No. 8

P.N. Garuda Indonesian Airways, Lockheed Electra L-188C, PK-GLB, accident at Mapanget Airport, Menado, Indonesia, on 16 February 1967. Report, not dated, released by the Civil Air Transport Board, Ministry of Communications, Indonesia

1.- Investigation

1.1 History of the flight

Flight 708 was a scheduled domestic flight from Djakarta to Menado, with intermediate stops at Surabaya and Makassar. It departed Djakarta at 0030 hours GMT on 15 February and proceeded on an IFR flight plan to Surabaya. While en route to Surabaya No. 4 engine would not synchronize. The flight landed at 0200 hours at Surabaya where an oil leak on No. 1 propeller was found. After rectifying these faults the flight departed from Surabaya at 0300 hours. On approaching Makassar bad weather was reported and after two attempts to land, the pilot-in-command elected to divert to another aerodrome. Two aerodromes were available - Denpasar, the first alternate and Surabaya. Although Surabaya was at a greater distance, the pilot-in-command decided for various reasons to return to Surabaya/Djuanda and remain overnight. An oil leak on No. 1 propeller was again observed and noted for rectification. The flight departed the next morning at 0010 hours for Makassar where it landed without incident.

After approximately a one hour stop at Makassar the flight proceeded to Menado with an estimated time of arrival there of 0512 hours GMT. On approaching Menado the pilot-in-command requested the weather conditions and was given a cloud base of 900 ft and a visibility of 2 km. At an altitude of 1 500 ft the town of Menado and the beach were visible and the aircraft made a 360° turn over the bay of Menado: the aircraft then descended to 900 ft and intercepted the beach on a heading of 120° intending to make an approach to runway 18.

The pilot-in-command sighted the runway to his right, continued the approach through a gap between two hills, and called for the undercarriage to be lowered and completion of final checks. He instructed the flight engineer to stand by for an overshoot at which time the approach was being continued with the flaps in the landing position. The aircraft banked 15° - 20° to the right, and the co-pilot monitored and called the airspeed.

After passing a hill 200 ft above the runway elevation and some 2 720 ft before the runway threshold the pilot-in-command realized he was too high, also the aircraft was still to the left of the centre line and banked to the right. The nose of the aircraft was lowered and after intercepting the glide path at an indicated airspeed of 130 kt the control column was moved rearwards to a normal descent position.

With the airspeed rapidly decreasing below the target threshold speed of 125 kt, and whilst still banked to the right, the aircraft landed heavily 3 ft short of the runway manoeuvring area and some 156 ft short of the runway threshold. The undercarriage collapsed and the aircraft skidded, caught fire, and came to rest on the runway

1 442 ft after the threshold on a heading of 225°. The accident occurred at 0521 hours in daylight.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal		22	
Non-fatal		12	
None	8	50	

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

There was no other damage.

1.5 Crew information

The pilot-in-command, aged 36, held a valid airline transport pilot's licence with type rating for the Electra L-188C. He passed his last medical examination on 1 December 1966 with no waivers. His last proficiency check on Electra L-188C was completed on 26 November 1966. He had flown a total of 8 054 hours including 718 hours on the Electra L-188C. Within the last 90 days he had flown 205 hours of which 150 hours were flown on the Electra L-188C.

He had previously landed three times at Menado on Electra L-188C, twice on runway 18.

The co-pilot, aged 36, held a valid airline transport pilot's licence with type ratings for the Electra L-188C. He passed his last medical examination on 3 October 1966 without waiver. He had flown a total of 8 336 hours including 505 hours on the Electra L-188C.

The flight engineer, aged 28, held a valid flight engineer's licence with type ratings for the Convair 340/440 and Electra L-188C. He passed his last medical examination on 25 July 1966.

The flight radio operator, aged 36, held a valid radiotelephony licence endorsed on 22 November 1960. He passed his last medical examination on 25 July 1966.

Also aboard were three air hostesses and a steward. All held the required certificates.

1.6 Aircraft information

The certificate of airworthiness of the aircraft was valid until 23 June 1967. It had been properly maintained in accordance with the approved maintenance specifications. The last 500 hours inspection was performed on 13 November 1966.

The aircraft underwent an ultrasonic inspection at Hong Kong on 14 January 1967 for detecting possible wing plank splice cracks and corrosion (Service Bulletin 620).

It had flown a total of 12 359 hours, including 455 hours since the last 500 hours inspection and 171 hours since its ultrasonic inspection at Hong Kong. Repair of the left wing in accordance with Lockheed Service Bulletin 619 had not yet been carried out.

