BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile
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SAFETY INVESTIGATION REPORT

Accident to the PIPER - PA46 - 500TP "MERIDIAN" registered N149C on 29 May 2023 at La Môle

Time	Around 10:30[1]
Operator	FLY INVEST INC TRUSTEE
Type of flight	Own-account transport, cross-country
Persons on board	Pilot and passenger
Consequences and damage	Aeroplane destroyed
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.	

Unusual acceleration performance during take-off run, take-off with insufficient speed, precautionary landing in a field

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements, radio-communication recordings and images recorded by the airport's security cameras.

The pilot was carrying out a flight under VFR[2] from La Môle airport (Var) bound for Limoges-Bellegarde airport (Haute-Vienne). At approximately 10:30, he lined up on runway 06 and started the take-off. During the take-off run, the pilot felt that the aeroplane was not accelerating normally. He continued the take-off run up to the displaced threshold of opposite runway 24, where the wheels left the ground. The aeroplane was unable to gain height and struck small trees approximately 190 m further on. The pilot decided to carry out a precautionary landing and land in a field located just after the small trees. On contact with the ground, the landing gears collapsed. The aeroplane slid for around 30 m. The right wing hit a small tree, then the aeroplane spun making a U-turn before coming to a stop approximately 20 m further on (see **Figure 1**).

The pilot set the fuel selector to the OFF position and cut off the electrical power supply. The two occupants evacuated the aeroplane pending the arrival of the emergency services.

[1] Except where otherwise indicated, the times in this report are in local time.
[2] The glossary of acronyms and abbreviations frequently used by the BEA can be found on its website.

