COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 209/CENIPA/2014

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-HNC**
MODEL:	**HB-350B**
DATE:	**27DEC2014**

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 Appendix 2, 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.

SYNOPSIS

This is the Final Report of the 27DEC2014 accident with the HB-350B aircraft, registration PT-HNC. The accident was classified as “Undetermined”.

After takeoff, the aircraft collided against the ground in a forest area in the municipality of Bertioga - SP.

The aircraft was destroyed.

The pilot and the four passengers perished at the site.

An Accredited Representative of the BEA - *Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile*, France (State where the aircraft was designed), and of the NTSB – National Transportation Safety Board, United States (State where the engine was designed) were designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	(Brazil's) National Civil Aviation Agency
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CFIT	Controlled Flight Into Terrain
CG	Center of Gravity
CHST	Certificate of Supplemental Type Approval
CHT	Technical Qualification Certificate
CIV	Pilot's Flight Logbook
CM	Registration Certificate
CMA	Aeronautical Medical Certificate
CTM	Maintenance Technical Control
CTP	Main Gearbox
DCTA	Aeronautics' Science and Technology Department
DTCEA-MT	Airspace Control Detachment – Campo de Marte
DTCEA-ST	Airspace Control Detachment - Santos
FAA	Federal Aviation Administration
FCU	Fuel Control Unit
GSO	Safety Manager
H350	HB 350B Type Rating
IAE	Aeronautical Space Institute
IFI	Industrial Development and Coordination Institute
IMC	Instrument Meteorological Conditions
METAR	Meteorological Aerodrome Report
N2	Power Turbine Rotation
NM	Nautical Miles
NTSB	National Transportation Safety Board
PCH	Commercial Pilot License - Helicopter
PPH	Private Pilot License – Helicopter
PSI	Pound force per Square Inch
PTG	Power Turbine Governor
RBHS	Robinson Helicopters Type Rating
SBMT	ICAO location designator – Campo de Marte
SBST	ICAO location designator - Santos
SBHV	ICAO location designator – Albert Einstein Hospital Helipad
SDIX	ICAO location designator – Iporanga Helipad – Guarujá - SP
SERIPA	Regional Aeronautical Accident Investigation and Prevention Service
SSP-SP	São Paulo Public Security Secretariat
STC	Supplemental Type Certificate
TWR	Control Tower
UTC	Universal Coordinated Time

1. FACTUAL INFORMATION.

Aircraft	**Model:** HB-350B **Registration:** PT-HNC **Manufacturer:** Helibras	**Operator:** Helimarte Air Taxi Ltd.
Occurrence	**Date/time:** 27DEC2014 - 1315 UTC **Location:** Next to the Bertioga Canal **Lat.** 23º51'57"S **Long.** 046º09'41"W **Municipality – State:** Bertioga - SP	**Type(s):** "Undetermined" **Subtype(s):** Nil.

1.1 History of the flight.

The aircraft took off from the Campo de Marte Aerodrome, São Paulo, SP (SBMT), at 09:37 a.m., with one pilot on board, in order to attend a passenger transport.

After about 30 minutes, he landed in the helipad of Iporanga Condominium, Guarujá - SP (SDIX), to board four passengers and proceed to the helipad of Albert Einstein Hospital, São Paulo, SP (SDHV), with one pilot and four passengers on board.

At approximately 1.44 nautical miles (NM) from the take-off point, the aircraft collided against the ground in a forest area in the municipality of Bertioga, SP.

The aircraft was destroyed.

The pilot and the four passengers suffered fatal injuries.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	4	-
Serious	-	-	-
Minor	-	-	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft was destroyed.

1.4 Other damage.

Nil.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown	
	Pilot
Total	1.131:35
Total in the last 30 days	24:00
Total in the last 24 hours	1:00
In this type of aircraft	853:00
In this type in the last 30 days	20:00
In this type in the last 24 hours	1:00

N.B.: The Data on flown hours were obtained from the pilot's CIV records.

1.5.2 Personnel training.

The pilot took the Private Pilot course - Helicopter (PPH) at the *Escola Master Helicópteros*, SP, in 2005.

