

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A - 073/CENIPA/2019

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PT-YTJ
MODEL:	AS 350 B2
DATE:	06MAY2019



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 Final Report has been made available to the ANAC and the DECEA so that the technical-scientific analyses of this investigation can be used as a source of data and information, aiming at identifying hazards and assessing risks, as set forth in the Brazilian Program for Civil Aviation Operational Safety (PSO-BR).

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 06MAY2019 accident with the AS 350 B2 aircraft model, registration PT-YTJ. The accident was classified as “[UNK] Unknown”.

On the day of the accident, the aircraft disappeared after taking off from the Novo Aripuanã Aerodrome (SWNA) - AM, according to reports, transport three passengers to an Inn located on the Acari River.

On 10MAY2019, the aircraft was located by the Search and Rescue (SAR) team.

The aircraft was destroyed.

No survivors were found.

An Accredited Representative of the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA) - France, (State where the aircraft was designed) was designated for participation in the investigation.

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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
CMA	Aeronautical Medical Certificate
CIV	Pilot Flight Logbook
COMAER	Aeronautics Command
CGNA	Air Navigation Management Center
CNPJ	National Register of Legal Entities
DCERTA	Correct Take-Off Computerized System
EACAR	<i>Escola de Aviação Civil Asas Rotativas</i>
FIS	Flight Information Service
HMNT	Single-Turbo Helicopter Rating
IAM	Annual Maintenance Inspection
ICAO	International Civil Aviation Organization
ICA	Aeronautics Command Instruction
IML	Legal Medical Institute
IS	Supplementary Instruction
LFASC	Forensic Laboratory for the Analysis of Substances and Compounds
METAR	Aviation Routine Weather Report
OM	Maintenance Organization
PCH	Commercial Pilot License – Helicopter
PIC	Pilot in Command
PPH	Private Pilot License - Helicopter
RBAC	Brazilian Civil Aviation Regulation
REDEMET	Aeronautics Command Meteorology Network
SACI	Integrated Civil Aviation Information Service
SALVAERO	Search and Rescue Coordination Center
SAR	Search and Rescue
SN	Serial Number
SWNA	ICAO Location Designator - Novo Aripuanã Aerodrome - AM
SIPAER	Aeronautical Accident Investigation and Prevention System
TPP	Registration Category of Private Service
TPX	Aircraft Registration Category of Non-Regular Public Air Transport
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	Model: AS 350 B2	Operator: Good Fly Locação de Serviços Ltd.
	Registration: PT-YTJ	
Occurrence	Manufacturer: HELIBRAS	Type(s): [UNK] Unknown Subtype(s): NIL
	Date/time: 06MAY2019 - 1500 UTC	
	Location: Forest Region	
	Lat. 05°42'33"S Long. 060°15'48"W Municipality – State: Novo Aripuanã – AM	

1.1 History of the flight.

The aircraft took off from the Novo Aripuanã Aerodrome (SWNA) - AM to carry out a personnel transport flight to an Inn located on the Acari River, with a pilot and three passengers on board.

During the en-route flight, the helicopter disappeared, being located on 10MAY2019, in a forest region, on the Aripuanã River, near the Flechal Community.



Figure 1 - General view of the PT-YTJ wreckage location.

The aircraft was destroyed and no survivors were found.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	3	-
Serious	-	-	-
Minor	-	-	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft was destroyed.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	PIC
Total	Unknown
Total in the last 30 days	Unknown
Total in the last 24 hours	Unknown
In this type of aircraft	Unknown
In this type in the last 30 days	Unknown
In this type in the last 24 hours	Unknown

N.B.: The Investigation Team did not have access to the PIC's CIV.

The data relating to the flown hours were partially obtained through the records contained in the ANAC's Digital CIV's system, which contained 162 hours and 6 minutes of total flight time and 122 hours and 56 minutes in the aircraft model.

1.5.2 Personnel training.

The pilot took the PPH course at the EACAR - *Escola de Aviação Civil Asas Rotativas*, in 2006.

1.5.3 Category of licenses and validity of certificates.

The PIC had the PCH License and had a valid HMNT Rating.

1.5.4 Qualification and flight experience.

According to the data obtained from the Digital CIV, contained in the ANAC's SACI, the last flight recorded in a helicopter in the HMNT class was dated 12JAN2019 when the endorsement to operate the aircraft model BH 06 was received.

The PIC had experience in the type of flight on which he was operating. However, according to the data recorded in the SACI, it was not possible to verify compliance with the requirements established for recent experience contained in section 61-21 of the RBAC nº 61, which dealt with Licenses, Ratings, and Certificates for Pilots, as follows:

61-21 Recent Experience

(a) Except for the deadlines established in section 61.19 of these Regulations, a pilot may only act as pilot-in-command of an aircraft if, within the preceding 90 (ninety) days, he has performed:

(1) for day-flight operations:

[...]

(ii) in the case of other aircraft, at least 3 (three) take-offs and 3 (three) landings during the day or night, during which the aircraft controls of the same category and class/type have been operated;

[...]

1.5.5 Validity of medical certificate.

The PIC had valid CMA.

1.6 Aircraft information.

The aircraft, model AS 350 B2, Serial Number (SN) AS3045, was manufactured by HELIBRAS in 1998, and was registered in the TPP Category.

The aircraft CA was valid.

The owner did not present the relevant aircraft maintenance logs.

