## GENERAL INFORMATION

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| Identification number: | 2006133 |
| Classification: | Serious incident |
| Date, time[1] of occurrence: | 14 November 2006, 09.03 hrs |
| Location of occurrence: | Rotterdam TMA |

**Aircraft 1**

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| Aircraft registration: | N666MX |
| Aircraft model: | Cessna 560 XL Citation |
| Aircraft type: | Business Jet |
| Type of flight: | Charter flight |
| Phase of operation: | Departure |
| Damage to aircraft: | None |
| Crew members: | 2 |
| Passengers: | 2 |
| Injuries: | None |

**Aircraft 2**

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|---|---|
| Aircraft registration: | PH-XRV |
| Aircraft model: | Boeing 737-700 |
| Aircraft type: | Passenger aircraft |
| Type of flight: | Scheduled passenger flight |
| Phase of operation: | Descent |
| Damage to aircraft: | None |
| Crew members: | 2 |
| Passengers: | 43 |
| Injuries: | None |

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|---|---|
| Other damage | None |
| Light conditions: | Daylight |

## SUMMARY

A Cessna Citation departing from Rotterdam Airport (EHRD) and an approaching Boeing 737 had a traffic conflict due to the misconception of ATC that the Cessna Citation followed a different standard instrument departure procedure than it had actually been cleared for.

This investigation is based on interviews, information received from Air Traffic Control the Netherlands (LVNL) and the flight safety departments of the airlines involved.

[1] All times in this report are local times unless otherwise specified.

## FACTUAL INFORMATION

N666MX, a Cessna 560 XL Citation, executed a charter flight from Rotterdam Airport to Cannes Mandelieu (LFMD). The aircraft was cleared by the tower controller for a "Woody1B" departure after take-off from runway 24. When N666MX was handed over to Rotterdam Approach, the approach controller assumed that the aircraft was cleared for a "Refso1B" departure and would fly in westerly direction. Approach instructed N666MX to climb to FL50 to pass overhead the inbound PH-XRV.

PH-XRV, a Boeing 737-700, came from a westerly direction. It was instructed to descend to FL45 and to fly to beacon RTM. When the aircraft was handed over to Approach, it was cleared to descend further to 3000 feet for a radar vectors approach to runway 24 of EHRD. Because N666MX turned left to follow the "Woody 1B" departure and PH-XRV levelled off at about 5100 feet instead of 3000 feet, the separation between both aircraft diminished. Although several clues were available, the approach controller did not notice the impending traffic conflict.

When N666MX turned to the left to follow the "Woody1B" departure, the airplane would cross the intended flight path of PH-XRV. Both aircraft received a TCAS[2] resolution advisory (TCAS RA); PH-XRV was instructed to climb and N666MX was instructed to descend by TCAS. Almost at the same time the conflict was noticed by the approach controller who instructed N666MX to turn right to heading 330.

As a result of all instructions, (TCAS RA and the instructions of the approach controller) the conflict was solved and both aircraft continued the flight without problems. The closest distance between both aircraft was 0.4 nm horizontally and 900 feet vertically. The crew of both aircraft had visual contact with the other aircraft during the conflict.

## INVESTIGATION AND ANALYSIS

*Air traffic control (ATC)*

Air traffic control in Rotterdam airspace is divided in Tower and Approach. Tower is responsible for air traffic control in the Rotterdam control zone (CTR) up to 3000 feet and is located at Rotterdam Airport. Approach is responsible for air traffic control in the Rotterdam Terminal Control Area (TMA) up to 5500 feet and has been located in the common IFR[3] room in the LVNL building at Schiphol-Oost since 2002. Before 2002 Approach was situated at Rotterdam Airport. Due to management decisions Approach was moved to Schiphol. This resulted in one air traffic controller from Rotterdam Airport by return travelling to Schiphol to perform his air traffic control duties for the Rotterdam TMA. This was the case on working days between 07.00 and 23.00 hrs. The approach position at Rotterdam Airport was used when no ATC approach services were provided from Schiphol.