1.5.3 Category of licenses and validity of certificates.

The pilot had the Commercial Pilot License - Helicopter (PCH) and had valid technical qualifications of aircraft type H350, RBHS, R22 and R44. He did not have qualification to perform flights under IFR rules.

1.5.4 Qualification and flight experience.

The pilot was qualified and had experience for that kind of flight.

1.5.5 Validity of medical certificate.

The pilot had valid Aeronautical Medical Certificate (CMA).

1.6 Aircraft information.

The aircraft, serial number HB - 1116/2067, was manufactured by Helibras, in 1989, and was registered as multiple category (TPX/SAE-AC/F/N/P/R).

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engine and rotors logbook records were updated.

The last inspection of the aircraft, the "30 hours / 150 cycles" type, was performed on 17DEC2014 by Helisul Air Taxi Ltd. - Rio de Janeiro – RJ, having flown 8 hours and 25 minutes after the inspection.

The last revision of the aircraft, the "12 years / 144 months" type was performed on 06FEB2014 by the WM Aeronautics Maintenance Ltd. shop, in Diadema - SP, having flown 208 hours and 20 minutes after the inspection.

The aircraft had a major alteration in the powertrain, performed by WM Aeronautics Maintenance Ltd., a company certified by ANAC, with the incorporation of a kit supplied by Soloy LLC, which consisted of the installation of a Rolls Royce turbine, model 250-C30M. This change was made based on approved technical data. The following documents were used as reference:

• Certificate of Supplemental Type Approval (CHST) nº 2004S12-06 issued on 20DEC2004, by the Industrial Development and Coordination Institute (IFI);

• Supplemental Type Certificate (STC) # SH3324NM, issued on 06FEB1986, by the Federal Aviation Administration (FAA);

• Large Modification / Repair Registry (SEGVOO 001) issued on 10JUN2014, by ANAC; and

• Letter of permission / authorization from Soloy LLC for Helimarte Air Taxi Ltd., Issued on 02MAY2014.

The Aircraft Flight Manual has been updated, with the insertion of Supplement No. 9 published by Soloy LLC.

1.7 Meteorological information.

The weather conditions were favorable for the visual flight of Helicopters.

The local meteorological bulletins (METAR) of Santos Air Base (SBST), distant 7.5NM from SDIX, had the following information:

METAR SBST 271100Z 35003KT 5000 BR BKN012 26/23 Q1015=

METAR SBST 271200Z 20004KT 7000 BKN014 27/23 Q1016=

It was found that the conditions were favorable to the visual flight of helicopters with visibility between 5,000m and 7,000m, with the presence of humid mist and 5 to 7/8 of sky coverage at 1,200ft. The wind was calm.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Communications were only established with the Campo de Marte Control Tower (TWR) for exit permits. No communications were identified with Radio Santos, operated by the DTCEA-ST. No other type of communication was detected between the SBMT take-off and the time of the accident.

1.10 Aerodrome information.

The occurrence happened outside the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The impact occurred in a forest area, near a neighborhood in the city of Bertioga, SP. The wreckage was concentrated in a clearing opened by the aircraft itself.

The first impact occurred in a tree at 10m, at an angle of approximately 45º. There was fire after the impact. The entire cabin was consumed by fire. The tail cone, the rear gearbox and tail rotor were not struck by fire and showed no signs of failure. The main rotor blades, although incinerated, and the blades of the tail rotor, indicated low rotation at the final instants of the flight. The absence of torsion in the rear drive shaft corroborates to the low rotation at the moment of impact.

Figure 1 - View of tail cone, rear gearbox and tail rotor, not hit by fire.

The degree of destruction and carbonization of the aircraft did not allow a better verification of instruments and equipment.

The bodies of the victims were found charred near the front section.

No traces of feather, tissue, bone, blood, or any other material were found to indicate a bird strike.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

There was no evidence that physiological aspects or incapacitation affected the performance of the pilot.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Nil.

1.14 Fire.

The fire started immediately after impact. The combustion material was the fuel of the aircraft and the source of ignition was probably the friction of the aircraft with the ground. Despite the difficulty of access, the São Paulo state Fire-fighting Department fought the fire.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

Experts from the Aeronautical Space Institute (IAE) from the DCTA analyzed the engine, on 24 and 25FEB2015. The main gearbox (CTP) and rear were examined on 25FEB2015.

