# The Dutch Safety Board

**Occurrence #: 2003014** **Classification: Serious Incident**

## FACTUAL INFORMATION

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| Date of the occurrence: | 04-02-2003 | POB flight crew: | 4 |
| Place of the occurrence: | Amsterdam Airport Schiphol | POB cabin crew: | 10 |
| Aircraft registration: | PH-BFY | POB passengers: | 253 |
| Airline company: | KLM Royal Dutch Airlines | | |
| Aircraft model: | Boeing 747-400 | | |
| Type of aircraft: | Passenger aircraft | | |
| Type of flight: | Scheduled Passenger Flight | Injuries: | Nil |
| Phase of operation: | Take-off | | |
| Damage to aircraft: | 2 tires had to be replaced | | |
| Other damage: | A runway sign of runway 24 | Lighting conditions: | Night time |

## The flight and the occurrence

The flight was a scheduled passenger flight with a Boeing 747-400 from Amsterdam Airport Schiphol (EHAM) to Kuala Lumpur Sepang Airport (WMKK). The flight crew consisted of a captain, a senior first officer (F/O1), a less senior first officer (F/O2) and a second officer (S/O). It was decided that the captain would operate as “Pilot Not Flying” (PNF) and the F/O2 as “Pilot Flying” (PF). The company maintains a fixed seat policy in which the captain occupies the left-hand seat and the co-pilot occupies the right-hand seat.

One take-off data card was retrieved during the investigation. Information written on this take-off data card indicated runway 24 as take-off runway with a surface wind of 120 degrees with 23 knots.
The crew considered the runway “wet” for take off data calculations. The weather presented to the pilots during flight preparation[1)] indicated a wind direction of 220 degrees and a wind speed of 18 knots gusting to 28 knots. There were rain showers with some clouds at 800 to 1,000 feet. The cloud base was at 2,000 feet. Temperature was 3 degrees Celsius and the local pressure (QNH) was 991 hectopascal. The forecast indicated the wind to veer to 300-340 degrees and the windspeed to increase to 20 knots with gusts up to 33 knots. For performance calculations the crew did not take the wind into account.

During taxi-out the F/O1 noticed ATIS ‘Quebec’ (Q), which indicated a surface wind direction for runway 24 of 300 degrees with a speed of 19 knots. No other ATIS reports were noticed by the crew. In the latest ATIS report before take-off (“S”), the surface wind for runway 24 was reported from direction 310° with a speed of 22 knots, maximum 32 knots and minimum 14 knots. Both ATIS ‘Q’ and ‘S’ reported runway 01L as main take-off runway and runway 24 as secondary take-off runway. Reported wind conditions on runway 01L were almost identical to runway 24.

During line-up on runway 24, take-off clearance was received from the tower controller who also stated that the surface wind was 320 degrees at 18 knots, maximum 34 knots.

Take-off commenced at 18.55 UTC. During the take-off roll the PF continuously applied some (left) rudder and (right) aileron input to correct for the strong and gusty wind from the right. The aircraft properly tracked the centerline until two seconds after $V_1$. At that moment the rudder pedal position moved from 4.0 units to 20.8 units left in three seconds, resulting in a maximum rudder surface deflection to the left. As a result the aircraft veered to the left. While approaching the runway edge, the PF rotated the aircraft - at about 9 knots prior to $V_R$ - in order to avoid a runway excursion. At the same time he applied considerable right aileron input. During rotation the left-hand body gear hit a runway sign 18.5 meters beside the left edge of runway 24. The sign had a height of approximately 1.5 meters. According to the F/O1 and the assistant purser (seated in the cabin), the aircraft became airborne above

the grass. The captain, the F/O1 and several cabin attendants heard a ‘bang” shortly after becoming airborne. Also strong vibration was felt until the landing gear was retracted.

After take-off the crew evaluated the situation. At the moment the aircraft veered to the left, the F/O1 checked the engine instruments which indicated normal engine operation. Initially the crew assumed that the aircraft had hit a runway edge light. The possibility of a tail strike was also considered. Landing gear and pressurization indications in the cockpit were normal. Furthermore air traffic control (ATC) was requested to inspect the runway for damage and/or debris. After contacting and consulting the company the flight crew decided to continue the flight.

The remainder of the flight was uneventful. Inspection after arrival revealed that the two inner tires of the left-hand body gear were damaged. A metal pin was found embedded in one of the tires while the other tire had a deep gash. All tires remained inflated. The two damaged tires were replaced in Kuala Lumpur. Later it was established that the metal pin originated from a sign along the take-off runway.

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## Investigation & Analysis

The Dutch Safety Board did not investigate this serious incident in depth. This report is based upon factual information and investigation results as received from the involved airline.

During flight preparation two take-off data cards are prepared which are also used as landing data cards. On these data cards the relevant weather is noted. After the flight one data card is discarded and the other one is stored. On this take-off data card the wind at Amsterdam was noted as being 120/23 (120 degrees, 23 knots). On the flight documentation the wind from the actual weather report was reported as 220/18G28kt (220 degrees, 18 knots, gusts 28 knots). Most likely the wind notation 120/23 was incorrectly copied from the other (discarded) take-off data card. In addition the maximum wind gust of 28 knots was also not noted. The wind on runway 24 was almost head on. When the expected take-off weight is not runway length critical then the headwind component is not taken into account. A calculation with ‘zero wind’ has no adverse effect on performance calculations.

