

NOTES ON LIGHTNING STRIKES ON AIRCRAFT

The following reports of lightning strikes on aircraft have been received from the Department of Civil Aviation, Melbourne.

LIST OF LIGHTNING STRIKES REPORTED

No.	Date	Time	Location	Height	Aircraft	Cloud
1	9 Dec. 1964	1204 EST	Avalon, Victoria	2500 ft	Boeing 707	8/8 Stratus
2	16 July, 1965	2100 CST	Lofty Ranges, Adelaide	4000 ft	DC6B	-
3	17 July, 1965	1435 EST	Melbourne	4500 ft (2500 ft above hilly terrain)	Viscount	Broken Cu, Cb
4	4 Aug. 1965	1235 EST (0235 GMT)	Melbourne	5000 ft	DC3	Stratus
5	9 Oct. 1965	-	Sydney	8000-8500 ft	F.27	-
6	27 Oct. 1965	1640 EST (0640 GMT)	Canberra	13,000 ft	Viscount	Cb (cells)
7	26 Jan. 1966	1335 EST (0335 GMT)	Mackay/ Townsville	15,000 ft	Viscount 800	8/8 Cu, Ac Sc
8	16 Feb. 1966	1405 EST	40-50 mi west of Sydney	-	Boeing 707	-
9	6 July, 1966	1733 EST (0733 GMT)	60-65 n mi south of Tamworth	14,000 ft	F.27	-

DETAILS OF THE LIGHTNING STRIKES

1. 1204 EST 9 December 1964: Captain Harding was sitting in the right hand seat giving instruction to Second Officer B. Smith who was flying the aircraft during an instrument approach to Avalon. In the Avalon area at the time there was observed to be 8/8 stratus cloud with an average base of 1200 feet with some lower patches. No cloud of a pronounced convective nature was seen. There was no turbulence nor had any lightning been seen before the incident occurred. Rain was predominantly in the form of drizzle but in some areas it was a little heavier. The outside air temperature was not noticed. At approximately 09/1204 EST the aircraft was in cloud at a height of 2500 feet and at a speed of 180 knots heading about northwest during the procedure turn at the outer locator about 8 miles north of Avalon. The radar equipment was not switched on. The crew then saw lightning strike the nose of the aircraft and heard a loud report. This was followed by a moderate rumbling sound described as being similar to that experienced in the B-707 when the undercarriage is down. Very slight buffeting was felt but control of the aircraft was in no way affected, although it was apparent that a little more power than normal was required to maintain a given airspeed.

The instrument approach was continued and the compasses checked to determine whether they had been affected by the strike. When visual flight was regained the pilot avoided two patches of low cloud then flew past the control tower for an inspection of the damage. The aircraft then made a normal landing.

The pilot considers the initial hole made at the time of the strike was relatively small but was increased by progressive dislodgement of additional sections of the radome by the slipstream. This was indicated by the proportionate increase in noise and to a lesser degree, drag, during the period before landing.

Meteorological Situation

At noon on 9 December the meteorological situation over Victoria showed a strong south to southwest stream to the west of a cold front situated off the east coast.

The stream was unstable and contained many large cumulus clouds with tops to 18,000 and 20,000 ft giving moderate showers and occasional hail storms. Pilots on the Melbourne to Hobart route reported icing and some snow in the cloud.

At 1245 EST the conditions at Avalon were estimated to be as follows:

Height	Wind	Temperature	
Surface	220/20 kt, gusty	12°C	<u>Cloud</u>
2,000 ft	210/30 kt	6°C	$\frac{5}{8}$ Large Cu, bases 2500 to 3000 ft tops 18,000 to 20,000 ft
5,000 ft	200/30 kt	-2°C	
7,000 ft	200/30 kt	-6°C	
10,000 ft	200/25 kt	-12°C	<u>Weather</u>
15,000 ft	190/25 kt	-21°C	Frequent showers
20,000 ft	180/25 kt	-30°C	

2. 2100 CST 16 July 1965: A DC6B aircraft experienced a lightning strike at 4000 feet whilst descending over the Lofty Ranges into Adelaide. No storms were visible or detectable on radar and the aircraft, which sustained no apparent damage, was flying in and out of the cloud base, with an indicated outside temperature of 0°C.
3. 1435 EST 17 July 1965: On descent into Melbourne a Viscount aircraft experienced a lightning strike in the vicinity of the starboard outer engine but sustained no damage. The aircraft was 17 nautical miles northeast of Melbourne at 4,500 feet, 2,500 feet above hilly terrain and 200 to 300 feet below cloud of broken cumulus and nimbo-stratus type from which light snow was falling. Only slight turbulence was experienced and the outside temperature at the time of the strike was observed to be 8°C.
4. 1235 EST 4 August 1965: A DC3 aircraft, flying at 5,000 feet and 17 nautical miles southeast of Melbourne, was struck by lightning but suffered no apparent damage. The strike occurred at 0235Z on 4 August 1965, with the following weather prevailing at Melbourne: Surface wind 240°/5 knots, visibility 2 miles in continuous light rain, cloud base 1500 feet with lower patches to 850 feet. The aircraft itself was in stratus cloud and rain with an outside air temperature of -5°C.
5. - 9 October 1965: An F.27 aircraft, on climb out from Sydney, experienced what appears to have been two consecutive incidents of a large static discharge. Details of outside air temperature are not available, but the following is an account of the incident:-

Position: 20 DME SY on 219 Radial, SY VOR.

