

## GENERAL INFORMATION

Identification number:	2004052
Classification:	Serious incident
Date of occurrence :	10 April 2004
Location of occurrence :	Amsterdam Schiphol Airport
Aircraft registration:	PH-KCG
Aircraft model:	Boeing McDonnell Douglas MD-11
Type of aircraft:	Passenger aircraft
Type of flight:	Scheduled passenger flight
Phase of operation:	En route and landing
Damage to aircraft:	None
Cockpit crew:	3
Cabin crew:	10
Passengers:	274
Injuries:	None
Other damage:	None
Light conditions:	Daytime and nighttime en route and daytime during arrival

## SUMMARY

En route and during approach all cockpit display units blanked momentarily and a number of alerts were presented. During approach passing 1500 feet on the instrument landing system the autopilot and the autothrottle system also disengaged. A manual go-around was initiated and the information on the display units returned. During the following manual approach an unsafe gear warning appeared and a second go-around was performed. After contacting the company the gear was selected down successfully. The third approach and landing were uneventful.

## FACTUAL INFORMATION

The flight was a scheduled line flight from Vancouver to Amsterdam Schiphol Airport with an MD-11 aircraft. After 46 minutes in flight a level 1 alert "GEN 1 OFF" appeared. According to the crew all six display units blanked momentarily and a number of alerts were momentarily presented. The crew reviewed the electrical system and concluded that generator relay #1 had opened, probably because of a fault in the integrated drive generator #1. After they checked and discussed the consequences for the remainder of the flight, the crew concluded that the flight could proceed as planned and that the aircraft's autoland capabilities were not reduced due to the failure of integrated drive generator #1. Instrument meteorological conditions were forecasted to prevail at the expected time of arrival.

The rest of the flight was uneventful until the approach phase. Upon passing 1500 feet on the instrument landing system, with autopilot #2 in command, all six display units blanked for several seconds and autopilot # 2 and the autothrottle system disengaged. A manual go-around was initiated at around 1200 feet and the crew observed that one by one the information on the display units returned. Several level 1 and level 2 alerts appeared but most of them also disappeared again except for the alerts 'AC TIE 2 OFF', 'EMER PWR ON' and 'EPGS FAULT'. The crew consulted the emergency checklist but was unable to find additional information concerning these alerts. The alerts were not further addressed.

The crew assessed the situation and concluded that the automatic electrical switching during land mode bus isolation, associated with an automatic approach, had probably caused the power failure. Consequently the crew decided to fly the second approach with the autopilot disconnected. During the second approach, after gear down selection, both primary and secondary gear indications showed an unsafe gear position (red lights). However, the crew had heard the normal noises associated with a gear extension. They therefore suspected an indication system problem, possibly due to the previously experienced electrical problems. At an altitude of approximately 600 feet another go-around was initiated. The crew stated that they heard the gear retract during the go-around.

Initially the crew attempted to find an emergency checklist procedure or aircraft operating manual procedure that would relate the gear indication problem to the electrical problems experienced earlier. An applicable procedure could not be found. During the subsequent conference call with the company the gear was selected down once again to recheck the indications. This time gear selection resulted in a down and locked indication.

The third approach and landing were uneventful, and the aircraft landed with approximately 34 minutes fuel remaining.

During taxi-in, when the auxiliary power unit was started, display units 1 and 3 blanked for a few seconds, all 'CALL' lights on the captain's side audio selector panel illuminated, and the captain was unable to establish radio contact with air traffic control. The level 2 alert "FCC 1A" and "FCC 1B" were presented and the appropriate emergency checklist procedure was performed. Communication was restored and the crew continued taxiing to the gate.

The Dutch Safety Board did not investigate this serious incident in depth. Investigators of the Board did not go on site and the factual information is primarily based upon the information received from the company involved in this incident.

## **ANALYSIS**

The working principle of the logic of the electrical system of the MD-11 is as follows: during an automatic approach the electrical power control unit (EPCU) reconfigures the electrical system and separates the power sources for the flight control computers (FCC). The switching of power starts as soon as the aircraft descends through 1500 feet radio altitude on a valid instrument landing system signal with the autopilot coupled. The main connections between power sources and electrical busses within the aircraft's electrical system are provided by ten power relays. Each power relay incorporates three main contacts and several auxiliary contacts. The auxiliary contacts provide, amongst other things, input signals to the generator control units (GCU) and EPCU,

indicating an open or closed position of the relays main contacts. The EPCU and GCU use these signals to provide switching commands to the power relays

Based on analysis of the switching of power process, two relays of the incident flight were tested and appeared to suffer from several faulty contacts. It also became apparent that the type of power relays in the MD-11 fleet was susceptible to contact point erosion of the primary and auxiliary contacts and were therefore unreliable. The relay test device in use within the airline company frequently failed to reveal this type of problem. Further analysis also revealed that the mean time between unscheduled removals (MTBUR) of the MD-11 integrated drive generator within the company was higher than the world average MTBUR. The unsafe gear indication was not related to the electrical failure and was considered as a mere coincidence. The partial electrical failure during taxi-in was caused by a depleted aircraft battery.

## **CONCLUSION**

This event demonstrated the vulnerability of an MD-11 electrical system featuring these unreliable power relays. Essential flight information was interrupted and autoflight capability was lost during a critical flight phase in instrument meteorological conditions. Further, consultation of the emergency checklist did not prove to be helpful in providing an effective solution for this problem.

*Note: This report has been published in English and Dutch language. If there are differences in interpretation the Dutch text prevails.*