

No. 15

United Arab Airlines, DC-3, SU-AJG, accident approximately 5 km southeast of Al Mahalla-Al Kobra, United Arab Republic, on 15 January 1968.  
Report, not dated, released by the Director General of Civil Aviation, United Arab Republic

1.- Investigation1.1 History of the flight

The aircraft was to perform a non-scheduled international cargo flight from Cairo to Beirut. Before departure the operator's chief of the ground operations shift informed the pilot-in-command of the aircraft that bad weather was prevailing both on the route Cairo to Beirut and at Beirut Airport, and that the weather conditions had been confirmed by the crew of another aircraft who had arrived from Beirut at 0200 hours local time.

The pilot-in-command then went to the weather office and was again informed that the weather en route was very bad with low and medium altitude clouds, including some cumulonimbus extending from 550 m to 8 500 m, and that moderate to severe icing and turbulence within these clouds were highly probable. He was also informed that a SIGMET had been issued at 0115 hours (see 1.7 below).

Back at the operator's ground operations office he obtained once more all necessary weather information, including copies of two SIGMETS issued by Cairo and Beirut respectively and decided to delay his departure until 0700 hours expecting some weather improvement.

Although the aircraft had no de-icing equipment, it departed Cairo at 0721 hours and at 0735 hours the crew reported at FL 70 to Cairo Approach. Eight minutes later they reported over Zifta Beacon at the same flight level and were then instructed by Cairo Approach to contact Area Control. At 0745 hours they contacted and informed Cairo Control that they would return to Cairo due to icing. Shortly thereafter they repeated that message adding that there was some ice accretion on the aircraft. This was the last message from the aircraft.

At 1020 hours Cairo ACC received a message that the aircraft had crashed 5 km SE of Al Mahalla-Al Kobra. The accident had occurred at 0754 hours.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	4		
Non-fatal			
None			

### 1.3 Damage to aircraft

The aircraft was destroyed by impact and fire.

### 1.4 Other damage

There was no other damage.

### 1.5 Crew information

The pilot-in-command, aged 31, held an airline transport pilot's licence valid until 17 March 1968, with ratings in the Comet, DC-6, DC-3 and Antonov and an instrument rating valid until 17 June 1968. He had flown a total of 5 482 hours including 655 hours in DC-3 aircraft of which 39 hours were flown during the last three months. He had flown a total of 45 hours on instruments during these last three months.

The co-pilot, aged 27, held an airline transport pilot's licence valid until 15 May 1968, with type ratings in the DC-3 and Antonov, and an instrument rating valid until 28 August 1968. He had flown a total of 3 409 hours including 543 hours in DC-3 aircraft of which 12 hours were flown during the last three months. He had flown a total of 5 hours on instruments during these last three months.

The third pilot, aged 30, held a commercial pilot's licence valid until 3 June 1968. He had flown a total of 2 104 hours including 119 hours in DC-3 aircraft. During the last three months he had not flown on the DC-3.

Also aboard was a flight engineer.

### 1.6 Aircraft information

The certificate of airworthiness of the aircraft was valid until 6 November 1968 and the certificate of maintenance issued on 31 December 1967 was valid for 30 days or 125 flying hours.

The aircraft had no de-icing equipment.

The maximum allowable take-off gross weight for the aircraft was 11 700 kg. However, it was found that the load sheet had been compiled incorrectly and subsequent to the accident it was calculated that the weight of the aircraft at take-off had been 12 213 kg, i.e. nearly 500 kg in excess of the maximum authorized. This came from the fact that the basic weight of the aircraft was 8 658 kg instead of the 8 382 kg shown on the load sheet, a difference of 276 kg, and that the aircraft had been refuelled with 500 Imperial gallons and not 500 US gallons as reflected on the loadsheet - a difference of approximately 260 kg.

According to the operator's regulations it was the responsibility of the operations section to inform the loading section in writing concerning the fuel quantity necessary for the flight. However, it was found that this information was always passed by telephone both to the loading section and to the refuelling supervisor. It was also found that, although it was the responsibility of the loading section to ensure proper loading and security of the load and to prepare the weight and balance sheet, the loading of this aircraft had been carried out by incompetent and untrained personnel from the supply section. Additionally, no instructions had been issued from the loading section, no supervision had been undertaken, the load (an Avon engine) was not properly secured to the aircraft in accordance with the operator's manual, and no balance sheet had been prepared for this flight.

It was calculated that at the time of the accident the weight of the aircraft was approximately 12 100 kg. It was not possible to determine the centre of gravity at the commencement of the flight or at the time of the accident.

