

No. 13KLM, Royal Dutch Airlines, Constellation L749 Damaged on  
Landing at Don Muang Airport, Bangkok on 23 March 1952Circumstances

The aircraft, on a scheduled flight from Amsterdam, took off from Karachi for Bangkok at 2111 hours on 22 March 1953, with a crew of ten and thirty-four passengers. The flight was routine until approximately fifty-four kilometres from Don Muang Airport, near Bangkok, when the pilot noticed an abnormally clear, though not alarming, vibration of the control wheel and the dashboard. Increase of revolutions of the engines reduced the vibration to an insignificant point. Flying at approximately 500 metres on the approach to the airport, a turn to the left to base leg was started with a view to landing on Runway 21-03.

Suddenly a loud noise was heard and the aircraft vibrated heavily. This was caused by the failure of one of the propeller blades of No. 3 engine. Immediately after the engine broke free from the aircraft and fire broke out in the engine nacelle. The aircraft landed normally on Runway 21-03 but before the aircraft had come to a stop the right main landing-gear collapsed and the fire spread. All passengers and crew left the aircraft safely but the aircraft was destroyed by fire.

Investigation and Evidence

An investigation was made into the causes of the failure of the propeller-blade. The first cause of the fracture was due to a large number of tiny cracks, caused by hydrogen contained in the weld. These cracks led either by stress-raising effects or by stress-patterns caused by the hydrogen which the weld contained, to a combination of fissure-like fractures, which formed the starting point of the fatigue-failure.

About one hour before the failure of the propeller, the pilots noticed an abnormal, although not alarming, vibration of the control-wheel and the dashboard, the cause of which could not be established. The engine revolutions at the time were 2 050 per minute. The pilot-in-command considered the vibrations to be due to ice-accretion on the propellers and therefore changed the altitude from 5300 metres to 4200 metres. However, the vibration did not disappear altogether by this change in altitude so that they could not be attributed to ice-accretion.

The vibration was not considered to be due to engine-trouble, because the engine instruments did not show any vibration, the settings of the B. M. E. P. did not point to a decrease of power on any engine and an examination of the magnetos revealed that they were functioning normally. The vibrations were decreased to an important extent, however, by increasing the number of revolutions to 2 150 per minute.

The manufacturer of the propellers suggested that the vibration might have been caused by engine-roughness, which might have resulted in too high a stress of the blade in connection with the quality of the weld.

The Inquiry, on the evidence of the crew with respect to the operation of the engines and the disappearance of the vibration with the change of revolutions, did not deem this supposition to be acceptable. An investigation of No. 3 engine did not reveal any malfunctioning of the engine, however, there is no certainty in this respect, since the engine was damaged to an important extent and some parts were not recovered. Moreover, during a flight with an aircraft of a similar type, when two cylinders of No. 3 engine were not operating, vibration phenomena of a different nature occurred.

The Inquiry considered that as the propeller succumbed to a fatigue failure, the vibration may have been caused by the crack in the propeller-blade, which may have extended over an important part of the circumference of the fracture, a considerable time before the moment of failure.

A crack will decrease the rigidity of the blade against bending. However, it is doubtful, whether this local decrease in rigidity, especially at the lightly stressed trailing edge of the

blade-shank during bending, may have caused such a decrease of the frequency of the bending vibration that as a consequence resonance would have set in at the number of revolutions during which the vibration was noticed.

During the investigation it was not possible to investigate to what degree a crack in the blade-shank influenced its frequency. Such an investigation might have been made by means of an experimental determination of the frequency of a non-rotating blade clamped at the shank, for the undamaged condition of the blade as well as for conditions in which the blade-shank had been affected by cuts of different lengths.

Due to the possibility of recurrence of blade-failures, the Inquiry considered it advisable, in spite of the guarantee offered by a system of regular inspections introduced after the accident by the operator, to recommend that it should be ascertained whether abnormal vibrations, such as occurred in this case, should be considered as a warning that a fatigue-failure had developed in the blade. The Inquiry therefore recommended that an investigation should be made into the influence of failure development on the frequency of the propeller-blade.

#### Probable Cause

The probable cause was the failure of the propeller-blade during flight shortly before landing at Don Muang Airport. This caused the loss of No. 3 engine and fire to break out in the engine nacelle which could not be extinguished. When landing, the right main landing-gears collapsed as a consequence of the fire.