Accident during training flight
New Piper PA-44-180, Kampen, 14 August 2002

The Hague, november 11, 2008

CONSIDERATION

ACCIDENT DURING A TRAINING FLIGHT – INTRODUCTION

This is the report of the Dutch Transport Safety Board regarding an accident on 14 August 2002 during a training flight with a twin-engine instruction aircraft of type Piper Seminole of the Martinair Aviation School. The three occupants lost their life in this accident. The aircraft was destroyed.

This is the second serious accident at a Dutch flying school with which the Board has been confronted in the past five years. The first accident concerned a collision on 8 June 2000 near Smilde between two aircraft of the KLM Flight Academy. In that accident, three of the six occupants lost their lives and two were seriously injured. A report on that accident was published by the Dutch Transport Safety Board in June 2003.

DEVIATION FROM PROCEDURES

The training flight from Groningen Airport Eelde to Lelystad Airport on 14 August 2002 was aimed, among other things, at practicing the real-life shut down and restarting of one of the two engines. This is one of the training requirements for professional pilots with a licence for twin-engine aircraft. Regulations state that the shutting down and restarting of one of the two engines should at least be practiced on a flight training device intended for flight and navigation procedure training[1]. At the Martinair Aviation School, the exercise of shutting down and restarting the engine is first practiced on a flight and navigation procedure training device. Subsequently, the actual real-life shutting down and restarting of one of the two engines is done in flight, under supervision of a flight instructor.

Shutting down an engine on training flights should be regarded as an exercise with an amount of risk. Of this exercise, one may expect that a preceding thorough risk inventory and evaluation of flight operations has taken place, leading to control over possible dangers. This is, in principle, adhered to by respecting the user limitations of the aircraft. To this end, aircraft will have been through a certification process before they can be operational. The flight manual states these user limitations for example speed, altitude, and configuration.

The minimum altitude advised by the manufacturer for real-life shutting down and restarting of the engine is 4,000 feet. The minimum altitude prescribed for this exercise by the Martinair Aviation School was 3,500 feet[2]. The training flight on 14 August 2002 however, was carried out at 2,000 feet.

In a safety oriented philosophy, the deviation by the Aviation School from the minimum altitude as advised by the manufacturer for this exercise is noteworthy. This is illustrated when, after the accident, the Aviation School does increase the minimum altitude for this exercise to 4,000 feet, the limit advised by the manufacturer, at which altitude there are no noteworthy operational limitations.

When, as during this flight, the altitude is even lower than the 3,500 feet prescribed by the Aviation School for this exercise, it becomes clear that the built-in margins for the control of risks have disappeared. From statements during the investigation it became clear that shutting down one of the engines during training flights, happened several times at less than the prescribed minimum altitude of 3,500 feet. In these instances, the exercise was obviously conducted with a safe outcome, as is usually the case. That, however, was not the case with this flight.

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1 There are different kinds of flight training devices. There are non-moving training devices, intended for, among other things, flight and navigation procedure training. Alternatively there are advanced flight training devices that also simulate the movements of the aircraft. These so-called flight simulators are generally very costly.

2 According to the Martinair Aviation School, this altitude was chosen because of the structure of the airspace above Lelystad and its direct surroundings, where an altitude restriction of 3,500 feet is in place due to the traffic approach area for Schiphol that lies above.

The investigation and reconstruction of the accident show that shortly after shutting down the left engine, the still functioning right engine also stopped, probably as a result of an unintentional, incorrect manoeuvre by the crew, most likely the closure of the right engine fuel valve. As a result, an emergency landing became inevitable. Because not enough attention was paid to the primary task of steering the aircraft, speed dropped below stalling speed. This led to a loss of control of the aircraft at an altitude at which recovery was no longer possible. Witnesses stated that the aircraft lost altitude, rotating around its vertical axis before hitting the water.

The investigation also showed that this was the instructor's eighteenth training flight on this aircraft. The exercise of shutting down an engine was practiced only on a few of the eighteen instruction flights, including this flight. Although the instructor complied with the legal requirements for experience on training flights for (light) twin-engine aircraft, the Board is of the opinion that 'new' instructors should get thorough initial training and annual recurrent training on the possible dangers of wrong manoeuvres by trainee-pilots during exercise flights.