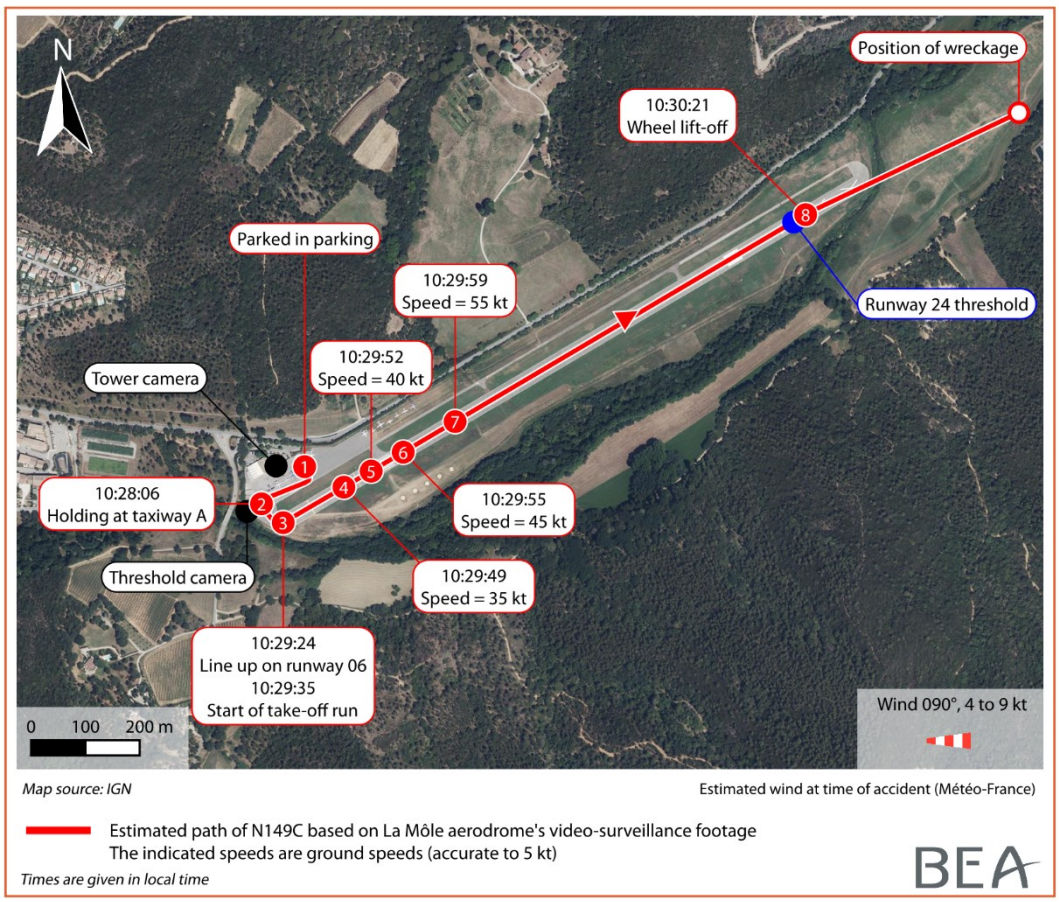


Figure 1: flight path of aeroplane

2 ADDITIONAL INFORMATION

2.1 Site and wreckage

The wreckage was lying on its belly bearing on its wings (see **Figure 2**), about 300 m east of the end of runway 06. The aeroplane had crossed an embankment, knocking down a fence, then it had damaged small trees located at the beginning of the field. The wreckage was oriented on a 180° heading, it was complete and grouped together. The flaps were retracted.

The observation of the main landing gear after the recovery of the aeroplane found no signs of overheating on the brake blocks or noticeable wear on the brake pads. The wheels rotated freely and there were no noticeable marks or damage to the tyres.

The wing tanks were full (530 l of fuel were drained off) and the fuel system was continuous from the tanks to the mechanical fuel pump.

There was no in-depth examination of the turboprop engine[3]. The exact position of the blades at the time of take-off (thrust/feather/reverse) could not be determined.

No anomaly was observed on the flight controls.

[3] Pratt & Withney CANADA PT6A-42A.

Figure 2: position of wreckage

Observations made in the cockpit found that the flap control was in the retracted position ("0"), the landing gear control was in the "extended" position, and the elevator trim control was close to the neutral position.

The throttle control was close to the maximum forward deflection (4/5 of travel), and the friction lever of the throttle control was set to the rear limit (minimum friction position) (see **Figure 3**).

Figure 3: position of controls after accident

2.2 Le Môle aerodrome information

Runway 06 slopes slightly downwards (gradient of 0.25 %) with a Take-Off Distance Available (TODA) of 1,131 m and an Acceleration/Stop Distance Available (ASDA) of 1,071 m. The VAC chart for the airport indicates that take-off must start at the yellow strip (see **Figure 4**). There were no use restrictions for runway 06 at the time of take-off.

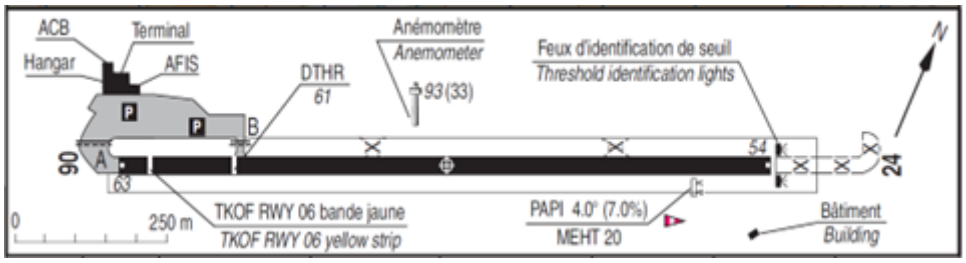


Figure 4: excerpt from VAC chart (source: AIS)

The airport is approved for restricted use[4]. To carry out a flight on certain types of aircraft (including the PA46), into or out of La Môle airport, pilots must keep their approval current, confirmed by an instructor approved by the French civil aviation safety directorate for the South-East region (DSAC SE). The pilot must be able to show one take-off and one landing as pilot-in-command on an aeroplane of the same class or type within the previous 24 months.