The last inspections, of the “1,200 hours/24 months” type and “IAM”, were carried out on 07FEB2019 by the Maintenance Organization (OM) Helipark, in Carapicuíba – SP.

1.7 Meteorological information.

The enhanced satellite image from the REDEMET, from 1430 (UTC), on 06MAY2019, indicated that there were no significant meteorological formations in the area close to the accident (Figure 2).

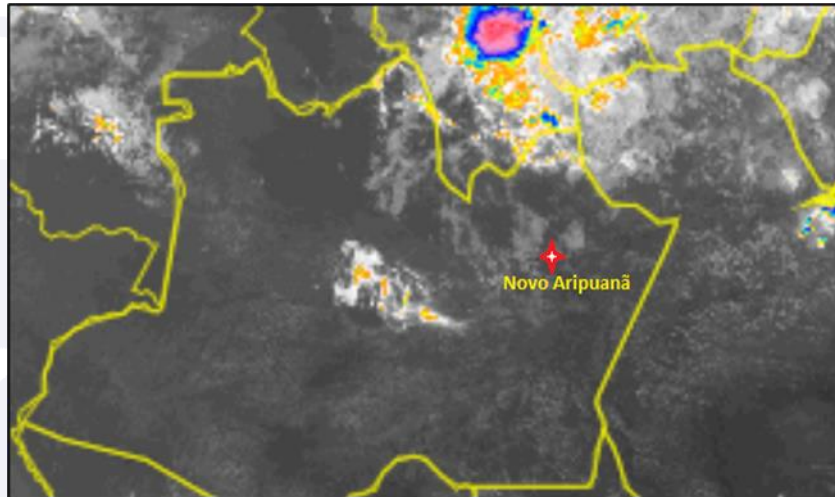


Figure 2- Enhanced satellite image, from 1430 (UTC). Source: REDEMET.

In the same way, amateur video footage that recorded the PT-YTJ'S take-off from SWNA for the flight that resulted in the accident also revealed that weather conditions were favorable for the visual flight.

1.8 Aids to navigation.

The region in which the PT-YTJ was flying was considered a Class G Airspace. In class G, it was allowed to operate under VFR, receiving only flight information service (FIS) whenever was viable. Thus, as this was not a controlled airspace, the presentation of a Flight Plan was waived.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place out of the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The impact occurred in a forest area. The distribution of the wreckage was of the concentrated type. Due to the characteristics of the accident site, it was not possible to determine where the first impact occurred.

The SAR team arrived at the accident site on 10MAY2019, around 1600 (UTC), and the Field Investigation team moved the next day.

Upon arriving at the scene of the occurrence, the presence of third parties was verified, and it was observed that the wreckage had been searched and tied to the trees, which altered the evidence and distorted the accident scenario (Figure 3).



Figure 3 - View of the wreckage searched by persons. Source: photo taken by third parties.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

According to the Amazonas' IML Report, the pilot's body was admitted to that Institute on 12MAY2019.

Also, according to that report, tissue fragments were removed for toxicological analysis. Still, the LFASC reported the impossibility of carrying out the laboratory analyses.

Through the medical history of the PIC, it was found that in the health inspection carried out in November 2018, there was information that he had undergone surgery on his right hip, in 2014, and on his left hip, in 2016, as a result of a car accident.

Such information was also included in the data from its last Health Inspection, carried out on 07FEB2019, in which it was also mentioned that, in August 2017, the pilot had undergone hip surgery. However, it was not clear whether there was a third surgical intervention.

As a result of this car accident, the PIC presented with paresis on the left, whose main limitation was the flexion and extension of the left foot, which was further aggravated by the brisk marching, dorsiflexion paresis, and mild plantar flexion paresis, with mild gastrocnemius atrophy, and mild to moderate anterior tibial atrophy, with a diagnosis of lower limb mononeuropathy.

The statement from the pilot's CMA contained the opinion: "solo flight prohibited" as per (Figure 4).

Classe	Primeira - PILOTO COMERCIAL (PC)	
Validade	21/03/2020	
Órgão	CLC22	C.C.F 0
Motivo da Inspeção	R-REVALIDAÇÃO INSPSAU (PERIÓDICO)	
Observações	PROIBIDO VOO SOLO / NOT VALID FOR SOLO FLIGHTS USAR LENTES CORRETORAS. PORTAR ÓCULOS RESERVA / USE CORRECTIVE LENSES	

Figure 4 - Extract from the pilot's CMA status. Source: ANAC's SACI.

Regarding the CMA, the RBAC nº 61 - "Licenses, Ratings and Certificates for Pilots", in force at the time of the occurrence, established in section 61.25, "CMA validity", the following requirements:

(a) It is the license holder's responsibility to fail to exercise the prerogatives that his licenses and related ratings grant him when:

(1) is aware of any impairment of his psycho-physical abilities that may prevent him from exercising said duties in safety conditions; and

[...]

Also, according to the RBAC nº 61, section 61.3, "Conditions Relative to the Use of Licenses, Certificates, Ratings, and Authorizations" established that:

[...]

(c) Aeronautical Medical Certificate: no one can act as a flight crewmember of Brazilian civil aircraft in accordance with the precepts established by these Regulations, unless they hold a valid CMA, issued by the RBAC 67 and appropriate to the respective license or certificate.

Likewise, the RBAC No. 67 - "Requirements for the Granting of Aeronautical Medical Certificates, for the Accreditation of Doctors and Clinics and the Agreement with Public Entities" also recorded in Subpart A - "General Provisions" that:

67.15 Validity of CMAs

[...]