One week prior to the accident the aircraft had experienced a hard landing on the left main gear. A hard landing inspection was performed by an apron-maintenance mechanic: a severe strut leak was observed which proved to be a flattened O-ring of the left piston rod.

The gross weight of the aircraft at take-off was 103 650 lb, well below the maximum permissible of 116 000 lb, its estimated landing weight at Menado was 94 800 lb.

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

1.7 Meteorological information

The prevailing weather conditions before and at the time of the accident were reported to be overcast with light showers over the airfield. The 0500 hours weather report was: wind southerly and about 2 kt, visibility 2 to 3 km, cloud 3/8 at 900 ft and 4/8 at 2 000 ft.

1.8 Aids to navigation

Not mentioned in the report.

1.9 Communications

No difficulties were mentioned in the report.

1.10 Aerodrome and ground facilities

Not mentioned in the report.

1.11 Flight recorders

See recommendation No. 7.

1.12 Wreckage

Examination at the site of the accident revealed that the aircraft first struck the ground with its right main landing gear approximately 3 ft short of the beginning of the manoeuvring area of runway 18. Detailed examination of the right landing gear revealed that it collapsed rearward and inboard. Propeller marks on the manoeuvring area

and the beginning of the runway indicated that the propellers struck the ground in the following order: No. 4 first, then Nos. 3, 2 and 1, and that the four engines were operating at the time. All four propellers were torn off from their respective engines. Impact of the left main landing gear was quite severe and the left wing failed at Station 140. Following this the aircraft skidded on its belly along the runway and caught fire. During the last part of its skidding the aircraft swerved slightly to the right and finally came to a stop on the runway at approximately 1 595 ft from the first point of touchdown, on a heading of approximately 225°.

1.13 Fire

When the left wing separated, fuel started spilling and caught fire and when the aircraft came to a stop it was ablaze. Due to the inadequacy of the fire fighting equipment the aircraft was burnt out.

1.14 Survival aspects

The fire started to engulf the aircraft when it skidded on its belly.

According to the crew, just after the aircraft came to a full stop the co-pilot instructed the flight engineer and the cabin attendants to open the forward main entrance door but unfortunately they did not succeed in opening this door from the inside. Meanwhile smoke and fumes began to penetrate the first class cabin (aft). The cabin attendants advised all passengers to proceed forward in order to escape from the right hand forward emergency exit and cockpit sliding windows. One of the cabin attendants tried to open the overwing emergency exits but was advised by another crew member not to open them because of fire outside the window. During that same time the flight crew attempted to open the forward main entrance door from the outside; however, they did not succeed either. Survivors evacuated from the aircraft through the right forward emergency exit and the cockpit sliding windows.

1.15 Tests and research

No information was contained in the report.

2.- Analysis and Conclusions

2.1 Analysis

On the basis of the statements of the pilot-in-command and crew it was considered that the pilot-in-command adopted an awkward approach technique which resulted in an excessive sink rate, and subsequently a heavy touchdown before the runway threshold and before the aircraft had been levelled for touchdown. It was considered that although the pilot-in-command had prepared for the possibility of an overshoot he may have been influenced to proceed with the landing approach because he did not wish to divert and place himself in the same position as the previous day. That is, the previous day he had diverted and remained overnight at his alternate and he was now making his second flight to his scheduled destination.

The Board was of the opinion that the reports concerning the synchronization of No. 4 propeller and the oil leak of No. 1 propeller were not contributing factors to the accident. No evidence was found during the course of the investigation indicating

sabotage, structural failure or mechanical malfunction prior to the aircraft's landing. As far as could be investigated the aircraft systems were normal and should have been capable of normal operation at landing. Further, the investigation of the maintenance records did not reveal any abnormalities which could have led to the accident.

From examination of the impact marks the Board considered that the pilot applied left rudder just prior to touchdown and that when the right landing gear made its first contact with the ground 3 ft short of the manoeuvring area, the aircraft was still right wing down and the heading of the aircraft was approximately 170° although the ground track was approximately 185° - 190°. Examination of the right main landing gear damage indicated that it had been subjected to side loads during the touchdown which may have been the cause of the collapse of the main landing gears. It was considered that this possibility could be substantiated by reference to the design criteria and Lockheed Report No. 11004 wherein it is stated that the main landing gear is designed for a sink rate of 10 ft/sec with a load factor of 1.2 at maximum landing weight.

Analysing the propeller marks on the pavement in relation to the aircraft dimensions, the Board believed that the No. 4 propeller struck the pavement first, followed by Nos. 3, 2 and 1. Further investigation on these marks revealed that No. 4 propeller struck the pavement with a forward velocity of approximately 80.5 kt.