2.3 Pilot and passenger licences and ratings

2.3.1 Pilot

The 60-year-old pilot held a valid American Commercial Pilot Licence - Aeroplanes (CPL(A)) issued by the United States civil aviation authority (FAA) in 2016. In August 2014, he had received the required training in the United States to fly PA46s (pressurised, high-performance aeroplane)[5]. At the time of the accident, he had logged approximately 1,390 flight hours, almost 480 hours of which on type, and approximately 7 flight hours in the previous 3 months, including 1 hour on type. The pilot indicated that, as part of his previous 200 flight hours, he had logged 150 flight hours on twin-engine jets. He had logged 45 flight hours on twin-engine aeroplanes (all on the Cessna 525 CITATION) and 12 flight hours on single-engine aeroplanes, including approximately 8 hours on TB20s and 3 hours and 40 minutes on PA46s in the previous 12 months.

He obtained the approval to use La Môle airport in May 2013 on a Cessna 172. His last take-off from La Môle was on 27 February 2022. He indicated that he had taken off from La Môle 60 times, including 43 times with N149C.

2.3.2 Passenger

The 62- year-old passenger held a French Private Pilot Licence - Aeroplanes (PPL(A)) issued in 1997. He indicated that he had logged approximately 3,000 flight hours. He specified that he had no experience on PA46s and had no role in the conduct of the flight.

2.4 Operator information

The pilot indicated that he had bought the aeroplane in 2014. The aeroplane had been registered with the FAA since 2016 in the name of FLY INVEST INC. The pilot is the CEO of FLY INVEST. In addition to N149C, this company operates a helicopter and three aeroplanes: a Piaggio P180 Avanti (twin-turboprop), a Cessna CitationJet CJ3 and a Citation Mustang (twinjets). The pilot indicated that he used the CJ3 or the Mustang more often than the PA46 for his business trips.

[4] It can be used under the conditions set out in the Môle airport's approval order of 25 July 2019 (Version in force on the day of the accident).

[5] According to the aeroplane manufacturer, a type rating is not required to fly PA46s.

2.5 Aircraft information

2.5.1 Adjustment of throttle friction

The friction of the throttle lever can be adjusted using a separate lever. The latter can be moved forwards or backwards to increase or decrease the friction.

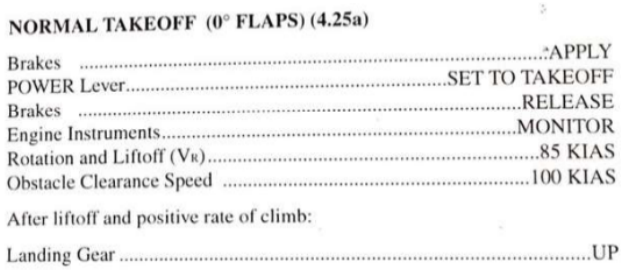
2.5.2 Procedures

In the manufacturer's Flight Manual, in the amplified section of the normal procedures for the engine tests, it is indicated to move the throttle lever forward to reach 1,900 rpm, and to move the friction lever forward to apply throttle friction so that the throttle will maintain a set position. The last step of the engine tests, after reducing power and checking the electrical power system, is to set the quadrant friction lock.

The reduced version of the normal procedures contained in the "check-list" section of the manufacturer's Flight Manual does not include moving the friction lever forward to apply throttle friction after the power has been set to 1,900 rpm, but does mention setting the quadrant friction lock at the end of the engine tests.

The check-list on board N149C was consistent with the reduced version of the manufacturer's Flight Manual.

The normal take-off procedure described in the Flight Manual does not mention adjusting the friction.



NORMAL TAKEOFF (0° FLAPS) (4.25a)

Brakes ..... *APPLY
POWER Lever ..... SET TO TAKEOFF
Brakes ..... RELEASE
Engine Instruments ..... MONITOR
Rotation and Liftoff (V_R) ..... 85 KIAS
Obstacle Clearance Speed ..... 100 KIAS

After liftoff and positive rate of climb:

Landing Gear ..... UP

Figure 5: normal take-off procedure (source: Flight Manual)

The manufacturer's Flight Manual also provides detailed information and explanations regarding the normal take-off procedure, specifying that the engine instruments should be monitored after runway line-up, power-up and brake release, to check that all indications are within the normal operating range.