As for the engine, it was observed, firstly, that the 1st stage of compression presented severe damages. The engine did not turn manually. It was seized.

Before starting to dismantle the engine, it was found that all the pneumatic lines were connected and with torque. To check for leaks in the pipes, a pressure of 50psi was applied to the foamed pneumatic lines. In this test, no leaks were identified.

As for the lubrication system of the engine, nothing abnormal was observed either. The presence of metallic particles was not identified in the two filings detectors (upper and lower). When checking the oil injectors of bearings 6, 7 and 8, no malfunctions were observed which could lead to lubrication deficiency in the bearings. The "last chance" oil filters of bearings 6 and 7 were clean and free of contaminants. Both the oil injector of the bearings 2 to 4, and their "last chance" filters, were without presence of contaminants. When disassembling the engine oil pumps, nothing was observed that could jeopardize their operation.

When viewing the fuel filter and its filter element, no filings or other contaminants, such as water, have been observed. The filter element was resected due to the action of the fire that happened at the impact of the aircraft. The fuel injector nozzle was apparently normal and showed no evidence that its "last chance" filter was collapsed due to lack of fuel. The mesh of this filter was examined with magnifying lens and light. No anomalies were found.

Due to the extent of the fire, it was not possible to sample the fuel for analysis in the laboratory. In the same way, it was not possible to verify the Power Turbine Rotation compensator (N2), the component that is responsible for the release of more fuel and

consequent increase in power between the takeoff and the leveling of the aircraft on cruise altitude.

The Power Turbine Governor (PTG) was found without its top. Inside, the counterweighing drive shaft was broken. Because the PTG has suffered a fracture, it was not possible to perform a bench test to verify its performance. Only signs of overload failure were found in all observed items, both fractured and deformed. There were no signs of fatigue failure or other mechanism.

When disassembling bearing # 1 from the engine, it was found that it was normal and spinning freely. The centrifugal impeller of the compressor scratched against its casing, but not sharply compared to an engine that is developing high power and suffers abrupt stop.

In the combustion chamber, it was observed the existence of unmelted metallic deposits on the air intake fins. On the thermal shield of the nozzle, it was verified the presence of the same deposit. The combustion chamber was also examined for hot spots and irregular burning of the fuel. It was found that it had normal working appearance and color.

During disassembly, no damages resulting from irregular burning or impact, erosion or sharp wear were observed on the stator of the 1st stage of the engine compressor turbine. On the 2nd stage, normal working color was observed, with no evidence of elongation of the vane, without damage caused by impact or overload. It was also possible to observe metal deposits on the vanes, but nothing that caused the engine to malfunction.

In the engine reduction box, it was found that all bearings and gears showed evidence of normal operation. The freewheel could be turned manually, with no abnormalities.

In the CTP, it was observed the intense action of the fire that happened after the fall of the aircraft, being emphasized the melted link of fixation. The lubricating oil filter of the CTP's supply nozzle was normal and without the presence of filings. A hole was found in the CTP carcass. After its opening, it could be verified, next to the gears, something pointed, probably of the aircraft, which possibly pierced the carcass of the CTP at the moment of the accident, since the rupture occurred due to overload.

On the mast sleeve, it was noted that all rivets were intact. Normally when the CTP is transmitting power and suffers abrupt stop the shear of these rivets occurs. It was also observed that all the bearings and gears of the CTP were operational, not being identified something that could cause its malfunction and, with that, contribute to the occurrence.

The Fuel Control Unit (FCU) was sent to its manufacturer for analysis, accompanied by the Investigation Committee. In both the FCU and other components of the aircraft fuel system, nothing was found that could compromise the fuel supply to the engine.

In the Alarm Panel, it was not possible to specify the correct light signaling for generator failure or shutdown (GENERATOR or GER). Likewise, the light indicating low engine oil pressure could be ENG-P or P-GTM. Anyway, they are lights that could be associated with the event of a low power, failure, or engine cut, if it were not possible the electric generation provided by the power turbine rotation or the engine oil pump does not offer sufficient pressure for proper lubrication.

