COMMAND OF AERONAUTICS

AERONAUTICAL ACCIDENT INVESTIGATION AND PREVENTION CENTER

FINAL REPORT
A - 042/CENIPA/2013

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-TPL**
MODEL:	**AT-502B**
DATE:	**01 March 2013**

NOTICE

According to the Law nº 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with item 3.1, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree nº 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of "non-self-incrimination" derived from the "right to remain silent" sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

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SYNOPSIS

This is the Final Report of the 01 March 2013 accident with the AT-502B aircraft, registration PT-TPL. The accident was classified as loss of control in flight.

During takeoff, after getting airborne, the aircraft collided with obstacles and then with the ground.

The pilot got out unhurt.

The aircraft sustained substantial damage.

An accredited representative of the National Transportation Safety Board of the USA, as well as an Advisor of the Air Tractor Inc., was designated for participation in the investigation.

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	(Brazil's) National Civil Aviation Agency
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CHT	Technical Qualification Certificate
CMA	Aeronautical Medical Certificate
HP	Horse Power
Lat	Latitude
Long	Longitude
MNTE	ASEL (Airplane Single Engine Land)
NTSB	National Transportation Safety Board
PAGR	Agricultural Pilot
PCM	Commercial Pilot License (Airplane category)
PMD	Maximum Takeoff Weight
PPR	Private Pilot License (Airplane category)
RBHA	Brazilian Aeronautical Homologation Regulation
SERIPA	Regional Aeronautical Accident Investigation and Prevention Service
SHP	Shaft Horse Power
SIPAER	Aeronautical Accident Investigation and Prevention System
SSDP	ICAO Location designator – ADRM of *Fazenda Fortaleza do Guaporé*, MT
UTC	Coordinated Universal Time

AIRCRAFT	**Model:** AT-502B **Registration:** PR-TPL **Manufacturer:** *Air Tractor Inc.*	**Operator:** Private
OCCURRENCE	**Date/time:** 01MAR2013 / 21:20 UTC **Location:** Fazenda Fortaleza do Guaporé **Lat.** 14°27'34" S – **Long.** 060°10'41" W **Municipality – State:** Vila Bela da Santíssima Trindade - Mato Grosso	**Type:** Loss of control in flight

1 FACTUAL INFORMATION

1.1 History of the occurrence

While departing from runway 34 of SSDP, the aircraft got airborne at approximately three meters from the departure end of the runway.

After rotating, the aircraft lost altitude and collided with two fences located in the overshoot area and then collided with the ground.

The aircraft came to a complete stop at 140m from the runway end. The pilot shut down the engine and abandoned the aircraft.

1.2 Injuries to persons

Injuries	Crew	Passengers	Third parties
Fatal	-	-	-
Serious	-	-	-
Minor	-	-	-
Uninjured	01	-	-

1.3 Damage to the aircraft

There was substantial damage to the leading edge of the left wing and to the empennage, as well as widespread damage to the remainder of the aircraft structure.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 Information on the crew

HOURS FLOWN	
	PILOT
Total	5,303:15
Total in the last 30 days	80:50
Total in the last 24 hours	04:30
In this type of aircraft	270:20
In this type in the last 30 days	80:50
In this type in the last 24 hours	04:30

Obs.: Information on Hours Flown provided by the pilot.

1.5.1.1 Professional formation

The pilot did his Private Pilot course at the Flying School of Francisco Beltrão, State of Rio Grande do Sul, in 1992. He graduated as an agricultural pilot from the Escola AeroAgrícola Santos Dumont Ltda. in Cachoeira do Sul, State of Rio Grande do Sul, in 2001.

1.5.1.2 Validity and category of licenses and certificates

The pilot had a Commercial Pilot license (Airplane category). His ASEL and agricultural pilot certificates were valid.

1.5.1.3 Qualification and flight experience

The pilot had qualification and enough experience for the type of flight.

1.5.1.4 Validity of the medical certificate

The pilot had a valid aeronautical medical certificate.

1.6 Aircraft information

The aircraft (serial number 502B-2850) was manufactured by the Air Tractor Inc. in 2012.

The airworthiness certificate was valid.

The airframe, engine and propeller logbooks had up-to-date records.

The last inspection of the aircraft ("50 hours" type) was made on 15 February 2013 by the Serra - *Serviço de Recuperação e Revisão de Aeronaves Ltda.* workshop in Tangará da Serra, State of Mato Grosso. It flew a total of 50 hours and 35 minutes after the inspection.

On the day of the accident had a total of 301 hours and 45 minutes relative to the airframe (since new), and had not reached the amount of hours necessary for the first overhaul.

1.7 Meteorological information

At 19:00 UTC, the aerodrome had moderate rain as a consequence of the presence of isolated CBs (cumulonimbus clouds).

At 21:20 UTC, the weather was VMC with temperature of 29ºC. It was not possible to determine the wind direction and strength.

1.8 Navigational aids

Nil.

1.9 Communications

Nil.

1.10 Aerodrome information

The aerodrome was private and had a single grass runway with thresholds 16 and 34, measuring 1200m x 20m, at an elevation of 738ft.

1.11 Flight recorders

Neither required nor installed.

