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SAFETY INVESTIGATION REPORT

Accident to the TECNAM P2010 registered F-HFMO on Monday 31 May 2021 at Tours - Val de Loire

Time	Around 13:05[1]
Operator	Air Paris Academy Training (APA)
Type of flight	Instructor standardisation
Persons on board	Instructor pilot-in-command, pilot, passenger
Consequences and damage	Pilot injured, aeroplane substantially damaged
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	

Loss of control during an engine failure exercise at take-off, at low height, collision with runway, in instruction

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements and data from the on-board computer.
The three people on board were instructors. The instructor in the LH seat was carrying out a standardisation flight for two instructors, one sat in the RH seat and one sat in the rear. To facilitate understanding, the report will indicate "pilot-in-command" for the instructor sat in the LH seat and who had the controls at the time of the accident, "pilot" for the instructor sat in the RH seat, and "passenger" for the instructor sat in the rear.

At 13:06, the pilot-in-command took off from runway 02[2] of Tours - Val de Loire airport to demonstrate the carrying out of an engine failure exercise for two instructors following standardisation training in the ATO[3]. It was the fifth flight for these instructors in the scope of the standardisation programme.

During the take-off run, the acceleration was nominal. The rotation was carried out at a speed of 63 kt and the pilot-in-command then displayed the standard climb attitude.

When the aeroplane arrived at a height of 80 ft, still overhead the runway and at a speed of 67 kt, the pilot-in-command sharply lowered the power lever to simulate an engine failure and pushed

[1] Unless otherwise stated, all times given in this report are in UTC. Two hours should be added to obtain the legal time applicable in Metropolitan France on the day of the event.
[2] Paved runway measuring 2,404 m long and 45 m wide. The landing distance available on runway 22 is 2,404 m.
[3] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.

on the stick to hold speed. The pitch attitude decreased, the aeroplane quickly lost altitude and came into contact with the runway.

The LH strut, the LH main landing gear and the nose gear collapsed. The LH wing came into contact with the ground. The aeroplane slid along the runway, pivoted 90° to the RH Side and then came to a stop on the edge of the runway. The occupants evacuated the damaged aeroplane unaided.

Figure 1: photo of damaged aeroplane

2 ADDITIONAL INFORMATION

2.1 Meteorological information

The Tours - Val de Loire aerodrome METAR, valid at the time of the accident, indicated wind from 080° of 8 kt, varying between 030° and 120°, CAVOK and a temperature of 24°C.

At the time of the take-off, the controller had transmitted the wind information as being 080°, 8 kt.

2.2 Persons on board information and statements

2.2.1 Pilot-in-command, instructor, PF

Total experience	5,500 flight hours including approx. 4,000 flight hours on fighter planes in the Air Force (Mirage 2000, Mirage F1, Alpha Jet).
SEP experience	Around 550 flight hours and 60 simulator hours.
Experience on type	317 flight hours.
Licenses and ratings	CPL(A) obtained in 2012, valid IRSE and IRME.

The 61-year-old former military pilot was recruited by the ATO, APA[4] in 2019. He had carried out FI training at the end of 2018 and beginning of 2019 by following a “short” FI course. This adapted course took into consideration his experience as a military instructor.

He said he was surprised that he was programmed for the flight, the aim of which was to standardize procedures as part of the integration of two instructors into the company. He thought that he was not identified within the ATO for these flights, which were reserved for other approved persons. He contacted the ATO's training manager, who nevertheless maintained the schedule. As he felt able to teach the techniques requested, he did not question the training manager's decision. He also knew that the school was experiencing some difficulties in the post-COVID-19 context, and that it was not the right time to cause delays in instructor training.

The flight consisted of demonstrating various instruction exercises on a flight from Tours - Val de Loire to Blois - Le Breuil aerodrome, with a crew change at Blois, followed by other commented exercises on the return flight. He carried out a briefing with the instructors in training, which lasted around an hour, recalling the various procedures, although he had no recollection of the engine failure on take-off being mentioned. Nor could he remember whether safety heights were discussed before starting or stopping an exercise.

Once the weight and balance had been calculated, he had fuel removed to bring the aeroplane into the flight envelope. It was the pilot who started up the engine, taxied to the runway and lined up.