#### 1.7 Meteorological information

The following weather forecast for the route Cairo to Beirut, issued at 0100 hours GMT and valid from 0400 to 0600 hours GMT, was provided to the crew before the flight:

<u>Altitude in metres</u>	<u>Wind</u>	<u>Temperature in degrees C</u>
1 500	230°/35 kt	0°
3 000	260°/45 kt	-8°
5 600	260°/75 kt	-24°

#### Clouds

Lower layer: 3/8 Stratocumulus and cumulonimbus, base 750 m, top 1 250 m;

2/8 Stratocumulus and 3/8 cumulonimbus, base 550 m, top 8 500 m.

Upper layer: 3/8 to 5/8 altocumulus, base 3 000 m, top 4 200 m.

Moderate to severe thunderstorm and ice showers with moderate to severe turbulence.

The forecast for Beirut airport issued at 0200 hours GMT and valid from 0600 to 1200 hours GMT was as follows:

wind 240°/14 to 32 kt changing to 280°/20 to 35 kt; visibility 8 km decreasing to 4 km, 3/8 Cb at 540 m and 6/8 Cu at 660 m, with showers and thunderstorms.

Two SIGMETs issued at 0115 hours and 0715 hours GMT and valid from 0115 to 0700 hours GMT and from 0715 to 1300 hours GMT respectively, gave the following forecast for the Cairo FIR North of 30°N:

Cumulonimbus 3/8 to 6/8, tops 32 000 ft, with moderate to severe turbulence and severe to moderate icing.

#### 1.8 Aids to navigation

Navigational aids at Cairo Airport and along the route of the aircraft were operating normally.

The aircraft was equipped with two radio compasses and was carrying the appropriate Aeronautical Information documents for the flight.

#### 1.9 Communications

Communications were normal until shortly before the accident when they became weak. Interference made it difficult to hear the last call of the aircraft as reflected on the recording made by the Air Traffic services.

### 1.10 Aerodrome and ground facilities

Not relevant to this accident.

### 1.11 Flight recorders

Not mentioned in the report.

### 1.12 Wreckage

The wreckage of the fuselage was found inverted with its front section buried in muddy ground to a depth of 2 m and its wing centre section nearly vertical to the ground. The engine which was part of the cargo was found at the same spot and depth. The tail unit was found in the main wreckage area with its elevators separated and no evidence of fire on them.

The following parts were found scattered around the main wreckage (see Fig. 15-1) with no traces of fire:

- the starboard wing, complete with flaps and aileron, was found at a distance of 110 m from the main wreckage;
- the starboard elevator was found at a distance of 132 m from the main wreckage;
- the port wing was found inverted at a distance of 112 m from the main wreckage;
- parts of the port aileron were found at various locations and distances from the main wreckage;
- the starboard engine was found at a distance of 114 m from the wreckage.

The starboard wing had struck the ground with its root first. Its navigation and landing lights were undamaged. Detailed examination of the wing indicated that it had been exposed to severe vertical upward loading which had caused wrinkles on its upper surface and shearing of several rivet heads and that separation started at the leading edge under tensile forces and progressed rearward under tearing and bending forces.

The port wing had separated approximately  $1\frac{1}{2}$  m from its joint with the centre wing section in an identical manner. Its aileron had separated in the air and parts of it fell at various locations around the main wreckage.

Examination of the starboard elevator revealed that its hinges had failed under bending, tearing and tensile forces similar to those which had led to the failure of the port aileron hinges.

The port elevator was not found at the accident site and it was believed that it fell a considerable distance away. However, examination of the hinges which were still attached to the port stabilizer revealed that they had failed under tensile and tearing forces similar to those that had brought about the failure of the starboard elevator hinges.

The starboard engine fell on the ground inverted: detailed examination revealed that its propeller was at a normal cruise pitch.

#### 1.13 Fire

Witnesses on the ground stated that they saw part of the aircraft on fire before impact with the ground. It was believed that when the starboard engine separated the fuel escaping from the broken fuel line caught fire. The fire spread into parts of the wreckage after impact and was put out by the fire department of the city of Mahalla-El Kobra when it arrived at the site of the accident.

#### 1.14 Survival aspects

This was a non-survivable accident.

#### 1.15 Tests and research

None mentioned in the report.