1.12 Wreckage and impact information

The first impact of the aircraft resulted from the rear landing gear hitting a fence located in the direction of departure at a distance of 86 meters from the end of the runway.

The elevation of the runway at the final point of the runway was 230m (altitude). The fence was 1.2 meters tall, and had been built where the terrain was at an altitude of 227 meters.

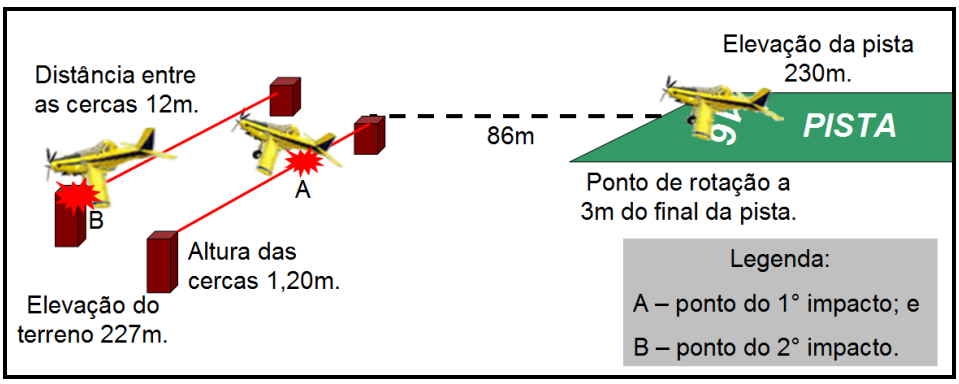

Figure 1 - Croquis showing the 1st and 2nd points of impact.

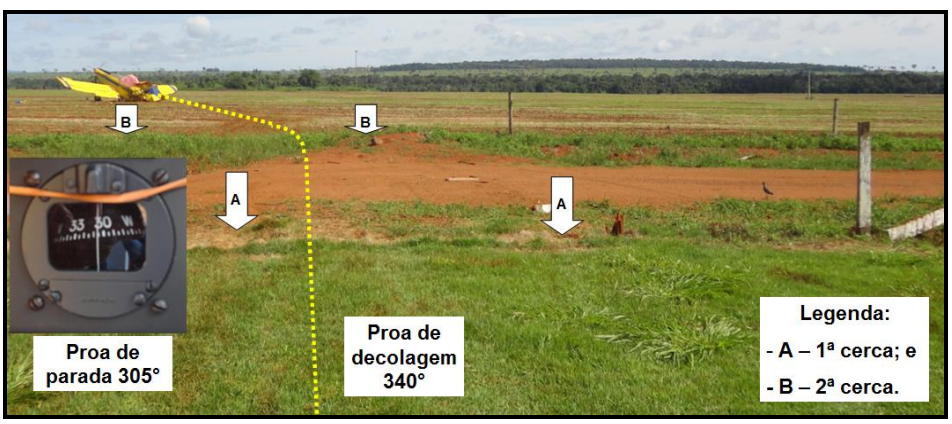

Figure 2 – View of the area of the 1st and 2nd impacts. The yellow line represents the projection on the ground of the trajectory of the aircraft, which went through the fences while still flying.

The second impact resulted from the collision between the left-wing leading edge with a post of the second fence located at a distance of 12 meters from the first fence (letter B in the picture).

Figure 3 – On the left, the fence post with a width of 9 cm. On the right, the mark left by the post on the left-wing leading edge (second impact).

In the wreckage, it was possible to notice that the flaps were fully lowered (26º).

There is not an indicator on the panel. The information is obtained by visually observing the wing. The detail shown in Figure 4 (augmented on the left) was obtained from the pilot's line of sight, indicating flaps completely extended.

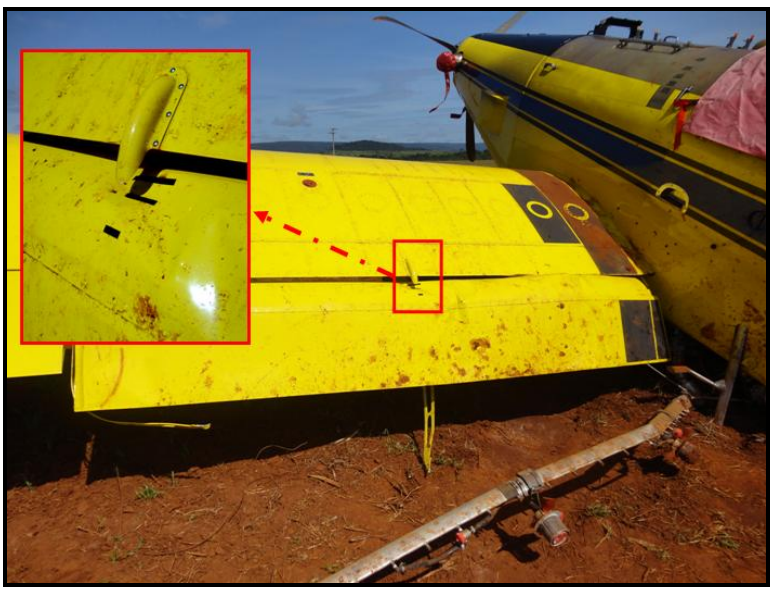

Figure 4 – Indicator of the left flap position.