The pilot-in-command called out and took the controls to carry out the demonstration. He indicated to the controller his intention to perform an engine failure exercise on take-off and land immediately ahead of him, on the remaining runway. He was aware that landing on the runway was not a common practice. He had been taught to do this in the past, and had done it himself without any particular problems.

The aeroplane's acceleration, rotation and climb were nominal. He sharply reduced power at an unplanned height, based on intuition, which he estimated to be less than 100 ft. He perceived that the aeroplane substantially slowed down, quickly pushed on the stick to hold speed, but observed a high sink rate. He did not manage to flare the flight path of the aeroplane which violently collided with the runway.

He analysed that the exercise was started too low, not allowing the aeroplane, which had lost a lot of speed, to recover enough energy to land safely. He indicated that he was not aware of the minimum safety height imposed by the ATO Operations Manual (see paragraph 2.6.2).

2.2.2 Pilot, instructor

Total experience	1,002 flight hours including 332 hours as FI
Experience on type	4 flight hours
Licence and ratings	CPL / IR-SE

It was his fifth standardisation flight, and the second in the RH seat. His statement was consistent with the pilot-in-command’s regarding flight preparation and its performance.

[4] See paragraph 2.6.

The briefing complied with the practices he knew. He could not remember if the engine failure at take-off had been discussed.

He was surprised to hear that the exercise would consist of immediately landing on the runway. However, he indicated that he had already heard of this practice, but had not carried it out himself, and that he had no reason to question the competence of the pilot-in-command, in whom he had complete confidence. In addition, the flight was part of his standardisation program.

He stated that as soon as the power was reduced, he perceived the aircraft take a “sharp stall dive” and then, just before the flare, realised that the height available would not allow them to land safely.

2.2.3 Passenger

Total experience	1,430 flight hours including approximately 780 hours as FI.

He indicated that the flight was scheduled as part of the standardisation of his instructor function, that the before flight briefing was compliant, with a reminder of the exercises to be performed and the associated key points, and that all the items of a before flight briefing were covered. He had no recollection of the engine failure with a runway landing having been mentioned. He was on board because he was to have the controls on the return flight.

During the take-off, he was looking to the RH side, to better familiarise himself with the environment in which he would be flying.

As soon as the power was reduced, he noticed the strong deceleration at low height, and specified that “something wasn't right” in this phase of the flight. When he looked ahead, he saw the ground coming up and the aeroplane hit the ground.

2.3 Aircraft information

The aeroplane’s certification airspeeds with the flaps in the take-off position are:

- rotation speed: 58 kt;
- climb speed: 86 kt;
- glide speed, V_{glide}: 84 kt;
- stall speed (with 1,160 kg and a maximum roll of 15°): 52 kt.

According to the flight manual, the procedure in the event of an engine failure on take-off is as follows:

If engine fails immediately after becoming airborne:

- ***Abort on the runway if possible.***

In case low altitude precludes a runway stop and / or engine restart:

1. **establish a glide attitude (VGLIDE)**
   - ***Find a suitable place on the ground to land safely.***

CAUTION

The landing should be planned straight ahead with only small changes in directions not exceeding 45° to the left and 45° to the right.
Any turn would reduce the glide performance.

At the time of the accident, the weight estimate was 1,154 kg for a maximum take-off weight of 1,160 kg. The aircraft was within its weight and balance envelope.

2.4 Analysis of on-board computer data

The data of the G1000 computer was read out by the BEA (see Figure 2 below).

