DUTCH
SAFETY BOARD

Immediate return after smoke in the cockpit

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The Hague, February 2014

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Dutch Safety Board

The aim in the Netherlands is to limit the risk of accidents and incidents as much as possible. If accidents or near accidents nevertheless occur, a thorough investigation into the causes, irrespective of who are to blame, may help to prevent similar problems from occurring in the future. It is important to ensure that the investigation is carried out independently from the parties involved. This is why the Dutch Safety Board itself selects the issues it wishes to investigate, mindful of citizens' position of independence with respect to authorities and businesses. In some cases the Dutch Safety Board is required by law to conduct an investigation.

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NB: This report is published in the Dutch and English languages. If there is a difference in interpretation between the Dutch and English versions, the Dutch text will prevail.

CONTENT

GENERAL INFORMATION

Identification number:	2012056
Classification:	Incident
Date, time[1] of occurrence:	8 June 2012, 14.04 hours
Location of occurrence:	Rotterdam The Hague Airport (EHRD)
Aircraft registration:	PH-JNE
Aircraft model:	Cessna 525A Citation CJ2
Type of aircraft:	Twin engine Business Jet
Type of flight:	Positioning flight
Phase of operation:	Take off
Damage to aircraft:	None
Cockpit crew:	Two
Number of passengers:	One
Injuries:	None
Other damage:	None
Lighting conditions:	Daylight

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

SUMMARY

Shortly after take-off from Rotterdam The Hague Airport (EHRD) runway 24 the crew noticed smoke in the cockpit and initiated an immediate return to EHRD. Four minutes later the aircraft landed after flying a right hand circuit. Fire services inspected the aircraft but did not find any evidence of fire.

The flight

The crew of the Cessna 525A Citation performed a positioning flight from Rotterdam The Hague Airport (EHRD) to Amsterdam Airport Schiphol (EHAM). Two days earlier the aircraft underwent scheduled maintenance at EHRD.

The aircraft took off from runway 24. The captain, age 31, was Pilot Flying (PF)[2] and the first officer, age 41, was Pilot Monitoring (PM).[3] During the take-off run at a speed of approximately 80 knots, the crew noticed an unusual smell which they mentioned to each other. They did not consider a rejected take-off and continued the flight. Shortly after take-off smoke became visible in the cockpit. The smoke was of a light type that can also be described as 'haze'. The crew performed the memory items, donned their oxygen masks and switched their microphones to the 'OXY-MASK' position.

The crew immediately notified air traffic control (ATC) about the smoke problems and the PM requested permission to fly two right turns in order to return to EHRD, and communicated this to the PF. The crew received a landing clearance from ATC. The crew did not declare an emergency. ATC handled the incident as an emergency situation and placed fire services on standby, next to the parking area.

Crew communication during the remainder of the flight was seriously impeded due to background noise induced by the oxygen masks. The crew used hand signals in order to communicate with each other. After the flight crew reduced the aircraft's thrust for approach, the smoke seemed to disappear. However, the flight crew decided to continue their immediate return to EHRD.

After an uneventful landing on runway 24 the flight crew followed the 'Follow Me' vehicle to parking position B2. The aircraft was parked near a Boeing 737 passenger aircraft. The crew shut down the engines and vacated the aircraft. The fire services inspected the aircraft, but did not find any evidence of fire.

Crew's experience

	Time with company	Total Hours	Hours on type	Hours in lastast three months
Captain (age 31)	Less than one year with the company	1473	1275	65
First officer (age 41)	5 years with the company	2200	810	74

2 Pilot Flying: the flight crew member controlling the aircraft's movements
3 Pilot Monitoring: the flight crew member performing radio communication and flight monitoring

Maintenance

Two days before the occurrence, scheduled maintenance was performed at EHRD. Part of the maintenance was the desalinization and washing of the compressors of both engines.

Investigation
After the flight, the aircraft's flight crew was interviewed for investigation. As the PH-JNE was not equipped with a cockpit voice recorder and flight data recorder, the findings that are concluded from these interviews were the primary source for the sequence of events.

Technical investigation
After the flight the aircraft's bleed air and air conditioning systems were checked. No evidence of fire was found, but the inspection of the airco and bleed pipes showed an overwhelming presence of white soap residue. It was concluded that this residue caused the unusual smell and the haze in the cockpit.