The Panel's analysis found that only the GEN / GER, ENG-P / P-GTM and PITOT alarms were probably lit (lit) at the time of the aircraft's impact on the ground or against obstacles.

1.17 Organizational and management information.

From the reports obtained, it was possible to observe safety management in the company, observing and monitoring the performance of its crew.

There were no reports of noncompliance with the law of the aircraft by the company and, in the documentary records; the pilot's working day was fulfilled as planned. It was reported that pilots were free to report to the Safety Manager (GSO) when they were tired or facing problems so that they were temporarily removed from the flight range.

1.18 Operational information.

The aircraft was within the weight and balance parameters specified by the manufacturer.

The aircraft operator, an air taxi company, received the request to transport passengers in the morning of the accident. He was on duty at the company's premises and the pilot was called to take off at an appropriate time.

According to witnesses, the pilot's readiness, mission planning, supply monitoring, and other arrangements went smoothly.

The pilot took off at 09:37 am, alone, for SDIX. Communications on SBMT output with the TWR were normal. In the radar review surveys, no images were found related to the flight of the aircraft.

Upon landing at the Iporanga Condominium, the pilot waited for the passengers to board the aircraft, with the engine on. The land staff of the condominium, with no abnormalities, attended the embarkation.

The takeoff had a normal profile, for the type of the helicopter, with northeast direction, offset with the bow of the destination, toward the point of impact. The ground collision occurred at 1.44NM in SDIX. The route taken between takeoff and impact could not be determined.

In the sketch (Figure 2) it is possible to contextualize the sequence of events.

Figure 2 - Sequence of events and location of the accident.

The information provided by the Operator, when compared with the receipt of supply, shows that the aircraft had enough fuel to comply with all the planned steps.

1.19 Additional information.

A video of the boarding of the passengers in the Condominium Iporanga and later takeoff of the aircraft was published on the Internet. Despite the poor quality, it is possible

to visualize that the aircraft remained activated, apparently with the pilot in the controls and that all the passengers have embarked in the rear cabin.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The following will present circumstances considered as possible contributors for the accident.

Although discarded, scenarios that are consistent with the characteristics of the flight, the aircraft and the terrain were also analyzed. The relationship is not exhaustive, dealing only with what is most common, since no clue has been conclusive.

2.1 Engine Failure

Examination of the wreckage undertaken at the accident site, and subsequent engine research concluded that the powertrain was operational and had a medium to low power level.

The Alarm Panel lights that (probably) were on at the time of impact, as well as the integrity of the CTP, corroborate to the hypothesis of power failure. However, nothing was found that could lead to engine failure.

Despite the great change in the powertrain, during the analysis, no damage was observed in the components related to the modification that could have contributed to the accident.

2.2 Fuel Supply

It is possible that the level of medium to low power found in the analysis of the wreck is the result of some feeding problem, either by contamination of the fuel supplied in the aircraft, contamination in the tanks, or failure in any of the system's components. The parts that make up this group, however, were severely hit by fire, so that this hypothesis could not be proven.

As no problems were reported in other aircraft that used the fuel from the SBMT supplier, the possibility of contamination prior to refueling was removed.

2.3 Tail Rotor Failure

The possibility of failure of the tail rotor, either by servo control locking, by breakage of the transmission line or the rear control line, or even an engine shutdown (or reduction of the power lever) has been considered minimizing a turning tendency of the aircraft.

No sign of failure in the tail rotor assembly was found either in the tail rotor itself or in its chain of command. The impact of the tail with the vegetation was also not consistent with this type of failure.

2.4 Failure in the flight control system, hydraulic system or other

No evidence at the scene of the accident indicated for any aircraft system failure other than that related to the powertrain. It cannot be ruled out that some other failure has occurred, but the high degree of destruction of the components may have obscured any evidence.

2.5 Controlled Flight Into Terrain – (CFIT) collision

The Investigation Commission disregarded this hypothesis since the collision against the ground happened in mangrove area, in the level of the sea, without elevations. The low

power proven in the tests performed on the powertrain also does not match a CFIT type of impact.