During taxi out the F/O1 checked the ATIS again. He could recall listening to ATIS ‘Q’ indicating (according to him) a wind of 300/19. The F/O1 passed this wind information to the active pilots but did not mention any wind gusts. ATIS ‘Q’ was valid from 17.57 – 18.14 UTC. Fifteen minutes before take-off ATIS ‘Sierra’ (S) became active at time 18.40 UTC. In ATIS report ‘S’ wind gusts were reported in excess of 30 knots, close to the maximum company crosswind limit. ATIS ‘S’ was not received by the crew, neither was the change in the ATIS reports mentioned by ATC, however, when ATC issued the take-off clearance, wind information was provided which indicated a crosswind in excess of 30 knots (320/18 maximum 34). The captain and the S/O also noticed the windsock which indicated a wind of at least 30 knots. Before take-off, all pilots were aware of the strong crosswind from the right. This was concluded from the track of aircraft departing in front which were drifting considerably to the left after becoming airborne. The circumstance that the crosswind was close to or in excess of the company limit was not mentioned by any pilot.

Maximum crosswind limits for each type of aircraft are established during test flights by the manufacturer in the certification process. This is the so called ‘demonstrated’ crosswind limit. Based on the judgment of the test pilots the aircraft manufacturer may also determine a (less restrictive) ‘recommended’ crosswind limit. The ‘demonstrated’ crosswind limit for take-off with the Boeing 747-400 is 30 knots. The ‘recommended’ crosswind limit for take-off is 40 knots. Most operators use the ‘demonstrated’ crosswind limit. The take-off crosswind limits used by the company concerned are based on the ‘demonstrated’ crosswind limit (including wind gusts) and are set at 30 knots for a dry runway and 25 knots in case of a wet runway. The latest wind information as received by the crew indicated a crosswind of 33 knots. This exceeded the company’s crosswind limitation.

ATC is not aware of wind limitations for each type of aircraft. Normally a runway will be selected with a maximum crosswind component of 20 knots. Since there was no runway available that fulfilled this condition, ATC offered the most suitable runways, being runway 24 and 01L. The decision to accept runway 24 for take-off was not challenged.

The effects of crosswind on the controllability of the aircraft are more pronounced during landing than during take-off. The take-off crosswind limits are based on an engine failure during the most critical stage of the take-off roll. If no engine fails, the aircraft can be well controlled during the take-off roll

even with crosswinds up to the maximum (recommended) value. Although the strong north-westerly wind was not instrumental in causing the runway excursion, the buffeting caused by the wind gusts and the constant control inputs required to track probably contributed to the incident.

The possibility of a technical failure was considered, but nothing was found that could support an airframe or system defect as cause for the loss of directional control.

During the take-off roll F/O2 (PF) continuously applied rudder and aileron inputs to correct for the gusty crosswind conditions. The aircraft properly tracked the runway centerline until approximately $V_1$. Just after $V_1$ the aircraft suddenly veered to the left. At that time the captain was looking inside to check $V_R$ on his airspeed indicator. He initially did not notice the movement to the left and – during the investigation - could not recall whether any input on the rudder pedals was given as he had his feet not on the pedals. After someone called out he looked outside and saw the aircraft approaching the runway edge. The captain then started to apply corrective rudder input but stopped immediately when the F/O2 initiated the rotation of the aircraft. F/O1 had checked the engine instruments for a possible engine failure but all indications were normal.

Because of the gusting wind conditions the airspeed indication fluctuated during the take-off roll, According to the PNF this required extra attention from him, so he was mainly head-down and his awareness of what happened outside the aircraft was reduced. Therefore he could not recall how accurately the PF had tracked the runway centreline and only became aware of the deviation from the runway centreline after being alerted by a call of one of the other pilots. Checking engine instruments is one of the tasks of the PNF during the take-off roll, but a frequent overall scan, including visual clues outside the aircraft, is an integrated part of the PNF's monitoring activities.

Data from the flight data recorders was used to verify rudder and aileron input. These data indicated that during the take-off roll left rudder and right aileron inputs were given. The aircraft moved closely along the runway centerline until $V_1$. Two seconds after $V_1$ the rudder pedal position increased within three seconds to a full scale left input. At the same time the control wheel input increased to a full scale right input. Recorded data indicated that the aircraft veered to the left while it banked slightly to the right. The aircraft was rotated 9 knots below $V_R$. After lift-off the rudder pedal input and right control wheel input returned to near neutral.

Whilst it is possible that a strong wind gust at $V_1$ could have caused the initial displacement, the wind was not responsible for the runway excursion. At speeds around $V_1$ the rudder authority is more than sufficient to counter any offset caused by the existing wind. Instead the runway excursion was caused by full left rudder input. It could not be determined whether this input was made by the F/O2. The reason for the large rudder pedal input at $V_1$ however could not be determined.

*The limited awareness of the cockpit crew regarding the adverse x-wind conditions – from the planning phase until the take-off - probably contributed to this incident.*

*The flight data recorder of the Boeing 747 registers overall control inputs only. It is not recorded whether an input is made from the captains or co-pilots position.*

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

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[1)] Actual weather printed on the flight documentation presented to the flight crew during flight preparation indicated:
SA 041655 22018G28KT 9999-TSRAGS FEW008 SCT010CB BKN020 03/02 Q991 27////95
BECMG 30016 TEMPO 31020G33KT 4000 SHGSSNRA=
Forecasted weather printed on the same flight plan indicated:
FC 041511 041601 26016KT 9999 SCT020 SCT035
PROB40 TEMPO 1618 26020G34 2000 SHGSSNRA SCT007 BKN010 BKN012CB
TEMPO 1601 4000 –SHGSRASN SCT010 BKN015 SCT018CB
BECMG 1618 32017G27KT
PROB30 TEMPO 1801 34022G35KT 2500 SHGSSNRA SCT010 BKN012 BKN015CB
BECMG 2124 35015KT=