The Board also believed that due to the low airspeed the aircraft had a slight nose-up attitude when touching the ground with its right main landing gear. As the right main gear collapsed, the lower fuselage at or around fuselage station 880 struck the pavement at a speed of around 80.5 kt, and as the right main gear was collapsing, propellers No. 4 and No. 3 were slashing the ground, whereby the movement to the left-wing-down direction occurred. The left main gear then struck the pavement, primarily with its outboard wheel, while the aircraft, due to the impact of the right main gear, moved to a heading of approximagely 190°. The impact of the left landing gear was quite severe. Almost immediately after the impact of the left landing gear, a failure of the inboard main landing gear rib occurred. However, the landing gear did not collapse and the left wing separated completely from the centre wing section at about wing station 140.

The fact that the left wing of the aircraft had not yet accomplished a repair scheme in accordance with Lockheed Service Bulletin 619, had no direct influence on the cause of the accident. Analyses produced by the aircraft manufacturer stress experts showed that the work required by Service Bulletin 619 would have had no influence in preventing the separation of the left wing. It was designed only to prevent fatigue cracks adjacent to or at the wing splices.

The separation of the left wing which caused the spilling of fuel from the wing tank, accompanied by the heat of the engine and also the heat produced by the friction between the aircraft body and the ground, could all have set the aircraft afire.

As for the casualties, the Board believed that they were primarily caused by fire and not by impact. All those passengers who apparently tried to escape from the rear service door, but were unable to open it quickly were trapped in the burning wreckage.

2.2 Conclusions

(a) Findings

The crew members were fit and held valid licences.

The aircraft was airworthy and maintained in accordance with the approved maintenance specifications. The gross weight of the aircraft at take-off and at landing was below the maximum allowable and the load properly distributed.

The last airspeed reading was 125 kt and decreasing; the touchdown point was approximately 3 ft short of the beginning of the manoeuvring area of runway 18.

The left wing was completely separated from the centre wing section between wing station 140 and wing station 160.

There was no evidence of failure or malfunctioning of the aircraft or its components prior to touchdown that could lead to the accident.

(b) Cause or Probable cause(s)

The Board determined that the probable cause of this accident was an awkward approach technique resulting in an excessive rate of sink on touchdown.

Contributory factors

Based on all available evidence the Board found that the following factors contributed to the accident:

1. The runway width of 98 ft which looks smaller from the pilot's point of view.

2. The uneven runway pavement which forces pilots to touchdown as close as possible to the threshold.

3. The marginal weather conditions prevailing at the time of the accident which forced the pilot to accomplish a tight circuit.

4. The relationship between the rate of sink and the negative thrust at low speed were not known to the pilot and the operator.

3.- Recommendations

As a result of this accident the Board recommended the following:

1. Review the approach procedure for landing at Mapanget Airport.

2. Review all runways having 100 ft width to be used by the Electra.

3. Runway pavement, shoulders and markings to be properly improved.

4. Approach area to be cleared and properly maintained.

5. Navigational aids and communications to be properly installed in accordance with the minimum requirements.

6. Airport emergency equipment to be completely furnished.

7. Installation of flight data recorders on all turbo aircraft having a maximum gross weight exceeding 12 500 lb and on all aircraft flying at more than 25 000 ft.