The panel of the left-hand side flap sustained impacts in the direction of lowering, while the impacts on the right-hand side were in the direction of retracting.

Since the surface of the flaps could have been hit with consequences to the indication, measures were taken close to the wing root, where the surface was intact and the attachment had no plays.

Such measurement made it possible to compare the accident aircraft with an intact aircraft of the same model.

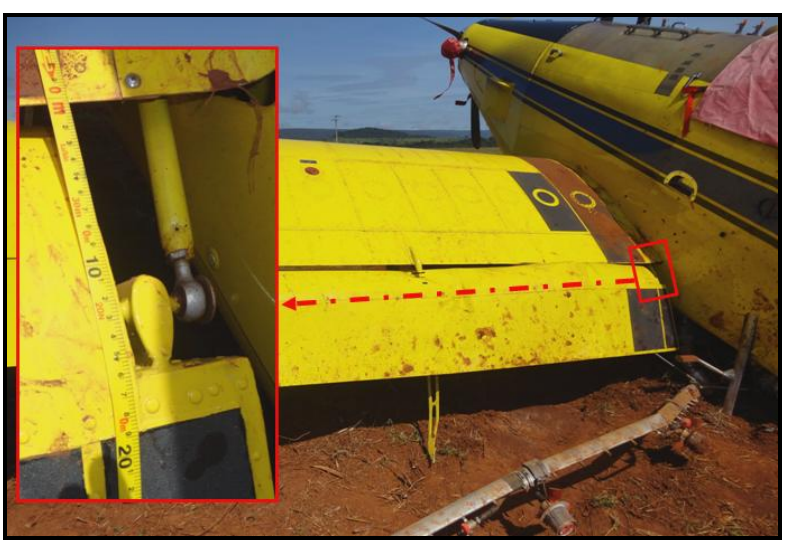

Figure 5 – Measurement made on the left-hand side flap panel, showing a distance of 17.7cm up to the rivets of the lower part.

Figure 6 - Measurement made on the right-hand side flap panel, showing a distance of 17.7cm up to the rivets of the lower part.

The elevator's and rudder's dampers were not in the neutral position, but their indications were considered not dependable on account of the impacts sustained.

Figure 7 – Position of the rudder and elevator trimmers.

Figure 8 – Damage to the left-wing leading edge.

Figure 9 – Damage to the rear section of the aircraft.

1.13 Medical and pathological information

1.13.1 Medical aspects

Not investigated.

1.13.2 Ergonomic information

A possibility is considered that the flaps may have been inadvertently moved on due to the fact that the switch is not approved for the aircraft design (see figures 12 and 13).

1.13.3 Psychological aspects

1.13.3.1 Individual information

The pilot had 21 years of experience in aviation, being an average of 11 years in commercial aviation and 10 years in agricultural aviation.

His longest experience was with Emb-202 (Ipanema) aircraft, with an average 4,000 flight hours.

He said he felt confident to perform any emergency procedure in the AT-502B aircraft.

On the occasions that, in other aircraft, he had to respond to emergencies such as engine failure and propeller breakage, he showed effective performance levels.

The pilot said that, on the day of the accident, he had worked in the morning period. The first sortie was around 07:30 local time, and he made 4 landings on a gravel runway, as well as 3 landings on a grass runway. He said that landings on gravel runways took place more frequently.

The pilot mentioned having been instructed by other operators not to make a takeoff with the Air Tractor in wet runway conditions, a fact that made him interrupt the operation at about 15:00 local time, when the rain started.

At approximately 17:20 local time, after the rain, although the grass runway was still a little wet, the pilot decided to make a takeoff with the purpose of emptying the aircraft hopper, which, according to him, had nearly 150 liters of chemical product.

The pilot declared that he did not take off from the runway threshold since the aircraft was “light” and he just wanted to empty the hopper. However, he affirmed that he would have taken off from the runway threshold if the hopper were full.

The pilot stated that, when his takeoffs did not begin from the runway threshold, he would always begin them at the same point. As a reference, he would make use a spot that was abeam a tree located at about 825 meters from the runway.

Such fact, according to him, was a habit, as he was accustomed to taking off from that point 4 to 5 times a day on average.

According to pilot's accounts, he knew that the operational performance of the Air Tractor was better than the Ipanema's.

He said that the fact the aircraft was "light", together with his awareness of both the runway conditions and the aircraft performance made him trust his own ability and the possibility of taking off without using the full length of the runway.

Despite the fact that the aircraft got airborne with only two to three meters left to the end of the runway, according to the pilot the aircraft lifted off normally.

The pilot explained that the takeoff run was longer than normal, as he noticed that it had become "heavier" in the last third of the runway. In spite of that, he did not consider the possibility of aborting takeoff.

1.13.3.2 Psychosocial information

When questioned on his attitude in relation to the flaps at the aircraft takeoff, the pilot said the he utilized them at 10º. Nevertheless, he said that there is a professional culture among some of the agricultural operators in Brazil establishing that a takeoff with full flaps is guarantee of a better aircraft performance.

1.13.3.3 Organizational information

The pilot involved in the occurrence had already worked for another company of the aircraft owner for a period of eight months in the years 2011 and 2012, flying a Beechcraft Super King Air 200 twin-engine airplane.