(c) The holder of a valid CMA must report to the ANAC, or the examiner responsible for its certification, any decrease in their psychophysical abilities that may prevent them from exercising the prerogatives of their licenses and ratings without affecting flight safety, as well as how to cease exercising these prerogatives until obtaining a new "fit" judgment by an examiner or the ANAC.

About obtaining or revalidating a 1st class CMA, Subpart A - "General Provisions" of the RBAC No. 67, in force at the time of the exams, established that:

[...]

67.13 CMA Classes and Categories

(a) Except as set out in paragraph (a) of subpart H of these Regulations, referring to the transitional provisions, a valid 1st class CMA shall be mandatory for a license holder of the following categories:

[...]

(2) Commercial Pilot (PC); and

[...]

The RBAC No. 67, Subpart C - "Requirements for Obtaining a 1st Class CMA", also pointed out that:

67.71 General provisions

(a) The candidate will be considered eligible to obtain or revalidate a 1st class CMA if he/she meets all the psychophysical requirements of this subpart.

[...]

67.77 Neurological requirements

(a) The applicant must not have a history or clinical diagnosis of:

[...]

(14) neurological disorders that produce loss of balance, sensitivity, muscle strength, or neuromuscular coordination; and

[...]

67.95 Osteo-articular requirements

(a) The candidate cannot present any anomaly of bones, joints, muscles, tendons, or related structures that, **at the discretion of the examiner or the ANAC**, are likely to cause any functional impairment that may affect flight safety.

(b) The applicant may not possess:

- (1) active disease of bones, joints, muscles, and tendons;
- (2) functional sequelae of congenital or acquired diseases;

Concerning the Concepts, Definitions, and Acronyms, section 67.3 of Subpart A - "General Provisions" of RBAC No. 67 stated that:

(15) the expression at the discretion of (o), whenever it appears in these Regulations referring to an examiner or the ANAC, means an opinion or a judgment to be issued by one of these for a situation not foreseen by these Regulations, or that means a concession or restriction to a candidate, to be made based on the experience and professional knowledge of the examining physicians and which **must be expressly justified and based on the records of expert health examinations**, either to grant or to deny a CMA;

The Investigation Team formally consulted the ANAC on the requirements to be followed by the clinics responsible for health inspections to grant a 1st Class CMA "Fit with Restriction - Solo Flight Prohibited".

The ANAC reported that the criteria were prevised in the RBAC nº 67, which contained specific conditions, such as the requirements established in section 67.79 "Cardiological Requirements" in its letter (c), which dealt with cases of myocardial infarction and patients with coronary artery bypass graft surgery or coronary angioplasty without myocardial infarction, respectively:

(c) In the cases prevised in paragraphs (b)(1) and (b)(2) of this section:

- (1) the judgment of the examiner or the ANAC, if favorable to the candidate for revalidation, must be "fit with restriction";
- (2) the validity granted for the CMA must be a maximum of 6 months; and
- (3) the examinations referred to in paragraphs (b)(1)(i) and (b)(2)(i) of this section must be performed by specialized medical services (not necessarily at the examiner) and, in future expert health examinations of revalidation, it is up to the examiner or the ANAC to perform them or not, without prejudice to the exams required by paragraph (d) of this section.

Through IS No. 67-004 Revision A, Medical Guide, the ANAC sought to better clarify the acceptable means of complying with the RBAC No. 67, bringing, for example, in section 5.7.9.2 which restrictions should be applied to a candidate in whom acute coronary syndrome or myocardial infarction was detected.

5.7.9.2 Candidates with 1st and 2nd class CMA who are deemed fit must receive the following restrictions:

- a) solo flight prohibited;
- b) training flight prohibited;
- c) no flight with another pilot with restrictions in the CMA.

As with the exceptions to the CMA for the cardiological requirements exposed above, it was also expected to find the situations related to the osteoarticular and neurological requirements for the application of the opinion "fit with restriction to solo flight".

Further on, in section 5.15, Osteoarticular requirements, of the IS nº 67-004, it was stated that the ANAC could request a medical flight test for candidates with "abnormal" physical structure, which included the pathology of the pilot in this accident. In this case, after performing the in-flight medical test, the candidate could be judged "fit with restriction to solo flight":

5.15.2 The ANAC may request a medical flight test, with special attention to emergency and evacuation procedures, for candidates with abnormal physical structure, including obesity, muscle weakness, and alterations in limbs or the spine. The candidate can be considered fit with the restriction of prohibition of solo flight.

In consultation with the investigation data, no evidence was found that the ANAC requested a medical flight test, as it could have been done, in accordance with the provisions of section 5.15.2 of IS 67-004A.

The last medical examinations were carried out in November 2018 and February 2019, and the restriction “Forbidden Solo Flight” was then inserted. However, his last operational check took place on 21DEC2017, when such a restriction was not yet included in his CMA.

On 19MAR2020, Resolution No. 537 implemented Amendment 04 to RBAC 67, removing the term “at the discretion of the examiner” from several sections, including section 67.95, which has the following wording:

67.95 Osteoarticular requirements

(a) The applicant may not possess:

- (1) active disease of bones, joints, muscles and tendons;
- (2) functional sequelae of congenital or acquired diseases;
- (3) symptomatic scoliosis, kyphosis and lordosis that may affect flight safety; or
- (4) disc herniation with neurological symptoms.

