GMT.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	4	33	
Non-fatal	4	28	
None			

1.3 Damage to aircraft

The aircraft was destroyed by the impact and subsequent fire.

1.4 Other damage

Minor damage when the right wing struck a guy wire of a radar reflector mast.

1.5 Crew information

The pilot-in-command, aged 52, held a valid Czechoslovakian pilot licence. He satisfactorily passed his last medical examination in June 1967. He was a qualified test pilot and instructor on DC-3, IL-12, IL-14, IL-18 and Bristol Britannia aircraft and was qualified to fly as pilot-in-command on domestic and international flights. He passed his last semi-annual proficiency check, including instrument check, on IL-18 aircraft on 27 January 1967 and was rated as excellent. He had flown the Prague - Gander - Havana route since 1962 and had carried out 19 take-offs and 37 landings by day, and 110 take-offs and 94 landings by night at Gander. He had flown a total of 17 303 hours including 9 400 hours on instruments and 7 560 hours by night, and 5 360 hours in IL-18 aircraft. During the 90 days prior to the accident he had flown 273 hours including 118 hours in IL-18 aircraft. At take-off from Gander he was occupying the left-hand pilot seat.

The co-pilot, aged 44, held a valid Czechoslovakian pilot licence. He satisfactorily passed his last medical examination in July 1967. He was qualified on IL-14, IL-18 and Bristol Britannia aircraft, on domestic and international flights and as an instructor on IL-14 aircraft. He was also qualified for instrument flying. He had flown the Prague - Gander - Havana route since 1964 and had carried out 11 take-offs and 27 landings by day and 94 take-offs and 89 landings by night at Gander. He had flown a total of 10 749 hours including 1 291 hours in IL-18 aircraft. During the 90 days prior to the accident he had flown 287 hours including 80 hours in IL-18 aircraft.

The navigator, aged 40, held a first-class navigator licence and a second-class radio operator licence. He satisfactorily passed his last medical examination in April 1967. He was qualified to fly both domestic and international routes on IL-18, Bristol Britannia, TU-104 and TU-124 aircraft. He had flown a total of 12 027 hours.

The radio operator, aged 35, held a second-class aircraft radio operator licence. He passed his last medical examination in October 1966. He was qualified to fly domestic and international routes on IL-14 and IL-18 aircraft. He had flown a total of 5 380 hours.

The flight engineer, aged 40, held a first-class engineer rating. He passed his last medical examination in February 1966. He was qualified as a flight engineer instructor on the IL-18 and was authorized to fly on the IL-14, IL-18 and Bristol Britannia on domestic and international flights. He had flown a total of 5 163 hours including 1 290 hours in IL-18 aircraft of which 102 hours were flown in the "D" model.

1.6 Aircraft information

The certificates of registration and of airworthiness of the aircraft were issued by the Czechoslovakian authorities on 22 April 1967 and on 16 May 1967 a certificate of airworthiness was issued for each of the four engines.

The maintenance records indicated that the aircraft had been properly maintained and certified in accordance with ICAO standards.

The total time on the airframe and the engines since manufacture was 766 hours.

The navigator's logs relating to the flights from Prague to Shannon and from Shannon to Gander were found in the wreckage. From the fuel calculations in these documents it was estimated that the aircraft landed at Gander with 6 613 kg of fuel remaining. From Gander records, it was found that 14 079 kg of fuel were loaded, which brought the total on

board to 20 692 kg. Estimating a 500 kg consumption for taxiing there were 20 192 kgs of fuel on board at take-off and the total take-off weight was at least 64 119 kg, which represented an overload of 119 kg. However, this would have had no significant effect on the performance of the aircraft.

The type of fuel being used was not stated in the report.

1.7 Meteorological information

The 0500 hours weather report for Gander was as follows: cloud 2 600 ft overcast, visibility 15 miles, temperature 49°F, dewpoint 45°F, wind 110°/8 mph, QNH 30.12 in of Hg.

A special weather observation taken at 0512 hours (2 minutes after the accident) gave exactly the same conditions except that the base of the overcast condition was recorded as 3 400 ft AMSL. There was no evidence of turbulence at or near the surface.

From midnight on 4 September to 0600 hours on the morning of the accident, Gander was under the infuence of a southeasterly flow of dry Maritime Arctic air, with moist Maritime Polar air above 12 000 ft. There was no evidence of any vertical development in the lower clouds, which were stratiform in structure and therefore it was considered impossible that lightning or thunderstorm activity could have been present. Air charts showed that from the surface to 3 000 ft the wind increased in velocity by about 10 kt and veered 20°. The presence of air subsidence at the end of runway 14 was therefore considered. However, because the airport was on the west side of a high pressure area moving east, the flat terrain and light wind, subsidence of significant value would not have been possible. The freezing level at the time of the accident was near 8 000 ft AMSL and icing would not have been encountered.