In 2012, the owner of the farm chose to purchase an agricultural aircraft, with the pilot providing advisement to determine that the Air Tractor AT-502B was the most adequate model. The aircraft was purchased new directly from the manufacturer.

The farm (*Fazenda Fortaleza do Guaporé)* had only one agricultural pilot, who started operation of the AT-502B on 27 November 2012.

Since there were neither initial nor continued training courses for this type of activity, the pilot gained experience with his daily flight routine, according to him.

Despite the shortage of training, the pilot was sent by the farm for a week-duration course in Florida-USA, specifically dedicated to the operation of the Air Tractor.

According to the pilot, the course dealt with emergency procedures, crop-dusting and simulator training. According to him, he acquired sufficient knowledge and graduated successfully.

The farm had two landing strips for operation; one with gravel and other with grass. The latter one required more attention, mainly if it was wet.

1.14 Fire

There was no fire.

1.15 Survival aspects

The pilot was wearing the flight helmet, preventing injuries to his head.

After a complete stop of the aircraft, the pilot shut down the engine and abandoned the aircraft through the normal exit, without recurring to any type of assistance.

1.16 Tests and research

"Flap Full" measures were taken from an undamaged AT-502B, in a way similar to what had already been done with the accident aircraft. The result obtained was 18cm between the flaps and the rivets of the lower part.

1.17 Organizational and management information

Nil.

1.18 Operational aspects

After more than ten years in the agricultural aviation, the pilot accumulated experience, flying aircraft such as the EMB-202 with power of 320HP and MTOW of 1,800Kg.

The pilot was doing the first crop with the AT-502B Air Tractor, which has 750SHP and MTOW of 3,629Kg.

On 1 March 2013, the pilot started his activities at about 07:00 local time. The first departure was at 07:30 and he flew 3 hours in the morning period.

In the afternoon, the first sortie was at 14:00 local time.

At 14:50, due to the proximity of cumulonimbus clouds and rain, the pilot discontinued the operation. The landing was made with the flaps at 26°, i.e., fully extended.

After landing, the aircraft received 850 liters of fuel.

Figure 10 shows the place of refueling and parking of the aircraft (indicated by the red circle around letter "A").

The administration office is indicated by letter "B".

At 17:20, after the rain stopped, the pilot decided to resume the operation, in order to dust the crop with the 150 liters of chemical product remaining in the hopper.

The capacity of the hopper is 1,893 liters.

There were no signs of pools of water on the runway, but it was still wet.

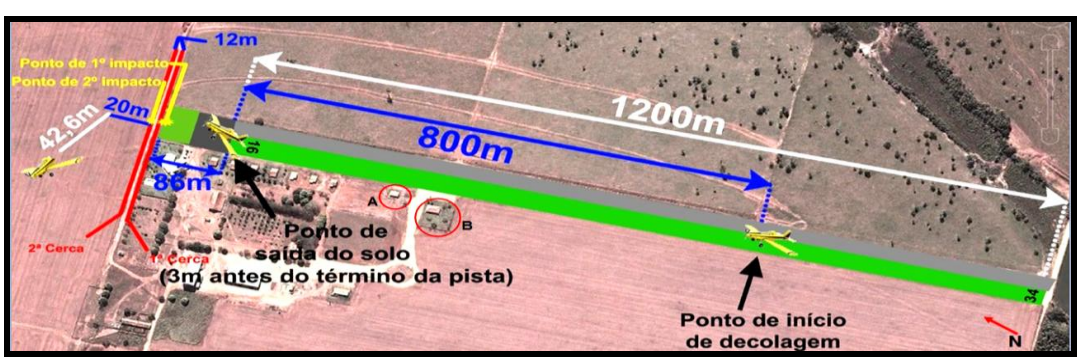

Figure 10 – The grass runway is represented in green. The fences are represented by the red lines (points of the first and second impacts).

The pilot taxied the aircraft from point “A” up to a runway intermediate position, whose location was known to the pilot with reference to a number of bigger trees on the right side of the runway.

During the investigation, it was determined that, from the point the takeoff run started, there were 825 meters (+/- 25m) of runway available.

The pilot informed that, for takeoff, he used the flaps at the 10° position and did not consult the takeoff graphs of the AT-502B Airplane Flight Manual Brazil.

The *AT-502B Airplane Flight Manual Brazil, in its pre-departure procedures, informs that the* “*flaps should be retracted for normal take-off*”.

The manual also says that for a “*full hopper and short field”* takeoff the flaps have to be in the 10° position.

According to the pilot, the aircraft got airborne at a distance of 3 meters from the departure end. Also according to him, the aircraft traveled a little more on the ground because the runway was heavy (the grass was wet due to rain).

He informed that all aircraft systems had a normal performance.

In the interviews of 6 March 2013, the pilot said that he did not remember the speed of the aircraft at the moment of rotation and lift-off.

The Section 4 (Performance) of the *AT-502B Airplane Flight Manual Brazil shows the graph for analysis of the takeoff run length necessary for the clearance of a 50ft obstacle.*

The parameters utilized take into account a dry paved runway, with the aircraft at its maximum takeoff weight (3,629Kg), using flaps at 0° and 10°.

There is no availability of graph for analysis of an unpaved runway.