(b) The candidate must not have an abnormality of bones, joints, muscles, tendons or related structures likely to cause any functional disability that could affect flight safety, as well as amputation in extremities or use prostheses or orthotics, unless that the condition has been the subject of a specific investigation and that, at the discretion of the ANAC, the condition is not likely to affect flight safety.

On 28MAY2020, revision B of IS 67-004 was published, maintaining in section 5.15 the same clarifications regarding the medical flight test request:

5.15 Osteoarticular requirements

5.15.1 Candidates with inflammatory, infiltrative, traumatic or degenerative diseases of the musculoskeletal system may be considered fit, as long as the pathology is in remission, without the use of medication that affects the safe exercise of air activity. In this case, the ANAC may request a flight medical test and issue a judgment with a ban on solo flight.

5.15.2 The ANAC may request a medical flight test, with special attention to emergency and evacuation procedures, for candidates with abnormal physical structure, including obesity, muscle weakness, alterations in limbs or spine. The candidate can be considered fit with restriction of prohibition of solo flight.

5.15.3 The candidate with a malignant condition of the musculoskeletal system must be evaluated considering the anatomical and functional impairment, the prognosis, and the histopathological type of each condition.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

According to data collected, the crewmember had been working as a helicopter pilot since 2011 and had more than 20 years of experience as an aeronautical maintenance mechanic, as well as having worked professionally in the Amazon region.

In his professional history, there was no record of involvement in an aeronautical occurrence.

The HMNT Class Rating Form, from the verification flight carried out on 21DEC2017, stated that the pilot had demonstrated safe piloting in all performed maneuvers.

However, in an interview with other pilots, the PIC was described as a self-confident and exhibitionist person, known for performing maneuvers considered “bold”. This

information was corroborated by observers in the city of Novo Aripuanã - AM, who reported seeing the pilot performing maneuvers described as “risky” a few days before the accident.

In addition to this information, videos posted on the internet showed the PT-YTJ being operated by the PIC and performing maneuvers not prevised in the flight manual after the take-off from Novo Aripuanã on the day of the accident.

According to information from the pilot who had carried out the transfer of the aircraft from São Paulo to Novo Aripuanã, the PIC of the occurrence was highly motivated, as the owner of the aircraft had the intention of setting up an air operation aimed at tourism in the region, so that he had created an expectation of being hired for this purpose.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

There were no survivors.

1.16 Tests and research.

The ARRIEL 1D1, SN 19203 engine, which equipped the PT-YTJ aircraft, was dismantled and inspected at SAFRAN, headquartered in Duque de Caxias - RJ.

During the inspection, disassembly, and analysis, it was evident that the engine was operating normally and was developing power at the moment the aircraft was involved in the accident.

In its internal components, no faults were identified, such as deflation, overheating, or anything that could compromise the functioning of the engine during its operation.

1.17 Organizational and management information.

The PT-YTJ operator was a company whose business activities consisted of performing auxiliary air transport, except for operating airports and landing fields.

According to what was found at the time of the occurrence, through the company's CNPJ, these activities included: the operation of facilities for air navigation (radio beacons, flight control center, RADAR stations, etc.), luggage storage services at airports, passenger transfer services within airports, fire prevention and extinguishing services at airports, aircraft interior cleaning services, other auxiliary activities to air transport not previously specified, and the services of pilots of airplanes incorporated as a company.

The company was based in São Paulo - SP, and the aircraft had been moved to Novo Aripuanã - AM to provide service to an Inn located in the region. The PIC was not part of the company's staff, having been hired as a freelancer.

According to the records contained in the Certificate of Full Content of the aircraft, issued by the ANAC, on 04APR2019, the transfer of the aircraft's ownership, PT-YTJ brands, to Good Fly Locação de Serviços Ltd., according to the contract dated 01MAR2019 and improved on 18MAR2019.

The company was not authorized to provide the non-scheduled public air transport service in the form of air taxi, according to the list available for consultation on the ANAC website, and the aircraft that was being operated was not registered in the TPX category.

The public air service for transporting people or cargo, duly remunerated, could only be performed by an airline certified by the ANAC after complying with all the requirements of the certification processes prevised in the RBAC No. 135 and its respective ISSs. Such processes included the presentation of documents, compliance with guidelines, preparation

of operation manuals among others, and seeking to ensure flight safety and, consequently, not expose passengers to any risk.

In April 2019, in an attempt to minimize and curb the use of irregular air transport, especially in the Amazon region, where there were several challenges for carrying out inspections, the ANAC made available an application entitled "Voe Seguro" capable of providing information about aircraft and companies authorized to perform the air taxi service.

In January 2020, the ANAC published Resolution No. 540 amending Resolution No. 472, of June 2018, which established administrative measures arising from the exercise of inspection activities under the ANAC's competence, including the definition "Clandestine Passenger Air Transport - TACA Pax" as the "passenger air transport service performed by an individual or legal entity, in a remunerated manner, in disagreement with or without the certificate, authorization or grant, as applicable, for the performance of this service".

Finally, it should be noted that, even after several requests and a formal notification from the Investigation Team, the owner did not send all the requested aircraft documentation.

1.18 Operational information.

The evidence gathered by the Investigation Team indicated that the aircraft was within the weight and balance limits, and had enough fuel to fly the plane.