Whilst flying between 8,000 and 8,500 ft in stratiform cloud with odd cumulus protruding above (airspeed 155 K), climbing in conditions of light icing and light to occasionally moderate turbulence, two lightning strikes or large static discharges were experienced. The time interval between the "strikes" was about 30 seconds. My impression of this particular electrical phenomena is that it appeared to be more in the nature of "Large Static Discharge" than actual lightning strikes. A loud bang accompanied by a bright red

glow illuminated the aircraft on each occasion, being quite different to the bright flash and sharp crack of a normal strike. No cells were evident on the aircraft radar at the time.

Damage to Aircraft:

- (i) One discharge wick on port wing tip burnt out.
- (ii) Three pencil-sized holes in nose section (one centre of Radome and two on port side of nose cone, approximately 14 inches apart and 3 to 4 feet to the rear of nose).
- (iii) Three small holes in rudder trim tab.
- (iv) A long line of burn pit-marks down the port under-side of fuselage, approximately 6 inches apart.
- (v) Some burn marks at rear edge of Radome.

All electrical and radio equipment worked normally after the strike and the aircraft compasses were not affected.

6. 1640 EST 27 October 1965: A Viscount aircraft, climbing out from Canberra at 13,000 ft and 36 nautical miles south of Sydney, was struck by lightning and sustained minor aerial damage. The aircraft was in cloud, light hail, and was experiencing moderate turbulence. The outside air temperature 1°C, and two weak cells were observed on the aircraft storm warning radar either side of track. The only report given to the aircraft notified a fully matured cumulo-nimbus in the vicinity of Burragorang, though a line of frontal storms was observed stretching from Wollongong to Katoomba, with a secondary weaker front in the vicinity of Goulburn.
7. 1335 EST 26 January 1966: A lightning strike occurred between Mackay and Townsville. The aircraft, a Viscount 800, was flying in 8/8 cumuliform and stratiform cloud at 15,000 feet, with an outside temperature of 0°C. Turbulence was moderate and some cells were observed on the weather radar of other aircraft in the vicinity. Minor damage only was sustained.
8. 1405 EST 16 February 1966: A lightning strike occurred on a Boeing 707. The aircraft was climbing in cloud, 40-50 miles west of Sydney and the outside air temperature was observed to be -4°C. No damage was sustained.
9. 1735 EST 6 July 1966: At approximately 60-65 nautical miles south of Tamworth, at an altitude of 14,000 ft, an F.27 aircraft was flown into what appeared to be the last 500 to 1,000 ft top of a reasonably insignificant cumulus cloud. Prior to entering the cloud, the radar was monitored and a practically negligible return from the cloud at 14,000 ft noticed. There were no indications of lightning in the area and nil interference to any radio equipment in use. The outside air temperature was -10°C; pitot, windscreen and power unit de-icing, all having previously been selected to "ON", were operating. On entering the cloud, slight turbulence was noticed and light sleet encountered. Precipitation static momentarily broke the squelch on VHF and a moment later a slight lightning flash was noticed to port and forward of the aircraft. It was anticipated by both captains that the aircraft would transit the cloud top in less than, say, 2 or 3 minutes and just after noticing the first sign of lightning it was expected that the aircraft would break clear of cloud. Seconds after the first general type of flash, two unusual flashes occurred ahead of the aircraft and appeared to be on a horizontal plane. Not at the same time but only seconds later, a large bang occurred which, on recollection, was not accompanied by a flash and the starboard of F.O.'s section of the windscreen shattered, fracturing in many places over the whole area of glass. De-pressurisation was immediately commenced, the aircraft broke clear of cloud, descent was requested and obtained and the aircraft descended to 6,000 ft. On inspection, it was found that the outer layer of glass only had been fractured and there appeared to be an impact mark, approximately the size of a marble, on the outer glass in the vicinity of the temperature sensing element of the nesa.

The flight continued to Mascot at 6,000 ft and $\frac{1}{2}$ lb of pressure differential maintained until in the circuit area.

NOTE: Two earlier reports of lightning strikes on aircraft, received from the Department of Civil Aviation, were published in Australian Meteorological Magazine No. 46, September 1964. Particulars of these are summarised below:

No.	Date	Time	Location	Height	Aircraft	Cloud
1.	24 January 1964	2120 EST (1120 GMT)	Between Sydney and Canberra	14,000 ft	Viscount	-
2.	11 June 1964	0920 EST	About 100 mi west of Sydney	11,000 ft	Viscount	Cu type in a rain area

Future reports too, will be published annually in December, No. 4, issues of the magazine.