Interviews revealed that a part of controllers from Rotterdam Airport were of the opinion that this relocation was a rather unfortunate choice. Several reasons were mentioned: some did not feel comfortable between the controllers of Schiphol. Furthermore at Schiphol the design of the radar monitors differed from the design of the monitors at Rotterdam Airport. Air traffic control at Rotterdam Airport used full colour monitors with self designed lay out and history dots, which indicate the track flown by aircraft. Air traffic control at Schiphol used standard, round, monochrome monitors without history dots. Furthermore at Rotterdam Airport all information of flights was noted on paper "strips" which are used by

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[2] TCAS: Traffic Alert and Collision Avoidance System is an aircraft collision avoidance system designed to reduce the danger of mid air collisions between aircraft.

[3] IFR: instrument flight rules.


*Illustration 1: standard instrument departures of EHRD*

the controllers; at Schiphol all flight information was electronically presented on the monitor, the Electronic Data Display (EDD). Finally the assistant controller, present at Schiphol, was not sitting next to the controller but 30 metres away and this assistant was not entirely familiar with the Rotterdam airspace.

When the Approach controller from Rotterdam Airport at Schiphol had his morning break between 09.00 and 10.00 hrs, his duties were temporarily handed over to a controller at Rotterdam Airport. Preceding the handing over, both controllers got in touch with each other by intercom communication.

Although the perception of discomfort was not felt by all controllers, it came up that the execution of approach control duties in the common IFR room at Schiphol Oost was felt suboptimal by a number of controllers from Rotterdam Airport.

The reasons and consequences of the relocation of Approach from Rotterdam Airport to Schiphol Oost were not deeper investigated.

*The controller*

According to the controller he went to bed around 23.00 hrs the day before, but he did not sleep well. It did not bother him much because he was used to sleep five or six hours. Due to his travelling time, he woke up in the morning around 04.30 hrs and arrived at Schiphol around 06.15 hrs. The controller's duty started at 07.00 hrs. He stated he felt well and did not feel tired.

During his duty he handled air traffic in the Rotterdam TMA which was handed over from Rotterdam Tower. Most of the outbound traffic was cleared for a "Refso" departure. After prior notice from Rotterdam Tower by intercom, N666MX was handed over to Approach at 09.03 hrs. In his intercom contact the Tower controller mentioned the departure "Woody". Two minutes later, when N666MX called Approach, the crew mentioned also that they were flying a "Woody1B" departure. Both remarks were not noticed by the controller. The standard departure “Woody” was also shown on the label as well as on the Electronic Data Display on the monitor. These clues were not noticed by the controller. This may be influenced by the small letter type on the monitor that was preset during a test and was not reset by the controller to medium, as he was used to have. In spite of the available information the controller was of the opinion that N666MX would fly a "Refso1B" departure. He had no explanation why he did not become aware of the available clues.

Almost at the same time, the inbound PH-XRV was descending and flying a course of 085 degrees to Rotterdam Airport and its crew reported on the frequency of Rotterdam Approach. According to the mind set of the controller, both aircraft were on opposite courses. He instructed N666MX to climb to FL50 and instructed PH-XRV to descend to 3000 feet to create sufficient vertical separation.

About half a minute later, intercom communication was created between the approach controller at Schiphol and the approach controller at Rotterdam Airport for handing over the duty temporarily. In the beginning of the conversation the approach controller Rotterdam Airport drew the attention to the conflict to his colleague at Schiphol but this remark was ignored and the conversation continued with generalities for about a minute. The engagement between the two controllers was made that Approach at Schiphol would handle the N666MX and PH-XRV after which Approach at Rotterdam Airport would take over the duties.

After this conversation Approach instructed PH-XRV to fly heading 100 degrees and almost immediately thereafter he noticed that N666MX flew another track as expected. Seeing this he was surprised and waited one or two radar sweeps to watch the intentions of N666MX. When it turned out that N666MX turned to the south, he instructed the aircraft to turn right, heading 330 degrees to avoid a conflict with PH-XRV that flew almost at the same altitude. At the same moment both aircraft received a TCAS warning; PH-XRV was instructed to climb and N666MX was instructed to descend. Both aircraft immediately followed the TCAS instructions. After the conflict was cleared, both aircraft continued their original course; N666MX on a "Woody1B" departure and PH-XRV inbound EHRD. Approach control at Rotterdam Airport took over the duties of the Approach controller who was taken care of by his colleagues at Schiphol.