2.5.3 Performance

The estimated take-off performance of the aeroplane in the conditions of the day and for La Môle airport (no wind, full throttle and flaps retracted), based on the data in the PA46 manufacturer's Flight Manual, was as follows:

- theoretical take-off run distance: approximately 650 m;
- theoretical distance to flight through 15 m: approximately 950 m.

According to the manufacturer (PIPER Aircraft), in the conditions of the day and in the aeroplane's configuration, the theoretical take-off run distance was 580 m, and the theoretical distance to flight through 15 m was approximately 885 m. Furthermore, the approximate time to reach the rotation speed (V_R) was theoretically about 26 s in the event of a standing start. The parameters expected during the take-off run, with the flaps retracted, were as follows:

- *Torque: 1,313 ft-lb*
- *RPM: 2,000*
- *V_R: 82 KIAS*
- *V_{LOF}[6]: 85 KIAS*

2.6 Analysis of images from airport security cameras

The images recorded by the airport's security cameras were retrieved. The analysis of the recordings showed that the pilot carried out the engine tests at holding point A (see **Figure 1**, point ❷). He then lined up on runway 06 and stopped at the threshold, before the yellow strip (point ❸). He next increased power with the brakes applied and 10 s later, started the take-off run. The ground speed after point ❸ could not be estimated.

Based on the manufacturer's information (see paragraph 2.5.3), the rotation speed V_R of 82 kt should have been reached after a distance of 580 m and a run of 26 s. In reality, the aeroplane only covered a distance of 350 m in 25 s, between points ❸ and ❼. It then covered a distance of 750 m in 22 s, between points ❼ and ❽. It took off 57 s after the start of the take-off run, level with the stripes of the opposite threshold (point ❽), after having covered a distance of 1100 m.

The analysis of the images recorded by the security cameras seemed to indicate that there was a slight headwind when the aeroplane went past the windsock.

2.7 Meteorological information

The analysis of the meteorological conditions did not bring to light any element that might have contributed to the accident.

The meteorological conditions estimated by Météo-France at the time of take-off were as follows: non-turbulent, easterly to northerly wind of 5 to 10 kt, CAVOK, temperature +24°C, no wind shear.

The AFIS officer informed the pilot of a wind from 090° of 4 to 9 kt at the start of the run. According to the pilot, during the take-off run, the windsock indicated a headwind of 5 to 10 kt, blowing from the right. According to the passenger, there was a headwind of 8 to 10 kt.

2.8 Statements

2.8.1 Pilot

The pilot stated that he had not found any anomalies during the pre-flight inspection, in particular when checking the deflection of the elevator. He did not carry out the bleeds, because the aeroplane had been moved before he arrived at the parking point with the passenger.

[6] The lift-off speed (VLOF) is the speed at which the aeroplane becomes airborne.

The pilot indicated that everything was nominal during the engine tests. After lining up on the runway and powering up the engine, he performed the following checks without calling them out: *"Power set/speed alive/no warning".* He explained that he then focused on the airspeed indicator to obtain the "V1 " speed. He indicated that during the take-off run, he held the bottom of the throttle lever with two fingers and that his hand was resting on the pedestal. He noticed on the airspeed indicator that the speed was increasing slowly and realised, after running for 200 m, that the aeroplane was not accelerating quickly enough. He indicated that no warning triggered. He considered rejecting the take-off twice, first at around 35-40 kt and then at around 55-60 kt (**Figure 1**). Nevertheless, having substantial recent experience on Cessna 525s, he thought that what he was feeling was normal and continued. He explained that the "V_1" speed was not reached. He focused on the airspeed indicator and did not remember having monitored the Torque (TQ). He had the feeling that the aeroplane was being slowed down and checked to confirm that his feet were actually on the floor. He initiated the rotation between 70 and 75 kt, at the end of the runway, then he removed his hand from the throttle lever to grab the control wheel with both hands, due to the presence of the embankment with small trees ahead of him. He pulled on the control wheel to clear the group of small trees and then the trees after the field, making sure that he did not cross onto the backside of the power curve. The stall warning sounded[7]. He let the wheel move forwards and maintained the aeroplane on the runway centreline. The wings caught on the small trees and he decided to bring the aeroplane back to the ground in the field.