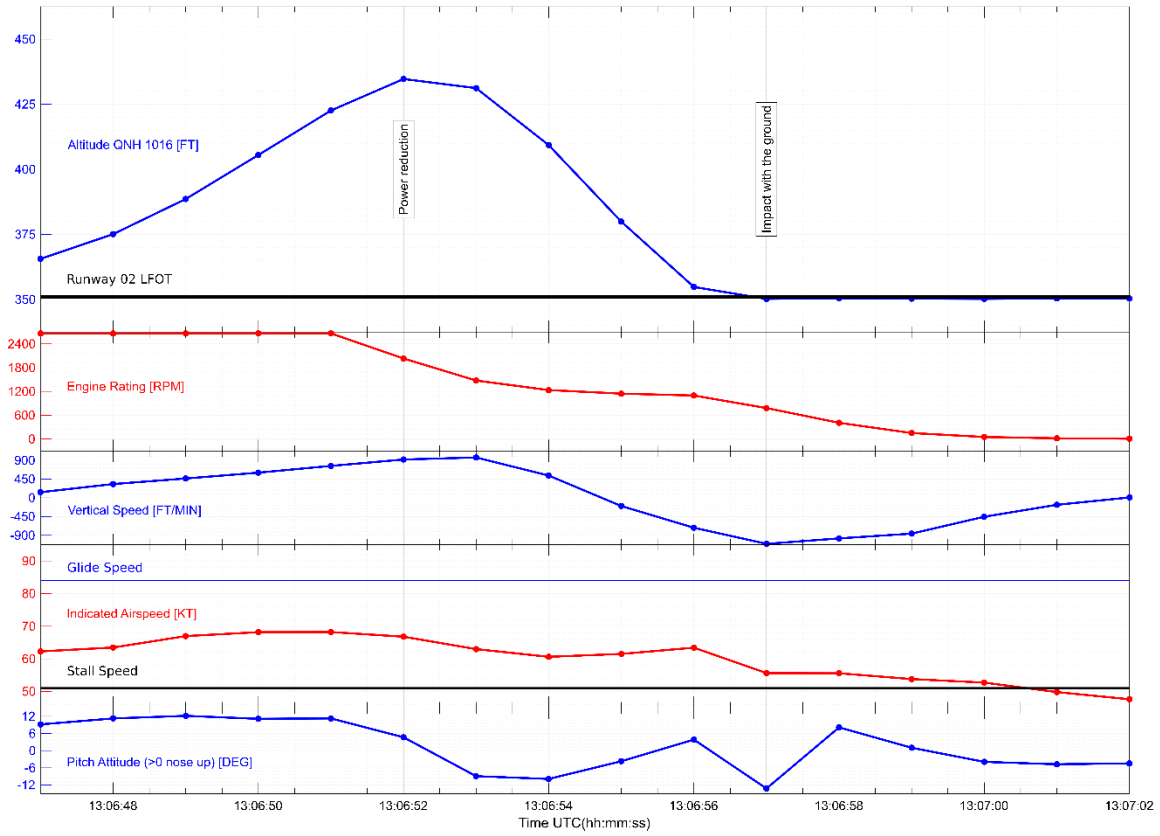

Figure 2: recorded parameters

The analysis of the data extracted from the G1000 found that:

- the engine power reduction, marking the start of the engine failure on take-off exercise, was carried out at a height of 80 ft and an indicated airspeed of 67 kt;
- the collision with the runway occurred between five and six seconds after the start of the exercise;
- between the reduction in power and the collision with the runway, the indicated airspeed decreased overall;
- the indicated airspeed remained above the stall speed in the take-off configuration (52 kt) and below the glide speed V_{glide} (84 kt) and climb speed (86 kt).

2.5 Good practices for engine failure at take-off exercise

2.5.1 ENAC guide for VFR training

The ENAC has published a guide[5] outlining best instruction practices for VFR training. The exercises in the "Failures during take-off" chapter are designed to ensure that trainees know how to adapt their piloting actions and implement procedures in the event of a failure occurring during the take-off phase.

Concerning an engine failure after take-off, the guide states that the pilot must adopt the pitch attitude for descent with engine idling. The flight path shall be modified to avoid large obstacles taking into account the permitted bank and remaining height. The guide then specifies that the flight manual "Failure after take-off" procedure must be complied with. The guide does not indicate a minimum height for starting this exercise.

2.5.2 FFA[6] SEP safety manual

The purpose of this manual is to provide the PPL(A) FE with the safety instructions which examiners shall comply with during all flights (FE training or test or verification exercises). It also provides the FI with the safety instructions to be complied with during student pilot flight training on single-pilot SEP class aircraft.

This manual does not replace the ATO's flight manual or operations manual. The provisions contained in the ATO or DTO operations manual, if different from the provisions contained in this SEP safety manual, will apply and this, in accordance with the operations manual. In all cases, the simulation of the failures must be adapted to the acquired experience of the FE/FI, the situation of the day and the crew.