The controller missed four clues that N666MX was on a "Woody1B" departure; it was mentioned in the first intercom contact with Tower; the crew of N666MX mentioned the departure when they initially called Approach; it was presented on the Electronic Data Display and it was presented in the label on the monitor. Besides that, the destination of the flight, southern France, could have been an indication that the aircraft would follow a southerly departure instead of a westerly. Also the remark of the approach controller at Rotterdam Airport of the approaching conflict was not caught during the intercom conversation. The reason for all of this has not become clear, but fatigue could have been a possible factor. The controller stated that the night before he slept about five hours and did not have a good night. He also stated that he was used to have short nights. Although the controller stated he did not feel tired, in scientific reports it is concluded that in case of repeated sleep restriction of less than 7 hours per night *"significant daytime cognitive dysfunction accumulate (…)"* and "*(…) findings on the effects of sleep restriction on neurobehavioral and psychological functioning suggests that adequate sleep duration (7-8*

*hours per night) is vital".*[4] Further it is concluded that "*vehicle accidents occur during the mid-afternoon and early morning, corresponding closely to the natural low points of alertness"*[5] and that *"sleep experts say most adults need between 7 and 9 hours of sleep and one could not get used to less hours of sleep (…)".*[6]
In the literature review "Fatigue in Air Traffic Controllers"[7] these conclusions are confirmed.

It could not be determined with certainty that the approach controller was tired. On the basis of the mentioned reports and the fact that the controller slept about five hours, which he was used to, could lead to the assumption that the physical and mental condition of the controller was not optimal which was possibly a factor in the cause of the incident.

This investigation also revealed that some controllers from Rotterdam Airport did not feel comfortable during their duty in the common IFR room at Schiphol Oost. This was partly caused by the differences in the layout of the monitors, partly by the feeling of being less accepted. Although not all controllers from Rotterdam Airport had this feeling, it is possible that this feeling influenced the functioning of the approach controller.

*N666MX*
After takeoff N666MX followed the "Woody1B" departure as it was cleared for. At 3000 feet the crew contacted Approach with the words *"FYG391E …. 3000 on the Woody 1 bravo"*. N666MX was cleared to climb to 5000 feet. This attitude was reached around navigation point (RNAV) EH164 where the aircraft turned left to follow the "Woody1B" departure. When the crew was asked to confirm that they were flying heading 270 degrees by Approach, they simultaneously received the TCAS RA "descend" which was immediately followed up. N666MX stopped turning and at approximately 4500 feet the crew had visual contact with PH-XRV that was flying above N666MX.
The execution of the standard instrument departure was according to the clearance and had no influence on the development of the serious incident. The reaction on the TCAS RA by the crew prevented a possible mid air collision.

*PH-XRV*
PH-XRV was flying at FL210 when it was instructed to descend to 4500 feet after which the aircraft started the descent. When PH-XRV was handed over to Approach, the aircraft was instructed to continue the descend to 3000 ft. This instruction was acknowledged but not read back by the crew. According to radar data it appeared that PH-XRV did not follow this instruction but levelled off at FL51 and continued a level flight for about 30 seconds. Not following this instruction played a roll in this serious incident; the approach controller stated the he instructed PH-XRV to descend to 3000 ft to establish sufficient separation between both aircraft which had an opposite course. If PH-XRV had followed the instruction, sufficient vertical separation would have been established.

The reason for not following the instruction by the crew was not investigated. However, an explanation could be that the indicated airspeed (IAS) of PH-XRV was too high to enter Rotterdam TMA, which has an upper limit of 5500 ft. Flying in the Amsterdam Control Area (CTA, airspace classification A) the aircraft had an IAS of approximately 310 knots. Since Rotterdam TMA (airspace classification E) holds a speed restriction of 250 KIAS[8], the crew possibly continued the flight in the upper regions of the Rotterdam TMA

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4 Journal of clinical Sleep Medicine, Vol. 3, No.5, 2007.