The Investigation Team interviewed another pilot, who had flown the PT-YTJ, from São Paulo - SP, to Novo Aripuanã - AM, in order to provide services to an Inn in that region. He reported having flown in the region, prior to the arrival of the PIC, in two distinct periods, namely between 10 and 22MAR2019 and between 12 and 26APR2019. It was also informed that the PIC arrived in the area only on 25 APR2019.

According to this pilot, the aircraft's overnights were held at the Acari Inn. The landings in SWNA were made only to refuel the aircraft, load material and transport personnel needed for the services at the Aripuanã Inn, which was being renovated.

Each stage between SWNA and the Aripuanã Inn took approximately 25 minutes of flight time. The model of the crashed aircraft had a range of approximately 4 hours with full tanks.

According to information obtained from third parties, the flight that culminated in the accident was intended to transport technicians to install the internet at the Aripuanã Inn. According to this information, the pilot and three passengers were on board, possibly the technicians who would perform the service.

As the wreckage of the aircraft was found about 41 NM from SWNA and close to the planned route, it was inferred that there was no significant deviation from the planned course.

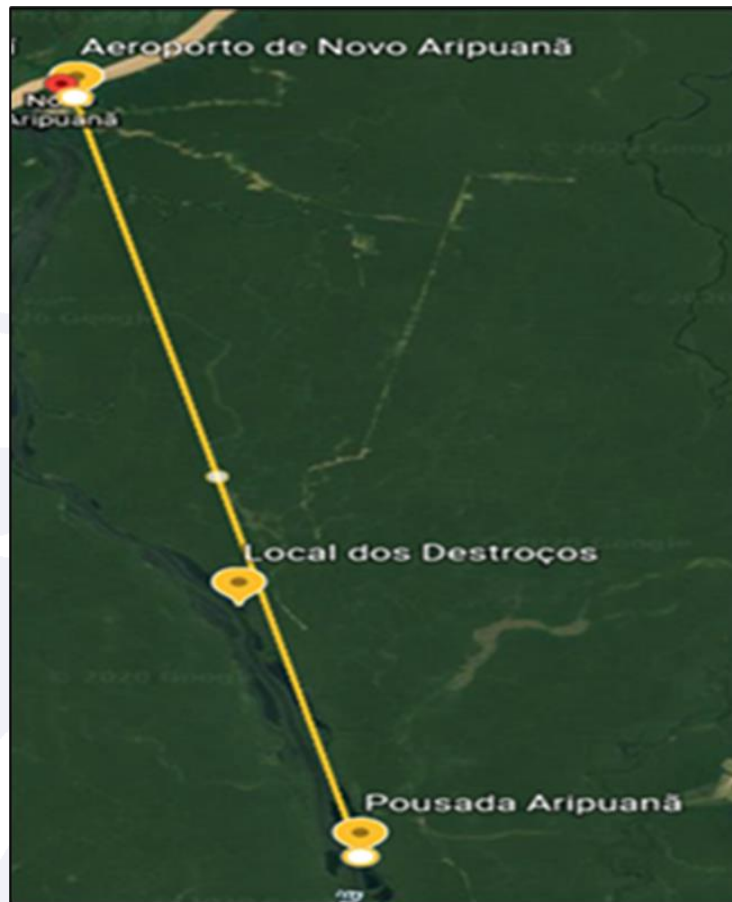


Figure 5 - Planned route for the aircraft and the wreckage site. Source: adapted from the Google Maps.

According to reports from observers and videos collected in Novo Aripuanã - AM, the pilot had already performed aerobatic maneuvers with the aircraft in that region a few days before the accident.

In a video received by the Investigation Team, it was possible to see the aircraft taking off for the flight in which the accident occurred. In this video, soon after the take-off and with passengers on board, an aerobatic maneuver was performed at low altitude, popularly known as "V-Zero" (Figure 6).



Figure 6 - Sequence of images from the aircraft PT-YTJ, performing the "V Zero" maneuver Source: ground observers in Novo Aripuanã - AM.

In this maneuver, the pilot would start an almost vertical climb, using high pitch attitude, until the speed reaches near zero and then, with the application of the tail rotor control, act in the vertical axis, approaching the ground in a pitched down attitude, in order to increase speed to allow recovery of level flight.

Item 15 Restrictions, Section 2-1 - Operations Limitations of the AS 350 B2 Flight Manual prohibited aerobatic maneuvers:

The following are prohibited:

- Flying in icing conditions
- Aerobatics
- Engine power reduction in flight using fuel flow control except for autorotational training.

On 07MAY2021, Airbus published Safety Promotion Notice No. 3640-P-00 warning about the risks associated with intentional deviation from normal flight maneuvers.

According to the text, lessons learned from previous accidents or incidents involving such deviations showed that a recurring aspect was the lack of preparation for the execution of such maneuvers, which were carried out in an improvised, impulsive and unplanned manner.

Among the risks associated with deviations from normal maneuvers was the one related to the extrapolation of the helicopter's certified flight envelope. As a consequence, some components could be subjected to loads for which they were not designed. This put the aircraft and passengers at risk, not only during the maneuver, but also on all subsequent flights, if the event was not reported and properly investigated.

The publication reproduced the concept of aerobatic flight contained in Chapter 1, Annex 2, of the ICAO:

Aerobatic flight: Maneuver intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal variation in speed.

Safety Promotion Notice no. 3640-P-00 also pointed out that the warning about the prohibition of acrobatic flights had already been inserted in the manufacturer's helicopter Flight Manual.