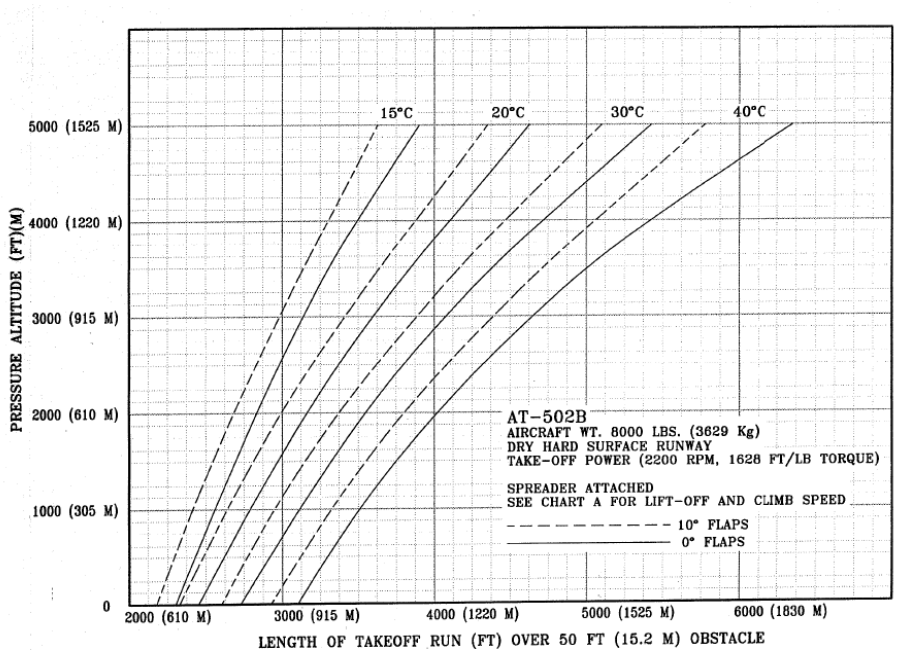

Figure 11 – Graph analysis of the takeoff run length needed for clearing an obstacle of 50ft.

The aircraft manufacturer informed not having official publications for the calculation of takeoff run length relative to aircraft weighing less than 3,629Kg.

Nonetheless, he said that the graph provides a conservative distance that can be used by lighter aircraft.

The data for analysis of the takeoff run were the following:

Weight of empty aircraft	2,147Kg
Weight of fuel – 850liters with density of 0.7914 at 29°C	673 Kg
Weight of chemical product in the *hopper, with density of* 1.0 at 29°C	150 Kg
Weight of crew	91 Kg
Weight total	3,061Kg

1.19 Additional information

The low-wing single-engine AT-502B Air Tractor, registered in the Private Air Service category, was utlized in the crop-dusting activity. It was equipped with a 750SHP Pratt&Whitney PT6A-34AG engine.

The manufacturer maintenance program ("AT-502B Inspection, page 1, of 7 November 2008) recommends that the time between inspections should not be greatly exceeded ("*A continuous inspection procedure is recommended, the time between inspections should not greatly exceed...")*

The aircraft was purchased directly from the manufacturer and went through a nationalization process in October 2012.

According to the operator, the aircraft was subjected to all the maintenance services at the Serra – Serviço de Recuperação e Revisão de Aeronaves Ltda.

According to a document issued by Serra Workshop on 1 October 2012 (List of Major Changes and Repairs Incorporated to the aircraft), the aircraft had not had major changes.

During the initial action performed by the go-team, it was verified that the aircraft had a switch that had been installed on the stick for retracting the flaps.

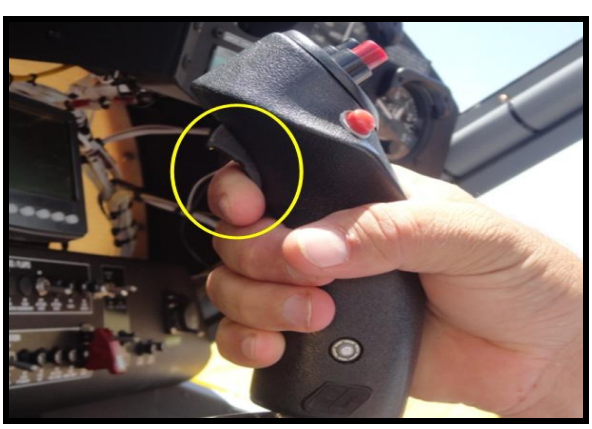

Figure 12 – Command for flaps extension.

Figure 13 – Command for retracting the flaps.

The aircraft flight manual does not make any reference to a flap control switch on the installed on the stick. Responding to a consultation by the investigator in charge, the Air Tractor manufacturer issued the following statement:

"Air Tractor does not install the flap switch on the stick. The only Air Tractor approved location for the flap switch is on the left-hand console below the engine controls."

According to the aircraft manufacturer's statement, the flap control switch installed on the stick is not approved in the AT-502B design.

The *switch* in the original design is located close to the levers' pedestal (figure 14).