THE RISKS OF FLYING ON ONE ENGINE IN TWIN-ENGINE AIRCRAFT

Investigations of past accidents, researched by the American National Transportation Safety Board (NTSB) with so-called 'light twin-engine aircraft' have shown that the percentage of fatal accidents involving engine malfunction are four times greater with 'light twins' than with single engine aircraft[3]. Approximately three-quarters of all fatal accidents following an engine malfunction on light twin-engine aircraft were caused by loss of control of the aircraft. Although the results of the NSTB's research are now 25 years old, these have not lost their relevance today. In the Netherlands, a KLM Cityhopper Saab 340 crashed in April 1994 and in September 1996, a Dakota DC-3 of the Dutch Dakota Association crashed. In both cases, loss of control occurred while flying on one engine.

The question arises whether the real-life shutting down and restarting of an engine in flight, in attempting to create a scenario as realistic as possible, outweighs the risks. Shutting down and restarting an engine are requirements in the training of professional pilots on multiple-engine aircraft. This exercise can be performed out on an approved flight training device. In (professional) flight training using light twin-engine aircraft, students generally have little flight experience. Inquiries at the three large approved aviation schools in the Netherlands, show that shutting down and restarting an engine on light twin-engine aircraft is only performed on approved flight training devices.

Taking into consideration the fact that there is no obligation for the real-life shut down of an engine in-flight for training purposes, and the risks attached if the choice is made to do so (regarding execution of the exercise and manoeuvres by trainee pilots), the Board is of the opinion that the real-life shut down of an engine in flight for training purposes should be avoided.

SAFETY CULTURE AND SAFETY MANAGEMENT SYSTEM

Investigation at the Martinair Aviation School shows that, on several occasions during training flights, the real-life shut down of one of the engines took place below the advised minimum altitude of 4,000 feet stated in the flight manual, as well as below the minimum altitude of 3,500 feet as prescribed by the Aviation School, without recognizing this as a safety risk.

Both staff at the Martinair Aviation School and students have stated that the instructor killed was known to be accurate and a follower of procedures. This claim does not to reconcile with the training flight in question, but can be explained when one accepts that it was not exceptional to perform the exercise of the real-life shutting down of an engine at altitudes that are too low.

The law states that for a training institute, a so-called Flying Training Organization, to qualify as such, a quality system must be in place. The requirements of this quality system however are insufficiently specific when it comes to safety. This made it possible that at the Martinair Aviation

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[3] Light Twin-Engine Aircraft Accidents Following Engine Failures, 1972-1976, Special Study, NTSB-AAS-79-2 d.d. 13 December 1979.

School, the minimum altitude for executing a training flight in which an engine is shut down, is not consistently mentioned in the Aviation School's documentation: The flight manual states 4,000 feet and the Aviation School states 3,500 feet.

That the requirements for the quality systems are not specific enough, is also shown by the following. The inconsistent mention of a minimum altitude above which this specific exercise must be executed, and the multiple deviations from the minimum altitude for this exercise, was not detected during audits and inspections. These shortcomings could not be detected in practice because Martinair's auditors and the inspectors from the aviation section of the Transport and Water Management Inspectorate, are not on board during these types of training flights due to the risks involved. The increased weight of having an extra person on board leads to a further decline in flight performance. Especially for this reason it would be expected that the requirements for, and the execution of, this type of exercise would warrant special attention during audits and inspections. Even more so because these types of quality control and supervision are meant to find such deviations from the norm and as such locate possible safety risks.

For the implementation of a safety management system, the Martinair Aviation School appointed a flight safety officer and implemented a reporting system for reporting dangerous situations. This regarded principally the (legally) required notification of serious incidents and accidents. It was not investigated whether this reporting system has led to (more) reporting of incidents by trainee pilots of deviation from the minimum altitude as prescribed by the Aviation School during the real-life shutting down of an engine on training flights. Following publication of the report by the Dutch Transport Safety Board on the KLM Flight Academy investigation, Martinair Aviation School implemented a system for anonymous reporting. Implementing a safety reporting system with possibilities for feedback, and encouraging instructors and trainees to report incidents without it influencing their assessment, were recommendations made in the report to the KLM Flight Academy.

The investigation of the accident at the Martinair Aviation School has shown that despite appointing a flight safety officer, and the reporting system that was in place at the time of the accident, the ascertained safety risk was not recognised by the management of the Aviation School. This leads the Board to conclude that management at the Martinair Aviation School has insufficient insight into the safety risks of the specific training situation regarding the real-life shutting down of an engine. Consequently, the shutting down of an engine at a lower than the prescribed minimum altitude, can not only be attributed to the actions of the instructor but also to the safety culture at the Aviation School where such deviant behaviour occurred more regularly and was permitted, because it apparently always went well in practice.