Still in relation to maneuvers recorded on video, paragraph 3.2.1 of the ICA 100-4 - "Special Air Traffic Rules and Procedures for Helicopters", provided that:

3.2.1 Except for landing and take-off operations, or when authorized by the DECEA Regional Organization with jurisdiction over the area in which the operation is intended, helicopter VFR flight will not be performed over cities, towns, inhabited places or over a group of people in the open air, at a height of less than 500 feet above the highest obstacle existing in a radius of 600 m around the aircraft.

On 12APR2003, Eurocopter issued *Lettre-Service* No. 1648-29-03 addressing the Servo Transparency phenomenon.

The Servo Transparency phenomenon is a reaction that can be observed in any helicopter equipped with unique hydraulic system, if operated beyond the approved flight envelope, during the execution of an abrupt maneuver or with high positive load factors. In the case of this helicopter model, the self-correction causes an uncommanded right-hand and collective cyclic reaction towards pitch reduction and, consequently, aerodynamic loading.

The following factors contribute to the occurrence of the Servo Transparency phenomenon: higher speed and gross weight, too much use of the collective in the direction of pitch increase, excessive positive load factor and high-altitude density. Thus, the combination of these factors should be avoided during the execution of maneuvers:

The pilot's reaction to the first indication of feedback from opposing forces should be to immediately reduce the aggressiveness of the maneuver. The pilot should follow the helicopter's self-correcting motion, allowing the collective pitch to decrease to reduce the overall load on the rotor system and gently counteract the right-hand

cyclic tendency in order to avoid a sudden left-hand cyclic movement when hydraulic assistance is restored.

1.19 Additional information.

It is important to note that the PIC's HMNT Rating, with expiration date in December 2019, i.e., valid at the time, guaranteed him the exercise of the "Pilot in Command" function, as observed in Figure 7, without any type of restriction being recorded.

HABILITAÇÕES			
Tipo	Validade	Função	Situação
HMNT	12/2019	Piloto em Comando	

Figure 7 - Extract of the PIC's Rating. Source: ANAC.

In addition, as a holder of the PCH, it was possible to exercise the following prerogatives, as provided in section 61.105 of the RBAC nº61:

61.105 Prerogatives of the holder of the commercial pilot license and conditions that must be observed to exercise them

(a) Subject to compliance with the precepts set forth in these Regulations, the privileges of the holder of a commercial pilot license are:

(1) to exercise all the prerogatives of the holder of a private pilot license of the corresponding aircraft category;

(2) to act as pilot-in-command of aircraft not employed in public air transport service flights

(3) act as pilot-in-command on public air transport service flights, in an aircraft certified to operate with a minimum crew of one (1) pilot;

(4) act as second-in-command on public air transport service flights in an aircraft certificated for operation with a minimum crew of at least two (2) pilots; and

(5) for the airship category, to fly the aircraft in instrument flights.

In this context, the pilot in question was "qualified" to operate in command of aircraft certified as Single Pilot, in which the minimum crew consisted of only one pilot.

In addition, the pilot did not have, in his rating, any aircraft classified as "type", i.e., certified for minimum crew of 2 (two) pilots, as stated in Subpart A, "General Provisions", of the RBAC nº61.

61.5 Licenses, certificates and ratings issued in accordance with this Regulation

[...]

(b) The following qualifications are endorsed on the licenses indicated in paragraph (a) of this section:

(3) type ratings: are endorsed on pilot licenses in the following cases:

(i) aircraft certificated for operation with a minimum crew of two (2) pilots;

Thus, there were doubts about the ways to prevent pilots with solo flight restriction from operating aircraft with Single Pilot approval.

In this sense, Subpart C, Requirements for Obtaining 1st Class CMA, of the RBAC nº 67, Amendment 01, in force at the time, defined that

67.71 General provisions

[...]

(f) In the expert health examinations, the function the applicant performs or will perform should be taken into account, as well as the therapeutic resources and prognosis of the disease that may exist.

Regarding the Flight Plan, despite not being mandatory to submit it in the region where the aircraft was operating, the Investigation Team asked the ANAC about the existence of a mechanism that was able to not allow that a pilot, with solo flight ban, could have his Flight Plan approved as PIC, when operating a Single Pilot helicopter, as was the case of the aircraft PT-YTJ.

The ANAC informed that they could not guarantee that pilots with the restriction in question had their Flight Plans rejected, because the approval process was under the full control of the CGNA.

There was only an alert to the CGNA, through the DCERTA, in case there were "problems in the pilots' documentation".

Thus, it was not clarified whether the solo flight ban was included in the term "pilot documentation problems", leaving doubts as to the effectiveness of this procedure.

Thus, doubts remained about how to reconcile the restrictions imposed by the CMA with the prerogatives of a holder of the PCH license, as well as how to monitor and supervise these operations.

Art. 88-Q, of Section IV, "About the Access to Aircraft Wreckage", of Law No. 12,970, of 08MAY2014, which dealt with the investigations of the SIPAER and access to aircraft wreckage established that:

The duty to remove aircraft involved in an accident, wreckage and property transported, in any part, shall be of the aircraft operator, who shall bear the resulting expenses.

In this sense, the SIPAER Investigation Authority requested the owner to remove the wreckage, as well as to make the documentation available for analysis. However, these requests were not fully answered, and only the radio navigation panel and the engine were recovered by the owner.