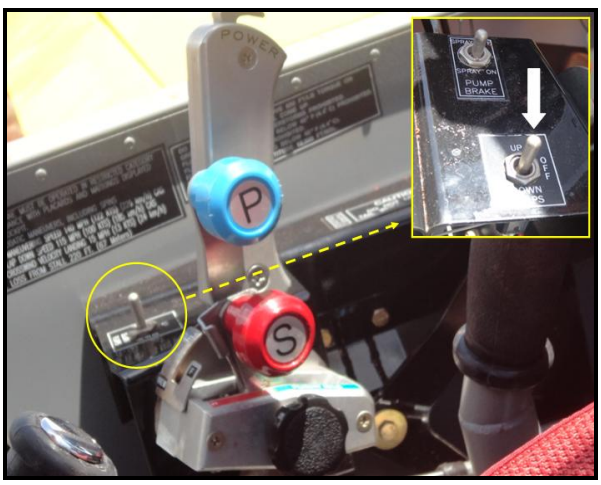

Figure 14 – Flap control s*witch* approved by the manufacturer, close to the levers' pedestal.

The SERIPA VI, by means of the Official Document n° 12/CH/680, of 30 April 2013, requested from the National Civil Aviation Agency a technical opinion relative to the installation of the flap-activation switch on the stick of the accident aircraft, since such device is not part of the AT-502B design.

By the time the investigation was finished, the ANAC had not made any comments on the issue.

The Brazilian Aeronautical Homologation Regulation (RBHA) 91 further establishes the following:

"91.103 – PREFLIGHT DUTIES

Before commencing a flight, the pilot in command shall familiarize himself with all the information available relative to the flight. Such information shall include:

***(b)** for any flight, length of runways and situation of the aerodromes to be used and the following information on landing and takeoff distances:*

***(1)** for a civil aircraft requiring an approved Flight Manual with takeoff and landing distance data, the takeoff and landing distance data therein contained".*

1.20 Utilization of other investigation techniques

Nil.

2 ANALYSIS

The pilot assisted the operator in the process of purchasing an aircraft. The aircraft model chosen was the one that best fitted the intended purpose of utilization.

The new AT-502B aircraft had been purchased directly from the Air Tractor Inc. and was the only one being used on the farm for crop-dusting.

Only the pilot would operate the aircraft. He did his agricultural pilot course at the *Escola AeroAgrícola Santos Dumont Ltda.,* in Cachoeira do Sul, State of Rio Grande do Sul, in 2001, and had already accumulated tem years of experience in the agricultural aviation.

After the aircraft was purchased, and before it was delivered, the pilot did an AT-502/402 training course in Florida, USA, and was granted a "*Pilot Proficiency Certificate AT-502/402 Initial Training*" in accordance with the standards of the *Central Florida Ag Aero.*

It is a known fact that, in order to obtain and establish a satisfactory level in the operation of an aircraft, a pilot needs to study and do practice training on a continuous basis considering the cognitive, physical, psychological, and technical efforts required by the aircraft, so as to guarantee the obtainment of the knowledge, skills, and attitudes necessary to operate it.

The replacement of an aircraft with other of a different model, with which one does not have experience, is an example of how the pilot needs to adapt to the new operational limits and requirements.

Such adaptation makes it possible for the pilot to reinforce and incorporate the various operating parameters of the new aircraft, allowing him not to mistake the new procedures with the operating standards of the former aircraft.

For a number of years, the pilot had flown Emb-202 aircraft (with a 320HP engine) in the crop-dusting activity. But now, for the first time, he was operating the AT-502B Air Tractor with an engine of 750SHP for spraying the crops.

The transition from the EMB-202 to the AT-502B Air Tractor may generate a false perception by the pilot that since he is now flying an aircraft with a lot more power (more than doubled), there is "surplus of power".

However, it must be considered that the EMB-202 has an engine of 320HP to push an aircraft of MTOW of 1,800Kg (a weight/power ratio equal to 5.62).

The AT-502B has 750SHP for a MTOW of 3,629Kg, that is, a ratio of 4.84.

The calculation above shows that 1HP of the EMB-202 pushes a weight of 5.62Kg, while 1SHP in the AT-502B pushes 4.84Kg. The difference is not, therefore relevant, considering that this latter has a heavier MTOW.

On the other hand, in some instances, the takeoff weight of the AT-502B will have values well above those of the EMB-202, requiring runway lengths longer than those used in the operation of the EMB-202 in its maximum takeoff weight.

In the case of the accident in question, there was a small amount of load in the hopper, that is, only 150 liters of chemical product in a compartment with capacity for 1,893 liters.

This generated a pilot's false perception that he had a "surplus of power" for the operation, favoring an overestimate of the aircraft potential.

In this context, the pilot was induced to not consult the performance graph and influenced to not utilize the entire runway length available.

The runway length was 1,200 meters, but the pilot chose to utilize just 825m (+/- 25m).

The investigation verified that the non-utilization of the full length of the runway for takeoff was a habit acquired by the pilot in view of the reduced load in the hopper.

The pilot had confidence in the safety of the operation, based both on his belief in his own technical ability and in the operational capability of the AT-502, which in his opinion was higher than that of the EMB-202.

Such attitude favored an inadequate judgment on the part of the pilot relative to the runway length and conditions necessary for a safe takeoff with the AT-502B Air Tractor.