COMPARABLE INVESTIGATION RESULTS AND THE REACTION OF THE RESPONSIBLE STATE SECRETARY

The investigation by the Board into the collision near Smilde of two training aircraft of the KLM Flight Academy on 8 June 2000 shows that the KLM Flight Academy lacked a sufficient safety culture and adequate safety management system to be able to guarantee flight safety. It also showed that the Transport and Water Management Inspectorate, aviation sector, as supervisor, and KLM as owner had set insufficient requirements regarding safety, a safety management system and safety culture. In the report by the Dutch Transport Safety Board, published in June 2003 about the investigation, the Transport and Water Management Inspectorate was advised that in their role as supervisor they should set requirements regarding safety, a safety management system and safety culture.

The reaction on 23 August 2004 from the State Secretary for Transport, Public Works and Water Management to this advice was as follows:

"Current legislation demands a system for quality. Part of this is the safety management system and safety culture, although this is not explicitly described in the legislation. Within the International Civil Aviation Organisation (ICAO) however, we've been working since October 2002 on developing a quality system for training institutes. This concerns a standard, not a recommendation; all countries will have to adhere to this standard once it is implemented. The requirements it sets are broader than those in current European legislation. For example, the cultural aspects of a training institute will be considered. The draft is expected to be presented to the Air Navigation Committee next year. If they agree to the draft, and after the opportunity for

comments as provided by publishing a state letter, the proposed regulation will be finished at the end of 2005. Implementation is expected in 2006 (…)"

CONCLUSIONS AND RECOMMENDATIONS

From the accident on 14 August 2002 at the Martinair Aviation School and the accident at the KLM Flight Academy on 8 June 2000, and also from various other previous accidents in other transport sectors investigated by the Board, it has been shown that the quality systems used do not suffice and that the structure and design of a safety management system plays a crucial role in governing, guaranteeing and improving safety. The Board is of the opinion that expansion of the current quality system at aviation schools, to include a more all-encompassing safety management system, is necessary. Some of this is confirmed by the steps that have been taken in this field by the ICAO. Implementation of such a safety management system, supported by a positive safety culture has the potential for increasing the levels of flight safety, because safety shortcomings will be recognised and corrected at an earlier stage.

The State Secretary for Transport, Public Works and Water Management has stated that the regulation regarding a mandatory quality system for training institutes is being developed by the ICAO and that it will be further reaching than what is currently laid down in European legislation. A part of this is the safety management system and safety culture. However, the implementation of this quality system is not likely to happen until 2006. For this reason, the Board is of the opinion that, while awaiting the final regulation, the Transport and Water Management Inspectorate, aviation section, should start encouraging the Flying Training Organisations to expand their JAR-FCL quality system to include safety management in order to improve flight safety.

Because of the similarities between the investigation reports from the KLM Flight Academy and the accident at the Martinair Aviation School, the Board does not want their recommendations to be limited to only the aviation school in question, as was the case with the KLM investigation. Consequently, the Board has, following the international developments regarding the implementation of a mandatory quality system for training institutes, of which safety management and safety culture are a part, aimed their recommendations for Flying Training Organisations at a general audience. The Dutch Transport Safety Board has two recommendations directed at the Minister for Transport, Public Works and Water Management, and three recommendations for Flying Training Organisations that train professional pilots and use light twin-engine aircraft.

It is recommended that the Minister of Transport, Public Works and Water Management:

- Encourages Flying Training Organizations to expand their JAR-FCL quality systems to include safety management, in advance of the regulation by the International Civil Aviation Organisation (ICAO), in order to improve flight safety.

- Ensures extra attention is given, in audits and inspections, to flight operations that harbour additional risks, such as the training of emergency procedures where the in-flight execution cannot be actually checked by auditors and inspectors.

It is recommended that Flying Training Organisations, who train professional pilots using light twin-engine aircraft:

- Do not actually shut down an engine in flight for the purposes of training.

- Ensure 'new' instructors get thorough training and annual recurrent training on the possible dangers of wrong manoeuvres by trainee-pilots during exercise flights.

- Ensure extra attention is given during audits, to flight operations that harbour additional risks, such as the training of emergency procedures where the execution can not be actually checked by auditors.