Therefore, the impossibility of access to all the documents and the wreckage, by the investigators, hindered the progression of the investigation actions for this occurrence, especially on the structural aspects of the aircraft.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a flight to transport personnel between SWNA and an Inn located in the Acari River.

According to what was found, the flight that ended up with this accident was to transport technicians to install the internet at the Aripuanã Inn. According to this information, the pilot and three passengers were on board, possibly the technicians who would perform the service.

From the data obtained about the operation of the aircraft, it was inferred that it was within the limits of weight and balance, and had enough fuel to meet the planned flight stage.

The aircraft disappeared after taking off from SWNA, being found destroyed and without survivors, on 10MAY2019, about 41 NM from Novo Aripuanã, near the planned route.

Weather conditions were favorable for the VFR flight.

The examination of the ARRIEL 1D1, SN 19203 engine, which equipped the aircraft, identified no faults, overheating or anything that could compromise the engine during operation.

The pilot had experience in the type of flight. However, according to the data recorded in the SACI, it was not possible to verify if he acted as PIC of a HMNT class aircraft within the 90 (ninety) days preceding the date of the beginning of his operation in Novo Aripuanã. The pilot's last registered flight was dated 12JAN2019.

The company that operated and owned the helicopter had acquired the PT-YTJ, in March 2019, and was not authorized to provide non-scheduled air transport service. The PIC was not part of the company's staff, having been hired as a freelancer.

In this sense, the hiring of a pilot with prohibition for solo flight, as stated in the status of his CMA, revealed inefficiency in both the management and supervision of the company's organizational processes, since there was the recruitment and selection, probably due to lack of knowledge, of a pilot who would operate a Single Pilot helicopter, with restriction for solo flight.

Regarding the PIC restriction for solo flight, the Investigation Team verified that in the last Health Inspection, performed on 07FEB2019, it was identified that this crewmember had undergone hip surgery as a result of a car accident.

According to the medical report of this Health Inspection, the pilot presented, as a consequence of the car accident, left dorsiflexion paresis, whose main limitation was left foot flexion, which was further aggravated by brisk marching, slight paresis of plantar flexion, with mild atrophy of the gastrocnemius and light to moderate atrophy of the anterior tibial.

Due to the physical limitations detected during this Health Inspection, the crewmember was considered "Fit with Restriction to Solo Flight".

It was found that the PIC was aware of his physical limitations, which were expressly described in his CMA, but, despite these limitations, the pilot operated without the accompaniment of another crewmember, contrary to the provisions of section 61.25 (a) (1) of the RBAC nº 61.

In this sense, considering the findings about the pilot's real psycho-physical abilities, who presented a condition of mononeuropathy of the lower limbs, even though he was considered "Fit with restriction to solo flight" for the CMA 1st class revalidation, there were doubts regarding the decision to grant that certificate, especially when analyzing what was prevised in sections 67.77 (a) (14) and 67.95 (a) (b) of the RBAC nº 67.

In the case of the pilot's pathology, it was considered that there was excessive subjectivity in the judgment regarding the granting of the CMA by the accredited clinic, and the reasoned justifications to support such evaluation were not recorded, as established in section 67.3 of Subpart of the RBAC nº 67.

With the publication of Amendment 04 to the RBAC 67, on 19MAR2020, it is understood that this discretion was solved, since the competence of the decision passed to the ANAC. However, by revising the IS 67-004 without changing section 5.15, it was apparently not clear to the examiner how to request or conduct a "specific investigation" as established in letter (b) of section 67.95, in view of the fact that this procedure was not inserted in that IS that was updated.

Moreover, as provided by letter (f) in the RBAC 67.71, to obtain or revalidate the referred CMA, it should have been considered the function on board that the applicant was or would be exercising, that is, whether the restriction "No Solo Flight" would be appropriate to the operational reality of that crewmember. However, this assessment did not occur, since the CMA was issued with a favorable opinion, but with a restriction on solo flight for a PIC that only flew aircraft certified to operate with only one pilot.

Nevertheless, it was concluded that obtaining or revalidating a 1st Class CMA, with restriction to solo flight, taking into account any psychophysical limitations that could impact

the safety of the operation, could also be validated through a medical flight test, as provided in section 5.12.1 of the IS 67-004A, which was not requested by the ANAC.

The pilot's attitude, notably linked to performing acrobatic maneuvers that were attested by observers on the ground and by videos collected in Novo Aripuanã - AM, revealed that, in addition to not observing the aspects related to the procedures provided, he overestimated his operational capacity, therefore disregarding the risks involved in the operation. Moreover, the data pointed to a more exhibitionist posture of the pilot, since he commonly performed aerobatic maneuvers in the aircraft.

On the day of the accident, it was observed that, after the take-off and with the passengers on board, an aerobatic maneuver was performed at low altitude, contrary to both existing provisions of the ICA 100-4 and item 15 Restrictions, Section 2-1 - Operations Limitations of Flight Manual AS 350 B2.

Therefore, the Investigation Team developed the hypothesis that, during a possible operation of the aircraft out of the regulations and standards (aggressive maneuvers that exceeded the helicopter's certified flight envelope), the PIC may have experienced physical demands that he was not able to withstand, due to his medical condition.

In this sense, the physical restrictions indicated may have contributed, at a certain moment of the flight, to the pilot's inability to use the flight controls in their full amplitude, especially regarding the use of the pedals, responsible for controlling the yaw movement.