However, despite the pilot's belief that the sighting of the approaching runway departure end did not influence his commands aimed at making the aircraft take off, he went against his own technical instruction of not taking off with the AT-502B from a wet runway, mainly from a grass one, which, according to him, would even require more caution.

For analyzing the takeoff performance, it is necessary to utilize the data shown above. The temperature was 29ºC, aerodrome altitude was 738ft, and takeoff weight was 3,061Kg.

With these data, it is possible to calculate the takeoff run distance necessary to clear a 50ft obstacle, by means of the graph in Figure 12.

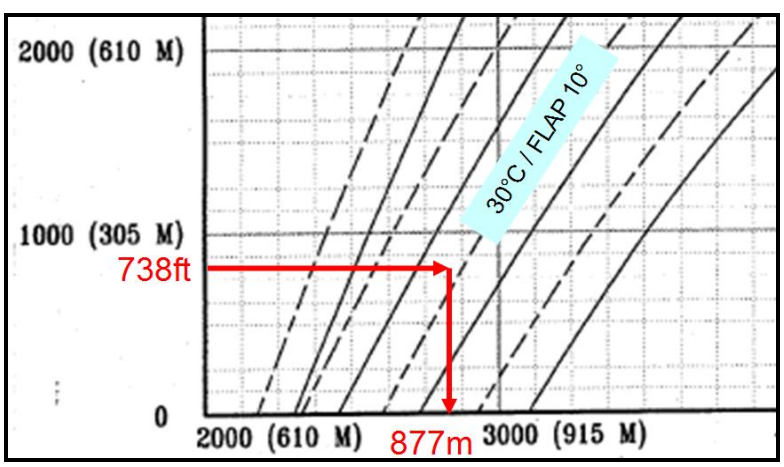

Figure 15 – Calculation of the takeoff run distance to clear a 50ft obstacle, based on the graph presented in Figure 17.

The graph available in the aircraft flight manual presents the takeoff performance for a dry paved runway only. There is no specific graph for either an unpaved or wet runway.

Thus, one has to consider that a grass runway will require a longer takeoff run when compared with a paved runway, on account of the higher friction coefficient of the surface, which will result in a more difficult acceleration.

Another aspect worth considering is the fact that the graph shows the calculation for an aircraft at its maximum takeoff weight only (3,629Kg).

The aircraft manufacturer informed that the graph provides a conservative distance which may be utilized for weights below the MTOW.

Based on the graph shown on page 12, the takeoff run distance to clear a 50ft obstacle on a dry paved runway is 877 meters.

If the calculation considered a wet grass runway, the result would be a distance of more than 877 meters.

Agricultural aircraft, in general, take off from and land on unpaved runways, resulting that the lack of graphs for this type of surface dos not favor an accurate calculation of the takeoff run distance.

Nevertheless, referring to the graph will always be necessary and will serve as a parameter for a safer operation. One must also take into consideration that, for an unpaved runway, the required distance for takeoff will be longer then the result presented by the aircraft flight manual.

The analysis of the aircraft wreckage showed that the flaps were at the 26° position, although the pilot informed that he had taken off with the flaps at the 10º position.

The left flap panel sustained impacts in the direction of lowering, whereas the right flap sustained impacts in the direction of retraction.

Since the actuators were found intact and without ‘play’, the information of flaps at 26° proved reliable, through comparison of the flap measures obtained from the accident aircraft and from another undamaged one.

These pieces of evidence led the investigation to consider a possible inadvertent lowering of the flaps during takeoff, or even at the beginning of the takeoff run with the flaps being moved to 26°.

Therefore, an ergonomic analysis of the switch installed on the stick became appropriate. According to the manufacturer, the switch in question is not part of the design, and thus it is not recognized by the Air Tractor Inc.

The stick, a piece of equipment adapted to conform with the hands of the operator, responds to his/her motor/reflex stimuli and does not require to be within the visual focus of the operator to be handled.

The moment a switch is incorporated to the stick, the very switch will be governed by motor/reflex commands.

The flap-control switch, informally installed on the stick of the At-502B Air Tractor, was small and sensitive to the operator’s touch, and also located outside of the pilot’s visual field.

In reference to the inadvertent lowering of the flaps, two moments would be favorable for the activation of this command by the pilot, on account of the switch sensitivity to touch:

– at the rotation of the aircraft, on account of the anxiety generated by the proximity of the runway departure end; and

– When the collision of the aircraft with the fence became imminent, due to a sudden emotional instability, which resulted from the context of the emergency. The anxiety generated and the adoption of reflex pulling movement for climbing may have favored the switch activation.

On the other hand, one cannot discard the hypothesis that the pilot may have initiated takeoff with the flaps completely extended.

This would result from a lack of perception, or due to his having followed the professional culture of agricultural pilots, who do that for taking off with the AT-502B, according to information provided by the very pilot.

It was not possible to confirm whether the takeoff run began with the flaps completely extended.

Such fact would have configured inobservance of the procedures established in the aircraft flight manual, which does not prescribe the use of flaps at 26° in any part of the takeoff phase.

However, it is possible to affirm that the positioning of the flaps in the 26° angle degraded even further the performance of the aircraft, which was already outside its operational envelope, when one considers the condition of the of the wet grass strip.