5 SLEEP, Vol.30, No.10, 2007.

6 Flight Safety Australia, May-June 2005.

7 Transportation Development Centre, Transport Canada, July 2000.

8 KIAS: knots indicated airspeed.

to reduce speed. An investigation by LVNL revealed that this behaviour was not uncommon in this airline. Another explanation might be that the crew did not hear or understood the instruction to descend to 3000 ft, however in that case they should have levelled off at FL45, according to the first instruction.

The TCAS RA "Climb" was immediately followed by the crew. During the climb manoeuvre the crew saw N666MX flying underneath from left to right with an estimated vertical distance of 600 feet. After the message "clear of conflict" the aircraft resumed its descent and the crew informed ATC that they would descend again to 4500 ft. The crew's reaction on the TCAS RA prevented a possible mid air collision.

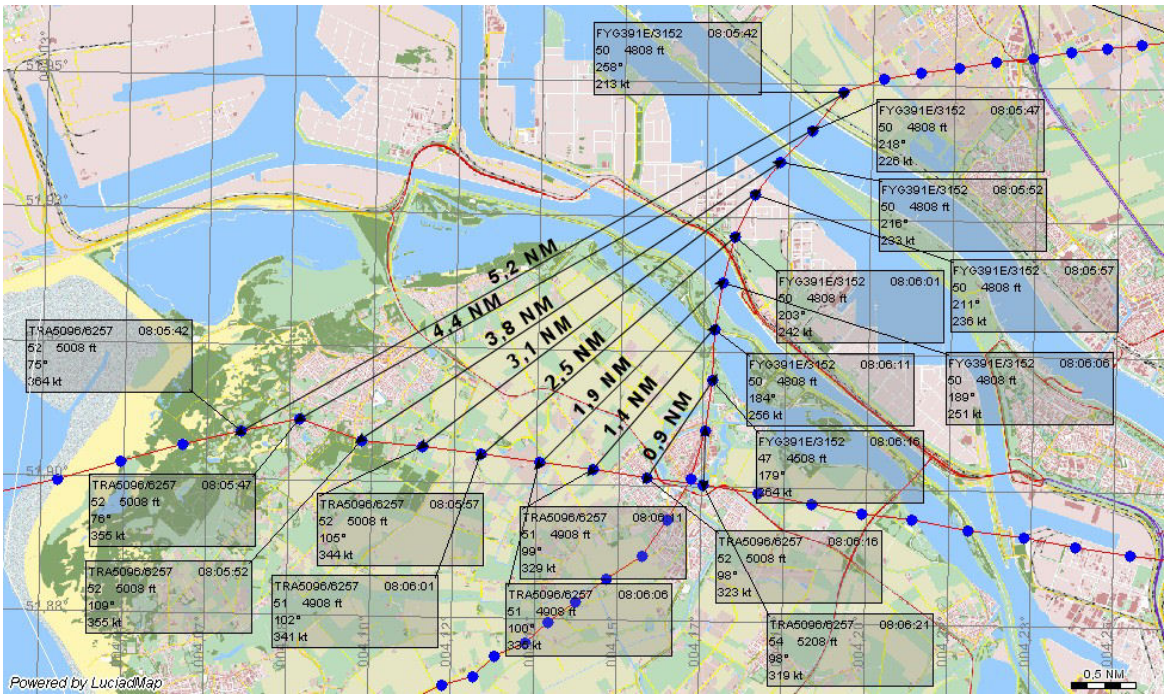


*Illustration 2: plot with the positions of both aircraft with the positions in-between (source LVNL)*

## CONCLUSION

The most probable cause of this serious incident was the misconception of approach control about the standard instrument departure flown by N666MX. A possible mid air collision was prevented by TCAS and the instructions of approach control.

Contributing factors in this occurrence are:

- The non optimal physical and mental condition of the controller possibly caused by fatigue.
- The suboptimal conditions for controllers from Rotterdam Airport to perform approach control duties in the common IFR room at Schiphol Oost.
- Not reacting of the ATC instruction to descend to 3000 feet by the crew of PH-XRV.

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