Ineffective pedal operation may have contributed to a possible loss of control of the aircraft in flight, which may explain the degree of destruction observed at the wreckage site.

Additionally, and based on the reports from ground observers who reported the recurrence of the PIC to intentionally perform maneuvers involving abrupt attitude changes, it cannot be ruled out, however, that the PT-YTJ was subjected to high positive load factors, which would constitute an operation vetoed by the AS 350 B2 Flight Manual.

Safety Promotion Notice No. 3640-P-00 warned, based on lessons learned from other accidents, about the lack of preparation for the execution of such deviations, which were carried out in an improvised, impulsive and unplanned manner.

Thus, the publication continued, among the risks associated with deviations from normal maneuvers was that of exceeding the helicopter's certified flight envelope. This would put the aircraft and passengers at risk not only during the maneuver, but also on all subsequent flights if the event was not reported and properly investigated.

That said, it cannot be ruled out that the PT-YTJ was exposed to structural stresses that exceeded the certified flight envelope for the helicopter which, consequently, may have affected the integrity of some component vital to the controllability of the aircraft.

It is worth noting that this was not the first time the pilot had operated out of the regulatory predictions. Previous successful experiences may have led him to disregard, once again, important aspects for planning and conducting a safe flight.

Besides, the manuals, regulations and instructions existing at the time of the occurrence were not enough to inhibit the unsafe acts of the pilot in flight. Moreover, inconsistencies present in the CMA revalidation process allowed the pilot to continue acting in an operational reality inconsistent with the limitations described.

Thus, by not meeting the minimum safety levels defined by the Brazilian State, guaranteed through compliance with rules and regulations, latent unsafe conditions can be created, which should be eliminated or mitigated through compliance with the regulation itself.

3. CONCLUSIONS.

3.1 Facts.

- a) the pilot had the PCH License and had a valid HMNT Rating;
- b) the pilot had experience in the type of flight, but it was not possible to verify compliance with the requirements established for recent experience;
- c) the pilot had a valid CMA, but with a "No Solo Flight" restriction;
- d) there is no record that a medical flight test was requested;
- e) the pilot had mononeuropathy in the lower limbs;
- f) the pilot was hired, as a freelancer, to operate a Single Pilot helicopter;
- g) the aircraft had a valid CA;
- h) the aircraft was within weight and balance limits;
- i) the weather conditions were favorable for the flight;
- j) the pilot performed aerobatic maneuvers with the aircraft in Novo Aripuanã - AM;
- k) the aircraft disappeared, after taking off from SWNA, being found on 10MAY2019, in the Aripuanã River, near the Flechal Community;
- l) it was evidenced that the engine was functioning normally and was developing power at the moment of the accident;
- m) the aircraft was destroyed; and
- n) no survivors were found.

3.2 Contributing factors.

- **Control skills – undetermined.**

The PIC may not have been able to use the flight controls to their full extent, especially with regard to the use of the pedals, which are responsible for controlling the yaw motion.

- **Attitude – undetermined.**

The pilot's behavior in relation to the air activity, described by observers and present in the videos collected, demonstrated an overconfidence in his own operational capacity, to the point of disregarding both his medical and operational condition, as well as the risks involved in operating outside the procedures provided in the AS 350 B2 Flight Manual and ICA 100-4.

- **Illness – undetermined.**

The pilot's last Health Inspection report was "fit with restriction to solo flight", due to his left foot paresis. The limitation was flexion and extension of the left foot, with brisk marching, mild paresis of plantar flexion, with mild atrophy of the gastrocnemius and mild to moderate atrophy of the anterior tibial.

It could not be ruled out that the presence of limitation of movements necessary to control the aircraft may have contributed to an eventual loss of control in flight.

- **Piloting judgment – undetermined.**

By performing aerobatic maneuvers, without planning, impulsively and in an improvised way, the PIC may have exceeded the certified flight envelope for the helicopter.

- Decision-making process – undetermined.

The ability to adequately assess the flight situation and act as expected for such situation was compromised, considering the positive experiences that the pilot already had in other uneventful flights. Thus, it is possible that, once again, relevant aspects (rules, regulations, medical and operational conditions) were not valued to perform the flight safely.

- Organizational processes – undetermined.

The hiring of a pilot with a solo flight ban, as stated in his CMA status, revealed inefficiency in the management of the company's organizational processes, since there was the recruitment and selection of a professional, who would operate a Single Pilot helicopter, with a solo flight restriction.

- Support systems – undetermined.

There were no specific requirements for the issuance of an opinion with restriction on solo flight, which characterized inadequacy of the set of rules made available for individuals to perform their duties.

Likewise, there were no mechanisms in place to allow the monitoring and enforcement of pilots with a prohibition restriction on solo flight.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

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:

To the Brazil's National Civil Aviation Agency (ANAC):

A-073/CENIPA/2019- 01

Issued on 11/03/2022

Evaluate the need to update the IS 67-004, in order to clarify the necessary procedures regarding the performance of "specific investigation", to issue an opinion prohibiting the performance of solo flight, instruction flight or flight with another pilot with CMA restriction, as well as the criteria for performing the medical flight test, so that there is no possibility that the physical condition affects flight safety.

A-073/CENIPA/2019- 02

Issued on 11/03/2022

Assess the relevance of creating mechanisms for monitoring and inspecting pilots whose CMAs are issued with restrictions for solo flight, instruction flight, or flight with another pilot with CMA restrictions.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On November 3th, 2022.