3 CONCLUSIONS

3.1 Facts

a) The pilot's Aeronautical Medical Certificate and Technical Qualification Certificate were valid;

b) The pilot had qualification and enough experience for the flight;

c) The aircraft had flown a total of 50 hours and 35 minutes after the last "50 hours" inspection;

d) The meteorological conditions were compatible with the intended type of flight;

f) The runway utilized for takeoff was a grass runway and was wet;

g) The distance utilized for takeoff was 825m (+/- 25m);

h) The aircraft takeoff weight was 3,061Kg;

i) According to the *AT-502B Airplane Flight Manual Brazil*, on a dry paved runway at an altitude of 738ft, with a temperature of 29°C, flaps at 10°, the takeoff run distance for clearing a 50ft object is 877m;

j) The aircraft collided with two obstacles located in the overshoot area at a distance of 86m and 98m;

k) The aircraft sustained substantial damage;

l) The pilot got out unhurt; and

m) After a complete stop of the aircraft, the flaps were at a 26° position.

3.2 Contributing factors

3.2.1 Human Factor

3.2.1.1 Medical Aspect

Nil.

3.2.1.2 Psychological Aspect

3.2.1.2.1 Individual information

a) Attitude – a contributor

The pilot showed a strong confidence in the operational potential of the AT-502B Air Tractor, together with self-confidence in his ability to fly the aircraft.

b) Memory – undetermined

The pilot's decision to utilize only part of the runway extension may have been the result of earlier experiences, since he had the habit of performing this kind of procedure under circumstances of little load in the hopper.

3.2.1.2.2 Psychosocial information

a) Work-group culture – undetermined

It is possible that the pilot was influenced by the erroneous professional culture existing among agricultural pilots relative to taking off with flaps at 26°, with the alleged objective of obtaining a better takeoff performance for the AT-502B Air Tractor.

3.2.1.2.3 Organizational information

a) Equipment (ergonomic characteristics) – undetermined

The existence of a flap control switch on the stick of the AT-502B Air Tractor may have favored a pilot's inadvertent command of the flaps to the 26° position during takeoff.

3.2.2 Operational Factor

3.2.2.1 Concerning the operation of the aircraft

a) Pilot judgment – a contributor

Without consulting the graph of performance contained in the aircraft flight manual, the pilot decided that it was not necessary to utilize the available 1,200 meters of the runway length. When he decided to start the takeoff run from an intermediate position, making use of 825 meters (+/- 25m), he operated the aircraft outside the envelope, favoring the collision of the aircraft with obstacles.

b) Aircraft maintenance – undetermined

After the aircraft was received by the operator, a flap control switch was installed on the stick in discordance with the AT-502 Air Tractor design. Considering the information (provided by the pilot) that the flaps were in the 10° position at the moment of takeoff, the extension of the flaps to the 26° position may have been the result of an inadvertent activation of the referred switch.

3.2.2.2 Concerning ATS units

Not a contributor.

3.2.3 Material Factor

3.2.3.1 Concerning the aircraft

Not a contributor.

3.2.3.2 Concerning ATS technology systems and equipment

Not a contributor.

4 SAFETY RECOMMENDATION

A measure of preventative/corrective nature issued by a SIPAER Investigation Authority or by a SIPAER-Link within respective area of jurisdiction, aimed at eliminating or mitigating the risk brought about by either a latent condition or an active failure. It results from the investigation

of an aeronautical occurrence or from a preventative action, and shall never be used for purposes of blame presumption or apportion of civil liability.

In accordance with the Law n°12970/2014, recommendations are made solely for the benefit of the air activity operational safety.

Compliance with a Safety Recommendation is the responsibility of the holder of the highest executive position in the organization to which the recommendation is being made. An addressee who judges to be unable to comply with a Safety Recommendation must inform the CENIPA on the reason(s) for the non-compliance.

Safety Recommendations made by the CENIPA:

To the National Civil Aviation Agency (ANAC):

A-042/CENIPA/2013 – 001 Issued on 03/06/2014

Consult with the aircraft manufacturer on the viability of providing the aircraft operators with graphs for the calculation of the takeoff run distance for the clearance of 50ft obstacles, considered the use of unpaved runways.

A-042/CENIPA/2013 – 002 Issued on 03/06/2014

To consult with the aircraft manufacturer on the viability of providing the operators with graphs for the calculation of the takeoff run distance for clearance of 50ft obstacles, considering the operation of the aircraft with weights different from the maximum takeoff weight.

A-042/CENIPA/2013 – 003 Issued on 03/06/2014

Increase the control procedures over the workshops certified for the maintenance of the AT-502B Air Tractor, in order to cohibit the installation of devices in discordance with the original aircraft design.

5 CORRECTIVE/PREVENTATIVE ACTION ALREADY TAKEN

On 14 June 2013, an operational bulletin (DIVOP 002/SERIPA VI/2013) was issued and forwarded to all the operators of the AT-502B Air Tractor in the Federal District and States of Goiás, Mato Grosso and Tocantins, as well as to the other SERIPAs. The Bulletin dealt with takeoff analysis and with the flap control switch installed on the stick.

6 DISSEMINATION

- Brazil's National Civil Aviation Agency (ANAC);
- National Transportation Safety Board (NTSB);
- SERIPA VI.

7 APPENDICES

Nil.

On 03 June 2014.