2.6 Inadvertent entry into IMC

Although meteorological conditions allowed the visual flight for helicopters, there was a layer of clouds at approximately 1,200 feet. This layer, which covered 5 to 7/8, was in the meteorological bulletin of Santos Air Base, distant 7.5 NM from the site of the crash. Under the layer, the conditions were favorable for the visual flight of helicopters. Above the layer, the pilot would probably encounter IMC conditions.

Some data exclude the possibility of inadvertent entry into instrument flight conditions. Firstly, the characteristics of the pilot regarding the correct conduct of the aircraft, without letting any kind of pressure make it deviate from the standard. It was recently the descent of Serra do Mar, that is, the pilot was aware of the current weather conditions. Another point to be considered, as a result of the analysis of the wreckage, is the fact that the aircraft has impacted with low or no power. This characteristic does not normally correspond to what occurs in a spatial disorientation by inadvertent input into IMC.

2.7 Piloting by not enabled person

The position of the bodies, verified in the examination of the wreck, did not allow a precise evaluation as to the occupation of the passengers in the aircraft.

The video posted on the internet and analyzed by the Investigation Commission removes the possibility that some of the passengers have taken over the commands of the aircraft in the place of the pilot. The left seat was installed together with the corresponding flight commands, but the fact that it is possible to visualize the embarkation of all the passengers in the rear cabin, together with the internal traffic difficulty, makes this hypothesis remote.

2.8 Bird Strike

No traces (feathers, blood, bones, tissue, etc.) of animal were found in the wreckage. Despite the state of the aircraft, after being consumed by the fire, engine, windshield, blades and other components exposed to this type of threat did not present signs that indicated collision with any species of fauna.

2.9 Pilot error

In the investigation process, there were no reports that the pilot was facing any health or emotional problems at the time of the accident. In his professional history within the company, nothing was found that would deprive his profile as a pilot, on the contrary, he was already an instructor and considered one of the most standard of the company's pilots. Considered by his peers the professional with greater theoretical and technical knowledge. He would become officially the pilot-in-chief, for he was already practicing the job.

Regarding autorotation training, it was not possible to determine if the pilot was well trained or not, but since he was already instructing, he was supposed to have a good operational level. This is compounded by the fact that people who knew him, as a professional, believe that if he encountered any unexpected events or problems, he would react on the spot given his knowledge in the maintenance area (he acted in this area for several years before becoming a pilot).

The pilot had already made flights in the area and had a lot of experience aboard that aircraft. The fact that he was carrying a sick child did not influence his emotional state, since there was no gravity in the passenger's state of health, as the pilot had already carried out other transport flights of a similar nature.

According to reports, the pilot was extremely cautious, doing everything that was planned. It was not part of his profile to act on impulse. He was considered by all as extremely careful, rational and methodical.

Since, at the time of the accident, there was an adequate compliance with the working day by the company's crew and also by the reports of people who had been with the pilot in the days prior to the accident, the possibility that he was passing by stress or fatigue at work was disregarded.

Finally, it was unanimous in the reports, the fact that he was an excellent pilot and that he would not exceed safety limits for the accomplishment of the mission.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid Aeronautical Medical Certificate (CMA);

b) the pilot had valid Technical Qualification for the H350 aircraft;

c) the pilot did not have qualification for Instrument Flight;

d) the pilot was qualified and had experience in that kind of flight;

e) the aircraft had valid Airworthiness Certificate (CA);

f) the aircraft was within the weight and balance parameters;

g) the airframe, engine and propeller logbooks records were updated;

h) only communications with Campo de Marte TWR related to departure, taxi and take-off authorizations were identified;

i) no aircraft-related image in radar review surveys was found;

j) the meteorological conditions at the time of the accident were favorable for the visual flight of helicopters, with a calm wind;

k) no evidence that the modification implemented in the powertrain has compromised its operation was found;

l) The engine was operational and had a medium to low power level;

m) in the inspection and analysis of the engine, mechanically, nothing that could induce a fault was identified;

n) in the FCU no evidence that compromised the supply of fuel to the engine was found;

o) PTG failed due to overload because of the impact;

p) the aircraft impacted the ground in SDIX at 1.44NM;

q) the aircraft was destroyed; and

r) the pilot and the 4 passengers suffered fatal injuries.