#### 1.16 Other pertinent information

The operator's Operations Manual required the signatures of both the ground operations officer and the pilot-in-command on the operational flight plan as evidence of their mutual agreement to the execution of the flight and that both parties shared a joint responsibility for estimating all the different factors affecting the flight, i.e. weather conditions, alternative aerodromes, navigational aids etc. In case of disagreement, the pilot-in-command had the right to make the final decision and in such a case the ground operations officer on duty would withhold his signature on the flight plan and he was required to submit a written report to his superiors.

It was found during the investigation that no copy of the operational flight plan issued by the operator's flight operations office was kept in the operator's files, no report had been submitted in respect of this flight, and that the original of the operational flight plan which had been handed to the pilot-in-command was neither signed by him nor by the ground operations officer.

When the ground operations officer, who was on duty on the date of the accident, was asked by the Board why the flight had been released in weather conditions where icing was forecast, notwithstanding the fact that the aircraft was not equipped with de-icing equipment, he stated that he had no information about that.

The Civil Aviation airworthiness division had informed the operator's chief inspector in a letter dated 3 January 1959 that the operation of Dakota should be prevented when icing conditions were anticipated. The operator's operations section had been informed in due course about the contents of that letter.

On 13 August 1963 the Civil Aviation Organization had sent a letter to United Arab Airlines recommending a system of surveillance by the operator on a 24-hour basis on all flights departing from or coming to Cairo Airport.

The duty of the surveillance officer was to:

- (1) advise flight crew whenever necessary and in cases of emergency;
- (2) cancellation of flights;
- (3) diversion of flights.

When the operator's flight operations manager was asked during the inquiry whether the above recommendation was implemented he stated that although he did not know about the letter, the recommendation was implemented during the Khamasin season (sandstorms season) and that he was personally on duty at the airport as from 12 January 1968 when the weather conditions deteriorated and kept vigilance on all flights for three successive days, during which he cancelled many flights because of the bad weather. However, on 15 January 1968, since the weather was improving, he left the responsibility of carrying out the flights to the pilots-in-command.

## 2.- Analysis and Conclusions

### 2.1 Analysis

The evidence indicated that both wings as well as the elevators and the left aileron were submitted to air loads in excess of the design load factors and that they had separated from the aircraft, nearly simultaneously, at low altitude.

The evidence also indicated that, at the time of the accident, moderate to severe turbulence and icing conditions existed. The freezing level was at approximately 4 500 ft and assuming a rate-of-climb of 500 ft/min the aircraft had started to encounter icing conditions about 9 min after take-off, i.e. around 0730 hours. When informing Cairo Control at 0745 hours that they would return to Cairo because of ice accretion on the aircraft they had already been flying in moderate to severe icing conditions for approximately 15 minutes - 9 minutes later the aircraft crashed.

It was believed that the pilot lost control of the aircraft as a result of a combination of ice accretion on the aircraft and of turbulence. When trying to regain control of the aircraft at low altitude the pilot imposed such load factors that the starboard wing and starboard elevator failed and the starboard engine was torn off from its mounting. The aircraft then went into a diving spiral and shortly thereafter the port wing also separated from the aircraft and the aircraft struck the ground in an inverted position.

### 2.2 Conclusions

#### (a) Findings

The aircraft carried a valid certificate of airworthiness and all technical checks had been carried out in due time in accordance with the approved maintenance schedules.

The weight of the aircraft at take-off was 500 kg more than the maximum authorized by the United Arab Republic for this type of aircraft. The load sheet had not been prepared correctly, and included several errors. Also the load was not properly secured to the aircraft in accordance with the operator's station manual requirements.

No trim sheet had been prepared for the flight and it was not possible during the investigation to determine the position of the centre of gravity at take-off and at the time of the accident.

In 1959 the Civil Aviation Department had instructed the operator not to operate DC-3 aircraft in weather conditions in which icing was anticipated because of the lack of de-icing equipment on these aircraft.

The pilot-in-command of the aircraft was briefed before the flight on the weather conditions en route and at the aerodrome of destination by the Aerodrome Meteorological Unit and the operator's Ground Operations. Furthermore he had been warned by a DC-6 pilot that the weather was rough. However, although the pilot-in-command was well aware that the aircraft had no de-icing equipment and that the weather forecast indicated probability of moderate to severe icing, he decided to attempt the flight.

During the investigation some of the operator's pilots were informed of the weather reports in question and they unanimously stated that they would not have carried out the flight in such conditions.

Most of the written instructions contained in the operator's ground operations and stations manuals were not implemented.