He indicated that he did not extend the flaps so as to have a better rate of climb after the rotation.

He specified that he did not set the friction as this was not one of his habits, and that he did not know what the friction setting was at the time of take-off. He did not rule out the possibility that the throttle lever moved backwards after the brakes were released.

2.8.2 Passenger

He indicated that he did not notice any anomalies from start-up to take-off. He had the impression that the aeroplane accelerated normally. He realised after the take-off that something was wrong, when the stall warning sounded and the aeroplane did not climb and remained at a height of 3-4 m, with a speed that was too low.

2.8.3 AFIS officers

Three AFIS officers were present in the control tower when the aeroplane took off. They quickly saw that it was not accelerating and lost sight of it because of the trees hiding the last third of the runway from the control tower. As they did not see it take off, they thought it had performed an acceleration-stop manoeuvre, until they saw a huge cloud of dust rising at the end of the runway. The AFIS officer immediately activated the siren to alert the airport's rescue and fire-fighting service.

[7] According to the Flight Manual, the stall speed in a clean configuration at 5,092 lbs is 79 kt. With the landing gear extended and the flaps fully extended, it is 69 kt.

2.9 Similar occurrences

PIPER Aircraft indicated to the BEA that they had no knowledge of any in-service occurrences associated with a throttle control moving backwards as a result of the friction being incorrectly set, and that no publication on this topic had been issued. The manufacturer's Flight Test Department added that, with the throttle lever friction set to minimum, no cases of the throttle lever moving backwards had ever been observed in any flight phase.

A survey of PA46 MERIDIAN owners was conducted during the investigation. Several of these owners explained that they had experienced the throttle lever moving backwards after power-up, or after rotation. Some of the owners described having experienced this phenomenon on several occasions. One of them explained that he noticed the throttle lever move backwards in association with a reduction in torque to below 1,000 ft-lb.

An examiner-pilot on PA46s explained that he had himself checked whether N149C was subject to this phenomenon and specified that, on one occasion, he had observed a reduction in torque down to 700 ft-lb. He explained that he had also observed during flights with students, that the friction was removed almost every time the power was reduced. As the friction lever is located on top of the pedestal, very close to the throttle control and as some pilots hold the throttle control at its base, the palm of their hand may touch the friction lever and release friction when moving the throttle lever back to reduce power.

2.10 Take-off briefing

Research carried out by the BEA during its investigation on the subject of the take-off briefing in FAA publications seems to indicate that this is not a well-established principle outside the world of commercial aviation.

An article entitled "10 Tips for Safer Takeoffs and Landings" was posted on the FAA *FlySafe – General Aviation Safety Enhancement Topics* blog in July 2022[8]. For take-off, it states in particular, that the best way to prepare for emergency situations on take-off is to "*Vocalize your plan even if there's no one to hear it but you*". The article suggests the following:

- Note the runway you'll use and the aircraft take-off configuration;
- Describe your departure path and note what you'll do in case of a power loss before rotation;
- State your rotation, lift off, and climb speeds;
- State what you'll do if power is lost in the climb;
- State where you'll go if you have to carry out an off-airport landing.

The article recommends several Go/No-Go decision points. During the take-off, the pilot must check the instruments to confirm power and airspeed indications.