3.2 Contributing factors.

Other – undetermined.

No factor searched was sufficiently clear, factual, to be considered a contributor to the occurrence. The fact that the engine was developing medium or low power when impacting against the ground is the only evidence of abnormality. However, the lack of elements that explained this particularity and the absence of other evidence made it impossible to list factors that contributed to the accident.

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, criminal, or administrative liability.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of the air activity operational safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".

Recommendations issued at the publication of this report:

None.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On September 4th, 2018.

ANNEX A

COMMENTS BY THE BEA REGARDING THE FINAL REPORT

Below, there is a list of all the comments forwarded by the *Bureau d'Enquête et d'Analyses pour la Sécurité de L'Aviation Civile*, which were not included in this Final Report wording.

- **COMMENT 1**

Regarding the following portion of the section "1.16 – Tests and research."

"In the combustion chamber, it was observed the existence of unmelted metallic deposits on the air intake fins. On the thermal shield of the nozzle, it was verified the presence of the same deposit."

Text proposed by BEA and Airbus Helicopters technical advisors

The discover of unmelted metallic deposits on the thermal shield of the nozzle could be consistent with the absence of flame in the combustion chamber.

BEA´s and Airbus Helicopters technical advisors comment

During the engine examination, it was conclude that the discovery of unmelted metallic deposits on the thermal shield of the nozzle could be consistent with the absence of flame in the combustion chamber.

CENIPA´s comment

The engine examination concluded that the component was operational and had a medium to low power level at the moment of the accident.

This information is explained on section 2.1, as part of chapter "2 - Analysis".

ANNEX B

COMMENTS BY THE NTSB REGARDING THE FINAL REPORT

Below, there is a list of all the comments forwarded by the National Transportation Safety Board, which were not included in this Final Report wording.

- **COMMENTS 1, 2 and 6**

Regarding the entire Final Report wording.

Text proposed by NTSB

AS-350B.

NTSB´s comment

Change the model of the aircraft from HB-350B to AS-350B, to match the initial notification.

CENIPA´s comment

Brazil has a national aircraft database managed by the Brazilian Civil Aviation Authority (ANAC). For standard national purposes regarding statistics, CENIPA uses the model defined by ANAC on Final Reports wording, HB-350B in this case.

- **COMMENTS 3, 4, 8, 9, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 31, 32, 34, 35, 36 and 37**

Regarding Synopsis, sections 1.1, 1.6 and 1.12.

Text proposed by NTSB

The helicopter.

NTSB´s comment

Replace the wording “the aircraft” with “the helicopter”.

CENIPA´s comment

According to Annex 13 and national regulations definitions, a helicopter is an aircraft for CENIPA.

- **COMMENT 7**

Regarding the entire Final Report wording.

Text proposed by NTSB

Aerospatiale or Eurocopter.

NTSB´s comment

Change the manufacturer “Helibras” to “Aerospatiale” or “Eurocopter” as appropriate.

CENIPA´s comment

Brazil has a national aircraft database managed by the Brazilian Civil Aviation Authority (ANAC). For standard national purposes regarding statistics, CENIPA uses the manufacturer defined by ANAC on Final Reports wording, Helibras in this case.

- **COMMENTS 10 and 11**

Regarding section “1.1 History of the flight”.

Text proposed by NTSB

The helicopter was destroyed by the impact and a postcrash fire.

NTSB´s comment

Change the section wording.

CENIPA´s comment

The description of the damages are detailed on section “1.12 Wreckage and impact information”, and the description of fire circumstances are detailed on section “1.14 Fire”.

- **COMMENT 12**

Regarding section “1.5.2 Personnel training”.

Text proposed by NTSB

Nil.

NTSB´s comment

Suggest adding where he obtained his commercial pilot course at.

CENIPA´s comment

This information was not clear for the IIC. That’s why it was not included.

- **COMMENT 14**

Regarding section “1.5.5 Validity of medical certificate”.

Text proposed by NTSB

Nil.

NTSB´s comment

Did the pilot have any limitations?

CENIPA´s comment

The description on section 1.13.1 says “there was no evidence that physiological aspects affected the performance of the pilot”.