(b) Cause or  
Probable cause(s)

The accident was due to ice accretion on the lifting surfaces of the aircraft accompanied by moderate to severe turbulence, which resulted in loss of aircraft control by the pilot. When he tried to regain control over the aircraft the lifting surfaces were loaded beyond the approved design limits, which brought about the disintegration of main parts of the aircraft in the air, and its subsequent impact with the ground and the death of all members of the crew.

Some of the contributing factors were as follows:

- (1) The load of the aircraft exceeded the approved load by about 500 kg.
- (2) The probable shifting of the cargo and the resulting effect on the aircraft's centre of gravity.

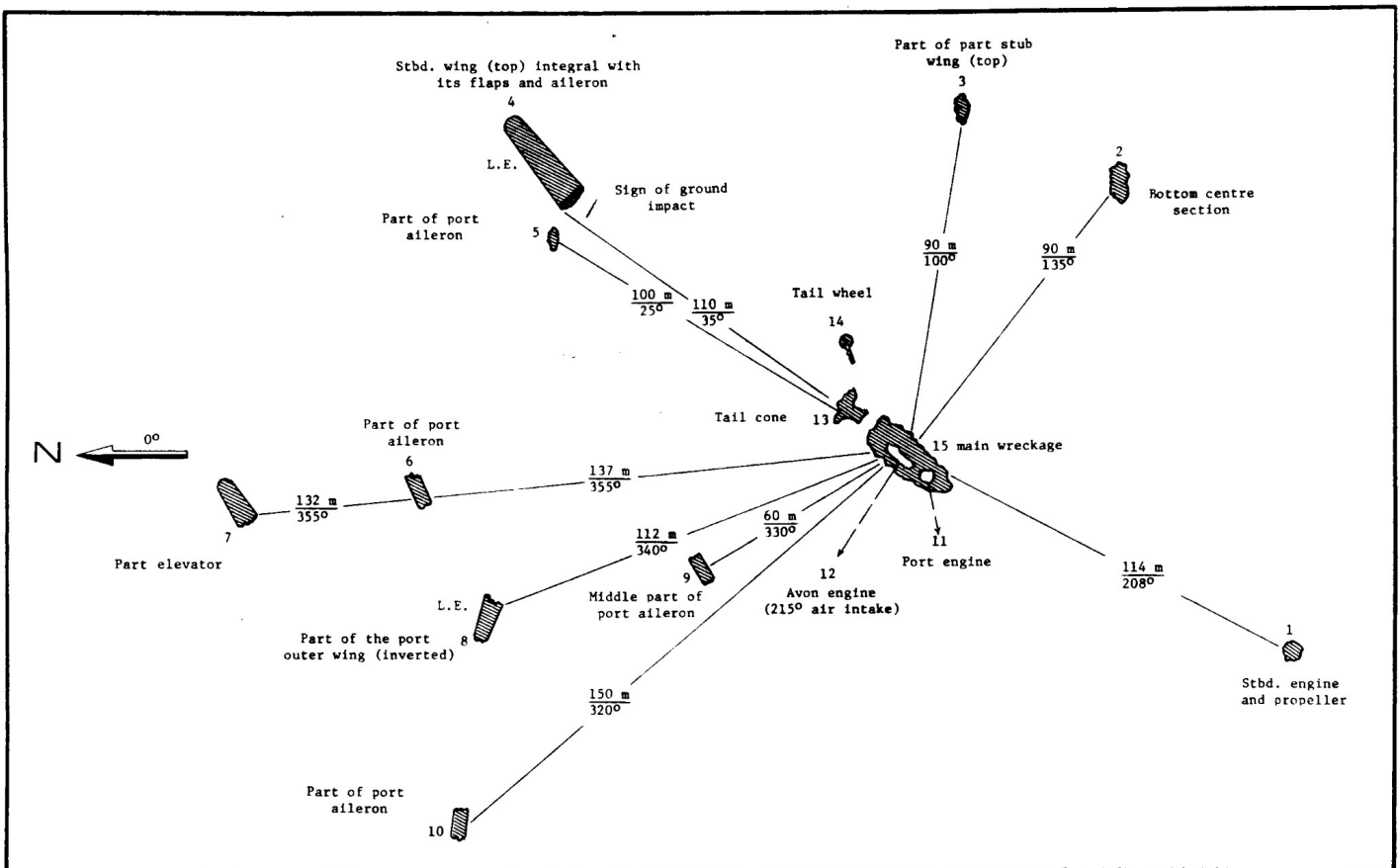


Figure 15-1. Wreckage plot of the aircraft