The *Guide de l'instructeur VFR* (VFR instructor's guide) published by the École Nationale de l'Aviation Civile (ENAC) indicates that the take-off briefing is a tool enabling pilots to introduce an action plan. It is based on the identification of potential threats and associated risks (Threat and

[8] The purpose of this blog is to promote aviation safety by discussing current technical, regulatory, and procedural aspects affecting the safe operation and maintenance of aircraft. Although based on current FAA policy and rule interpretations, all material is advisory or informational in nature and should not be construed to have regulatory effect.

Error Management, TEM), and the corresponding appropriate strategy, in particular in the event of an abnormal situation before rotation, or an engine failure after rotation.

2.11 Rejected take-off

The importance of planning and executing an acceleration-stop manoeuvre is discussed by the FAA in the document FAA-H-8083-3 Airplane Flying Handbook, Chapter 6 "Takeoffs and Departure Climbs".

This document specifies that, "*Emergency or abnormal situations can occur during a takeoff that require a pilot to reject the takeoff while still on the runway. Circumstances such as a malfunctioning powerplant, inadequate acceleration, runway incursion, or air traffic conflict may be reasons for a rejected takeoff. Prior to takeoff, the pilot should identify a point along the runway at which the airplane should be airborne. If that point is reached and the airplane is not airborne, immediate action should be taken to discontinue the takeoff.*"

The above-mentioned FAA publication (paragraph 2.10) also describes the "50/70 Rule". It states that, "*When planning takeoff from short unobstructed runways, establish a landmark at 50% of your calculated takeoff distance. When reaching that landmark, you should be at 70% of your rotation speed. If not, abort the takeoff.*"

In December 2022, the FFA Training Commission, in collaboration with the Prevention and Safety Commission published a practical guide on the same topic, entitled "Arrêter son décollage en sécurité" (How to stop your take off safely), which describes several factors that lead a pilot to make the decision to stop take off safely. This guide is also available on the Light aviation safety portal created by the DSAC, in the form of a poster entitled "Pilotes, optez pour le 50/50" (Pilots, opt for the 50/50 principle).

In March 2021, the BEA published a study on its website entitled "Reduction in engine power at take-off".

3 CONCLUSIONS

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

Scenario

On completion of the engine tests and before taking off, the pilot did not set the friction lock. He did not give an oral briefing before take-off, and probably did not have an action plan in the event of an abnormal situation occurring during take-off.

During the take-off run, the pilot focused on the speed and did not monitor the expected engine parameters, in particular the torque. It is probable that the position of his hand did not guarantee full control of the throttle control. Two hundred metres after releasing the brakes, the pilot questioned the acceleration of the aeroplane but thought it was a false impression. He then twice hesitated about rejecting the take-off, but continued with it.

Perceiving that he was approaching the end of the runway, he anticipated the rotation. The speed was not sufficient to allow the aeroplane to rise and clear the low obstacles located on the runway axis. Realising that he was unable to accelerate and climb, the pilot chose to reduce power and land in the field located beyond the end of the runway.

Contributing factors

The following factors may have contributed to the insufficient acceleration of the aeroplane during the take-off run and no decision being taken to reject the take-off:

- insufficient control and checking of the engine control parameters;
- no use of the friction lock to reduce the risk of the throttle control moving backwards at an untimely moment;
- the absence of a before take-off briefing.

The BEA decided not to carry out detailed examinations of the turboprop engine. Consequently, it is not possible to completely rule out an engine malfunction during take-off.

Safety lessons

Rejecting take-off in the event of an abnormal situation

During the take-off run, pilots may find themselves facing abnormal situations that are not always associated with the activation of a visual or aural warning. Pilots may then be unsure of the seriousness of the situation and delay the decision to reject the take-off. The criteria for rejecting the take-off must be clearly identified before starting the run and can be prioritised in the briefing.

Value of an oral briefing before take-of

When a problem occurs during the take-off, the pilot has no time to think and must act instinctively. Vocalizing the before take-off briefing is an essential anticipation process that mentally prepares the pilot for the possibility of rejecting the take-off in the event of an anomaly or incident, and the associated actions. This mental preparation is especially important when pilots are flying different types of aircraft with different characteristics and performance.