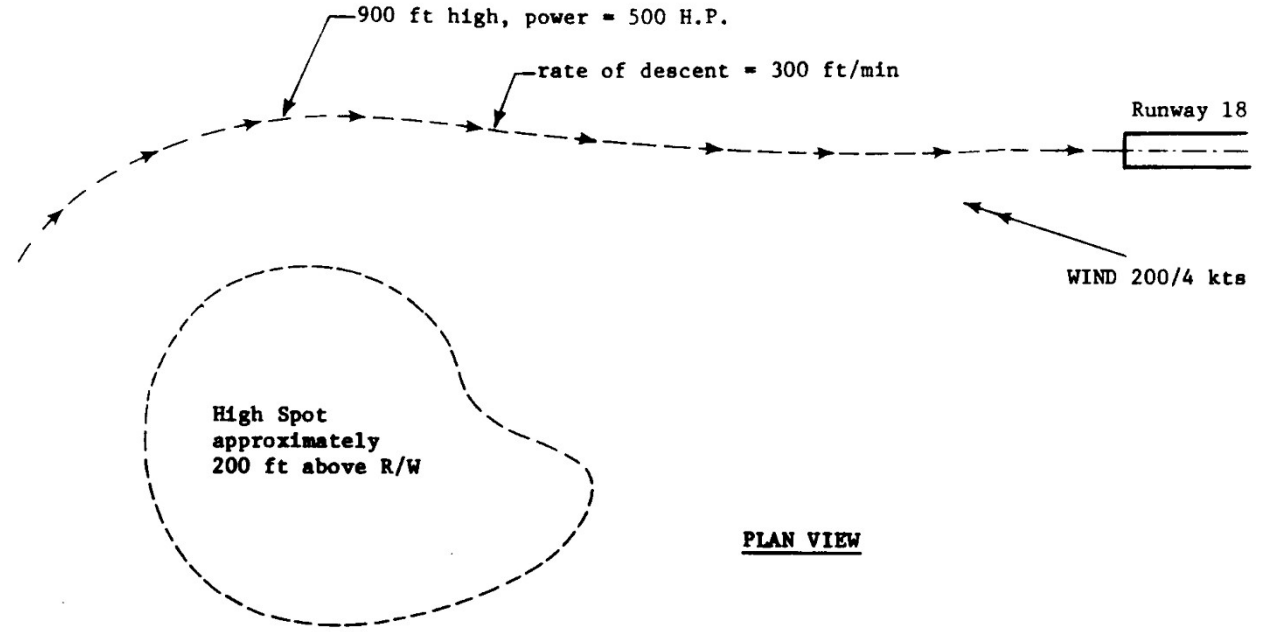
8. Review the seating arrangement of all civil aircraft in such a manner that there will be at least one cabin attendant occupying the most aft seat during take-off and landing.

9. Emergency drill to be carried out at least once a year by all personnel concerned.

ICAO Ref: AIG/085/67

Figure 8-1. PK-GLB fuselage at standstill 225° heading, left wing separated. Spilled fuel burned fiercely. Note fuselage damage by No. 2 propeller.

Figure 8-2. Over-all view a few minutes after the accident. Flight crew at main entrance door in attempt to open it. Note separated left wing still burning at far side. Empenage structure broke from main fuselage.



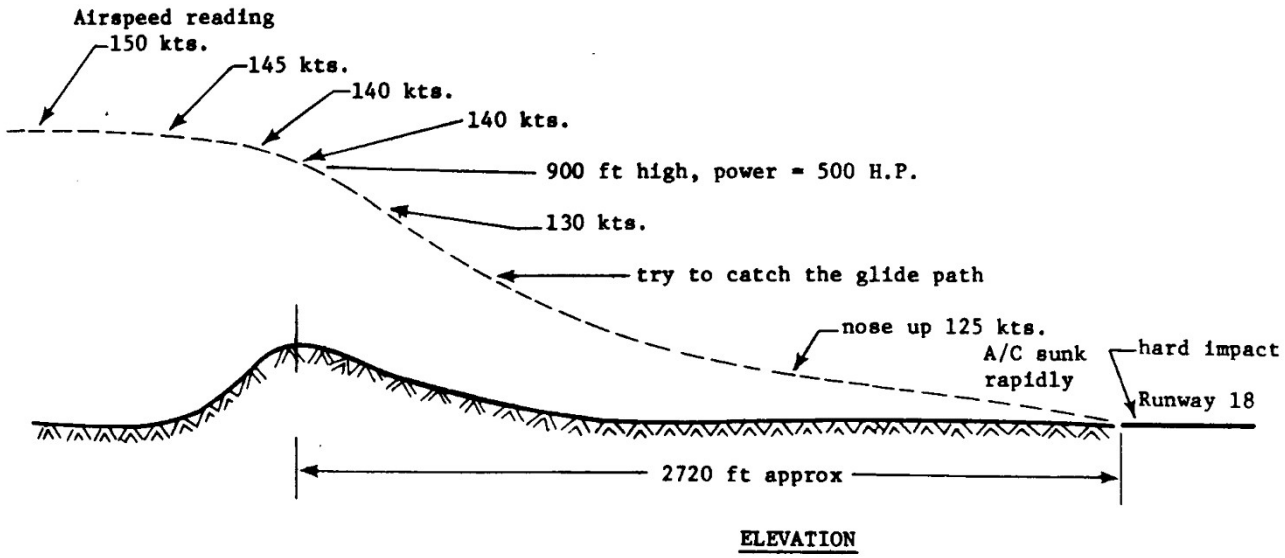


Figure 8-3. Approximate Flight Path of PK-GLB
Mapanget Airport, Menado, 16 February 1967