In the scope of the engine failure in initial climb exercise, the manual indicates the following points:

- Objectives
  - Control of aeroplane and of flight path
  - […]
- Carrying out exercise
  - Reduce engine power without making rough inputs on the throttle lever

[5] Guide de l'instructeur VFR, ENAC, Edition 4 / Amd 0 / 2023-01.

[6] FFA training commission, 3re edition, October 2022.

- Safety instructions
  - Minimum height for the examiner or instructor to start reducing power: 500 ft agl
  - Normal stabilised climb speed on starting exercise
  - […]
  - Minimum height at the end of the exercise 200 ft agl
  - […]
- Risks linked to the exercise
  - […]
  - Rough input or incorrect control of attitude.

2.6 Operator information

2.6.1 General

Created in 2018, APA is an ATO specializing in aeroplane pilot training.

The ATO began the first ATPL ground courses in November 2018 and received the first aeroplanes in the summer of 2019. The first flights with students took place in September 2019. Flights were interrupted in March 2020 due to the COVID-19 pandemic and resumed in May 2020.

2.6.2 ATO's Operations Manual

According to the ATO's Operations Manual (OM), the role of the Chief Flight Instructor (CFI) was as follows:

- "*The CFI shall be responsible for the supervision of flight and flight simulation training instructors.*
- *The CFI shall be responsible for the standardization of all flight instruction and flight simulation instruction."*

With regard to the engine failure exercise, the OM specifies that:

- *"Engine Failure after Take-off is to be initiated only by an Instructor or Examiner. Aircraft are not to be placed in a position which contravenes the low flying rules. When required ATC should be notified in advance by the Instructor prior to executing the Engine Failure after Take-off and the climb away.*
- *Engine Failure after Take-off simulation EFATO may not be initiated until the aircraft is at least 300 ft AGL."*

On the subject of standardization, the OM specifies that:

- all instructors, before starting to deliver instruction on an APA course, must have completed the standardization program;
- the CFI will be responsible for conducting the standardization program and ensuring that the new instructor has acquired a sufficient level of knowledge and skills before starting to deliver instruction;
- a minimum of four days is normally devoted to the standardization of a flight instructor.

The OM lists the FIs able to take part in the standardization of new instructors. The pilot-in-command of the accident flight was not authorized to standardize new instructors.

The instructor standardization and training program is listed in the ATO documentation. The number of flights and associated exercises are described. The program includes an engine failure at take-off exercise.

2.6.3 External audit

In August 2021, around three months after the accident, the ATO had an external audit carried out. The audit identified, in particular in a "Training" paragraph, that the rapid growth of the ATO structure had had the following consequences:

- degraded standardisation of the instructors;
- deviation in the compliance with procedures;
- a high instructor turnover (resignations and recruitment).

The audit also noted in a paragraph "CRM/HF", that despite the acknowledged free speech within the ATO and the goodwill of its instructors:

- communication could be improved;
- instructors had a substantial ancillary workload;
- the roles of senior management were unclear;
- there was a feeling of financial pressure on operations.

These points raised by the audit are consistent with the statements gathered by the BEA during the investigation.

The audit also mentioned the lack of flight hours of certain instructors on the type of aircraft operated.

The audit indicated that these dysfunctions stemmed from a lack of standardisation meetings, poor in-house communication of procedures, the absence of training checks, no recurrent training of instructors and a shortage of staff.

2.6.4 Safety management in ATO

A feedback tool was implemented in the ATO in August 2019. The large number of events recorded and processed indicated that the system had been well assimilated and adopted by all those involved.

The first Safety Action Group (SAG) report dates back to January 2020. Since October 2020, a Flight Safety meeting has been held once a month, with a briefing and minutes distributed to all instructors and accessible on-line.

In addition, since the accident, FI meetings have been scheduled every 15 days. The topics covered included:

- changes to SOPs;
- changes to instruction programs;
- safety instructions on the use of an aircraft or the execution of an exercise.

2.7 Additional statements

2.7.1 Chief Flight Instructor (CFI)[7]

Total experience	3,300 flight hours including approximately 1,400 hours as FI.