1.8 Aids to navigation

Not pertinent to this accident.

1.9 Communications

The communications equipment recovered showed no signs of malfunction, and one of the VHF receivers appeared to have been in the process of changing channels at the time of impact.

1.10 Aerodrome and ground facilities

Gander International Airport is licensed and operated by the Department of Transport. The airport was serviceable, and there was no evidence of any airport lighting malfunction at the time of the accident. The take-off was made from runway 14, which is 8 900 ft long and 200 ft wide with an asphalt surface. The elevation at the threshold is 471 ft and at the end 441 ft; however, the portion of the runway used by the aircraft prior to becoming airborne is essentially level. The runway lights were on and the approach lights to runway 32 were off including the warning light on a radar reflector mast located approximately 3 850 ft from the threshold of runway 32 and slightly left of the extended centre line. This mast, while within IFR zoning requirements, is lighted when the approach lights to runway 32 are on.

1.11 Flight recorders

The aircraft was fitted with a flight data recorder recording the altitude, airspeed and acceleration only. It was inoperative prior to and at the time of the accident.

1.12 Wreckage

The accident area was reasonably level with an elevation of about 430 ft AMSL: the surface consisted of muskeg, decayed vegetation and low shrubs.

The first evidence of impact was where the right wing struck the northeast guy wire of a radar reflector mast located slightly left of the extended centre line of runway 14, and 3 840 ft from the end of the runway. The guy wire was found on the right side of the wreckage trail, 670 ft beyond the mast.

The second contact marks were light cut marks in low shrubs made by Nos. 2, 3, and 4 propellers. These began about 105 ft from the radar reflector mast and 100 ft left of the extended centre line of runway 14. The propeller marks became more pronounced as contact continued and 22 ft beyond initial ground contact, marks resulting from passage of the under-fuselage skin became apparent in the shrubs. The fuselage then began to dig heavily into the ground and shortly thereafter, about 460 m beyond the radar mast, struck the railway embankment and rails of a railway track which crossed the extended centre line of runway 14 at an angle of about 10°. The aircraft then skipped a distance of approximately 400 ft through the air, over a depression in the ground. The wreckage trail was about 1 700 ft long in a relatively straight line on a heading of 129°M and parts, including the propellers, the engines and wings were shed along its path. The wings were broken into a number of sections and the fuselage into seven major parts.

Detailed examination of the wreckage did not reveal any evidence of malfunction or failure of the aircraft, its engines or systems prior to impact. No evidence of fire or explosion prior to impact was found. Evidence revealed that the undercarriage and flaps were retracted and that the engines were operating at slightly less than take-off power on impact.

Differences in the failures exhibited by the reduction driveshafts of the two left-hand and the two right-hand engines were attributed to the fact that the two left-hand propellers struck the railway rails and ties while the two right-hand propellers struck soft ground. There was no evidence of abnormally high engine operating temperatures or ingestion of foreign material prior to impact in any of the engines.

A significant percentage of the flight controls and related systems was recovered and it provided strong evidence that their operation was normal. The trim settings were normal and marks adjacent to the elevators on the tail cone, indicated that the elevators were in an aircraft nose-up position on impact. There was no evidence to suggest that the autopilot was engaged.

All available evidence indicated that the oxygen, electrical and instrument systems were functioning normally.

Because of the complete destruction of the flight deck area only a few flight instruments were recovered and these had been severely burned. No conclusion as to the operating condition of the instruments or associated systems could be reached. Available evidence indicated they were operating normally; however, according to data supplied by the operator, the pilot-in-command's altimeter was subject to frictional errors in excess of ICAO test compliance procedures.

1.13 Medical and pathological information

There was no evidence of incapacitation of a flight crew member prior to the accident. Post-mortem X-ray examination of those aircraft occupants with open wounds did not reveal the presence of any metallic or other foreign material.

1.14 Fire

The ground fire which followed impact destroyed the aircraft.

1.15 Survival aspects

The pilot-in-command, the co-pilot, the navigator and a stewardess were killed in the accident; the radio officer, the flight engineer and two stewardesses survived with serious injuries. Thirty-one passengers were rescued with serious injuries; however, three of them died later in hospital. No details on evacuation and rescue operations were given in the report.

1.16 Tests and research

An analysis of fuel supplied to the aircraft indicated it conformed to the required specification.