Compressor washing procedure
According to the aircraft's Maintenance Manual, all air systems shall be physically disconnected from the engine, when the compressor is washed. After the compressor is washed all air systems have to be reconnected to the engine. Thereafter the engines have to be run at idle for five minutes to ensure excess cleaning fluid and water is evaporated or blown from the engine and to check that there are no bleed air leaks.

According to the procedure, the bleed air selector must remain in the '*off/closed*' position during the five minutes the engines are running at idle. This is important to prevent residues from entering or contaminating the air system.

The subsequent investigation by the involved maintenance organization showed that the compressor wash was not performed according to the power plant cleaning procedures. It was found that shortly after the engine was started for the ground run on June 6th, the bleed air selector was selected to the 'LH' or 'Both' position. It is likely that water and/or cleaning fluid entered the bleed air system through the RH- and/or LH bleed air source after the engines were running, as part of the washing procedure.

According to the report of the maintenance organisation, the bleed air temperatures are moderate during idle. It is believed that this is the reason the smell and smoke were not noticed during the ground run after the compressor wash. During take-off the bleed air temperature rose significantly and the cleaning fluid evaporated and produced the observed smell and smoke.

Operational investigation
At the moment the odour appeared during the take-off run the crew members notified each other about their observations and decided to continue the take-off. In general it can be said that only an odour of an unknown origin is no reason to reject a take-off. When smoke became visible just after take-off the flight crew decided to perform an immediate return. Which, in this case, was the most practical and understandable thing to do.

The crew performed the correct procedures for cockpit smoke scenarios, but did not switch off their hot microphones.[4] The result of this was that the communication between the cockpit crew as well as the communication with ATC, were masked by the loud breathing sounds caused by the masks. This hampered the crew coordination. The captain was the PF and he mainly concentrated on handling the aircraft. Faced with the communication problem and the task to return as soon as possible, the PM took the initiative in the decision making process. The report as drawn up by the involved airline indicated, the fact that the captain's experience, age and time served with the company was lower than that of the PM, a natural reverse of command may have emerged or may have contributed to the way the crew handled the problem. The captain stated however, that he followed these initiatives as he agreed with them.

It is unclear why the flight crew did not declare an emergency by transmitting a distress call (e.g. 'Pan-Pan' or 'Mayday'). In situations where smoke and/or a burning smell is present in the cockpit, an emergency should be declared in order to accommodate the aircraft's landing as quickly and efficient as possible.

Despite the fact that the flight crew did not declare an emergency, based on the communication difficulties, ATC services handled the incident as an emergency by alerting the fire services. At the moment the aircraft landed it was still unclear what the cause of the problem was. Instead of terminating the flight on the runway after landing, the crew followed the airport authorities vehicle to the ramp, where the aircraft was inspected by the fire brigade. The runway offers a safer area for handling fire emergencies, without obstacles or risk to other parties.

This incident revealed that the crew did not receive sufficient training (actual and simulator training) in the use of oxygen masks and the resulting (possible) difficulties in communication. The operator now uses the event in their CRM training.

4 Hot microphone: open microphone mainly used for the intercom function for communication between the cockpit crew members when using headsets and boom microphones.

CONCLUSIONS

Due to the selection of the bleed air during the ground run, cleaning solution entered the aircraft air system. During the take-off the high temperature in the aircraft air system caused the cleaning solution to evaporate, leaving a soap residue behind. This was observed and smelled by the flight crew.

When the odour appeared during the take-off roll the flight crew decided to continue the take-off. In general it can be said that only an odour of an unknown origin is no reason to reject a take-off. When smoke became visible during the initial climb, the crew correctly initiated the memory items and returned to EHRD immediately.

The flight crew did not declare an emergency. ATC decided to handle the situation as an emergency by placing fire services next to the designated parking area.

Parking the aircraft on the ramp after a smoke incident with unknown origin imposes a risk to third parties.

The crew's training for scenarios when and how the oxygen masks should be donned, was inadequate. This caused the communication during the flight to be seriously impeded.

Figure 1: The PH-JNE. (Source: JVL.Holland)

EPILOGE

In emergency situations, the use of the standard phraseology PAN (3x) or MAYDAY (3X) accommodates for better understanding the emergency by ATC and other traffic.

Stopping the aircraft on the runway immediately after an emergency landing due to smoke or fire, reduces risk to occupants and third parties.

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