[7] The duties of the CFI are set out in paragraph 2.1.2 of the report.

Employed by the ATO early on in its existence, he actively participated in the introduction of most of the standards and practices. He indicated that it had often seemed necessary to him, based on what he saw and even more so, in his role of CFI, to centre the ground and flight instruction work in a strict non-adaptable framework. He explained that certain instructors, former military pilots, were more accustomed to the operational conversion of pilots who already had a licence than to the training of ab initio pilots which he believed required different teaching methods with more rigour in the demonstrations.

He had participated in the choice of instructors authorised to teach certain aspects according to their skills and carried out some in flight and on ground proficiency checks[8] and training flights. He considered that the pilot-in-command at the time of the accident should not have been participating in the standardisation session because he believed that the pilot did not have enough experience on the aeroplane type.

Informed of the flight, he advised the training manager that he did not agree with the choice of instructor pilot-in-command for this standardisation session. He indicated that as he was then absent from the site, he had not been able to stop the session from being carried out. It seemed to him that his position as CFI was not recognised.

2.7.2 Deputy flight safety officer

Employed by the ATO when it was created, he was an instructor himself. He indicated that the interval between the ATO being created and the first familiarisation flights carried out by the instructors who had been recruited was short. While not carrying out flights in haste, they were nevertheless the priority. There was then a period without flights due to the COVID-19 pandemic which he used to draw up specific instructor standardisation documents. At the end of this period, flight activities had to resume. He indicated that it was possible that this disrupted period might have insidiously created a distance between the aircrew and their rigorous knowledge of the ATO's internal rules, such as the designation of flight crews or minimum heights for safe execution of exercises.

He indicated that he had heard the ATO pilots mention carrying out the engine failure exercise and landing on the runway.

He knew the experience and competence of the ATO instructors who, in most cases, had been military pilots and instructors.

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

The instructor pilot-in-command was scheduled by the training manager to carry out the fifth standardisation flight for two new instructors in the ATO. The instructor pilot-in-command was aware of a list of instructors authorised to carry out the standardisation. He was not on this list as the Chief Flight Instructor (CFI) considered that he did not have enough experience on the aeroplane type. Thinking that he was not authorised, the instructor pilot-in-command informed the

[8] The ATO told him who had to be checked, he had not checked the instructor of the accident flight.

training manager of this. The latter maintained the flight as scheduled despite the CFI not being in agreement.

The instructor pilot-in-command felt able to teach the techniques requested, and did not call into question the training manager's decision.

Before the flight, the instructor pilot-in-command carried out a briefing which covered a set of exercises and their training points. He probably did not cover the failure at take-off exercise and the key points for carrying it out.

Once the aeroplane was lined up on the runway, the instructor pilot-in-command called that he was taking the controls. He informed the two instructors on board and the air traffic controller that he intended to carry out an engine failure exercise and land immediately ahead on the remaining runway.

He simulated the failure at low height and low speed by sharply reducing power. He pushed on the stick to maintain a sufficient speed. Despite his input, the speed globally decreased. The aeroplane, operated at its maximum take-off weight, rapidly lost altitude and energy and collided with the ground during the attempted flare, around five seconds after power had been reduced.

Contributing factors

The following factors may have contributed to the engine failure at take-off exercise being carried out at an insufficient height and speed:

- the standardisation flight being carried out by a non-approved instructor according to the ATO's rules as his experience was considered insufficient on the aircraft type;
- overconfidence of the instructor pilot-in-command in his ability to safely carry out this standardisation flight programme;
- a lack of communication on the ATO's documentation in the process of being introduced;
- the setting up of the ATO's structure in a short time period and the ATO's intention to quickly standardise the new instructors.

Safety lessons

The purpose of the standardisation in an aeronautic structure is to share a common set of core practices between the members of this structure. In instruction, and in particular, in instructor standardisation, the instructor's exemplarity is all the more important in that his practices will model those of the future instructors which in turn, will model those of future pilots. An exercise shown in an unsafe manner in instruction contributes to the spread of dangerous practices.

This point was also illustrated by the BEA report into the accident to the APM 20 registered F-GRRH on 6 February 2022 on Eyguières aerodrome.