2.- Analysis and Conclusions

2.1 Analysis

In evaluating the available evidence it was considered unlikely that the following factors contributed to the cause of the accident:

(a) crew experience, competency and physical fitness;

(b) despatch, loading and flight planning;

(c) weather;

(d) airport and associated facilities;

(e) aircraft structure, power plants;

(f) maintenance of the aircraft.

The surviving flight crew members, the radio officer and the flight engineer were interrogated. The radio officer, who was in the process of conducting communications with the tower at the time of the accident was not aware of any difficulty or problem in flight before the aircraft struck the ground. The flight engineer, who was seriously injured, gave a vivid description of an explosion and fire aft of the flight deck door (which was open), in the area of the cabin above the forward baggage compartment. Intensive investigation failed to reveal any evidence of pre-impact explosion or fire in this area. However, the flight engineer's recollection could be accurate and consistent with the explosion which occurred on impact with the railway embankment, and the fire which immediately followed.

From the propeller cuts in the shrubs and initial impact marks, it was determined that the initial ground contact was made with the aircraft in an approximate 6° nose-down attitude with the wings nearly level. Calculations based on the distance between the propeller cuts and governed engine rpm, indicated that the aircraft ground speed was about 196 kt (331 ft/sec) or 363 km/hr. All pertinent reported, calculated and factual flight path and performance information was programmed in a digital computer and a series of flight paths were developed. One of the computed flight paths (see Figure 21-1) met most of the pre-determined conditions and was selected as the probable flight profile. From a study of this data the following conclusions were reached:

(a) The aircraft could not have attained the known impact velocity if a stall had occurred;

(b) The maximum height reached was approximately 125 ft above the point where the aircraft left the runway.

There was insufficient evidence to reach firm conclusions concerning the events preceding the accident. There were, however, a number of factors which individually should not have presented any problem, but a combination thereof could have been significant in the circumstances.

1. The duration of the flight was extremely brief, i.e. airborne for 32 - 33 seconds. There is considerable activity in the cockpit during this phase of take-off, and even a momentary distraction for any reasons would be undesirable.

2. It was a dark overcast night, and the area of initial climb was devoid of lights. Transition to instrument flight shortly after rotation would have been required.

3. Prior bench calibration of the pilot-in-command's altimeter indicated an instrument friction error, which could have resulted in a slight delay in the response of the instrument.

4. Data supplied by the State of Registry also indicated a possible error in pitch indication of the pilot-in-command's and co-pilot's gyro horizons, as a result of acceleration forces during take-off and climb. The magnitude of this error on the two main gyro horizons could have been in the order of 1° at take-off, increasing to 2.4° during the 32 - 33 seconds prior to impact. The error on the pilot-in-command's auxiliary or stand-by horizon could have ranged from 1.5° to 4° in the same period.

5. Because the recovery of flight instruments was minimal, it was not possible to rule out a malfunction of a flight instrument during the climb, resulting in misinformation or a miscue to the pilot.

6. The flight crew were considered to be currently competent and operating regularly on two types of major equipment. While this procedure may be acceptable, it could without specific safeguards be conducive to cockpit error.

2.2 Conclusions

(a) Findings

The crew were adequately experienced and competent on the aircraft type. There was no evidence of incapacitation of a flight crew member prior to the accident. The crew was considered to be fit, well rested and fully qualified to carry out this flight.

There was no evidence to indicate that the aircraft was not airworthy at the time of the accident. The maintenance records for the aircraft were in order and indicated that it had been properly maintained. The aircraft was overloaded by 119 kg at take-off; however, this would have had no significant effect on the performance of the aircraft. According to available data the pilot-in-command's altimeter was subject to frictional errors, which could have resulted in slight delays in response and the pilot-in-command's and co-pilot's gyro horizons were subject to pitch indication errors as a result of acceleration forces.

The existing weather conditions did not contribute to the accident; however, it was a dark overcast night and the initial climb area was devoid of lights.

The airport, including runways, zoning and lighting met the required standards.

There was no evidence of any malfunction or failure of the aircraft, its engines or systems, which could explain the shallow climb of the aircraft shortly after take-off or the nose-down deviation which existed at the time of the initial impact with the ground.

(b) Cause or Probable cause(s)

The cause of the accident was undetermined.

3.- Recommendations

None were contained in the report.

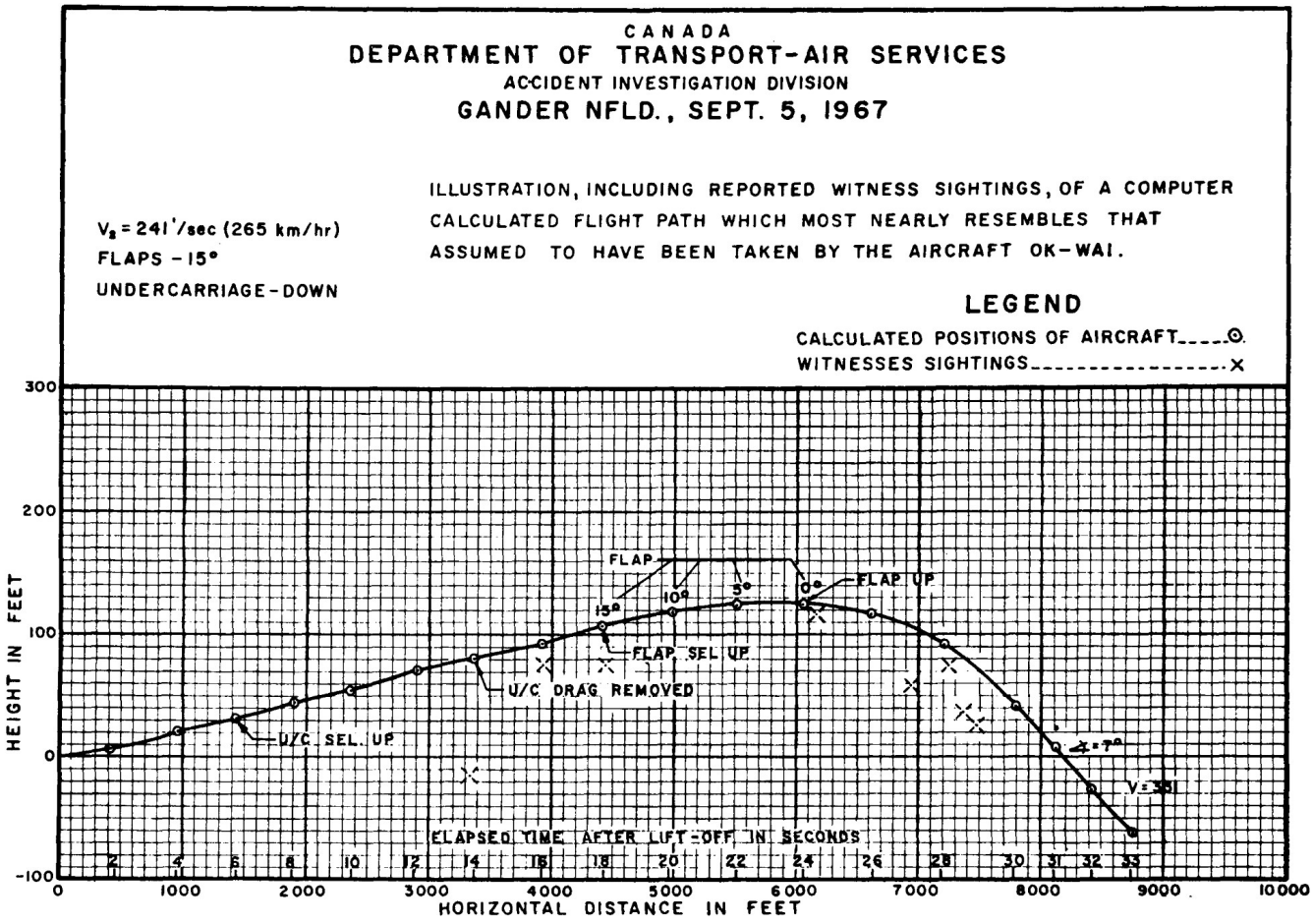
CANADA
DEPARTMENT OF TRANSPORT-AIR SERVICES
ACCIDENT INVESTIGATION DIVISION
GANDER NFLD., SEPT. 5, 1967
ILLUSTRATION, INCLUDING REPORTED WITNESS SIGHTINGS, OF A COMPUTER CALCULATED FLIGHT PATH WHICH MOST NEARLY RESEMBLES THAT ASSUMED TO HAVE BEEN TAKEN BY THE AIRCRAFT OK-WAI.
V_s = 241'/sec (265 km/hr)
FLAPS - 15°
UNDERCARRIAGE - DOWN
LEGEND
CALCULATED POSITIONS OF AIRCRAFT
WITNESSES SIGHTINGS
HEIGHT IN FEET
300
200
100
0
-100
FLAP
15°
10°
5°
0°
FLAP UP
FLAP SEL UP
U/C DRAG REMOVED
U/C SEL. UP
ELAPSED TIME AFTER LIFT-OFF IN SECONDS
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 31 32 33
0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
HORIZONTAL DISTANCE IN FEET

Figure 21-1