

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A - 061/CENIPA/2013

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PT-HUW
MODEL:	BELL 412
DATE:	27MAR2013



NOTICE

According to the Law n^o 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 n^o 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 27MAR2013 accident with the BELL 412 aircraft model, registration PT-HUW. The accident was classified as “[LOC-I] Loss of Control in Flight”.

The aircraft took off from the 9PCI platform (Floating Production Storage and Offloading - FPSO - RIO DE JANEIRO) to the 9PSL platform (P-07), in order to carry out a cargo transport flight, with two crewmembers and one passenger on board.

In the final approach for landing on the P-07 platform, there was a noise followed by a strong vibration. The crew made an approach to land on the water.

After landing, the three occupants evacuated the aircraft without external assistance and were rescued.

During the helicopter's rescue maneuver, there was a section between the main transmission and the fuselage, which sank, not being recovered from the bottom of the sea.

The aircraft was destroyed.

The occupants left unharmed.

An Accredited Representative of the Transportation Safety Board (TSB) - Canada, (State of manufacture of the aircraft engines) was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS	5
1. FACTUAL INFORMATION.....	6
1.1 History of the flight.....	6
1.2 Injuries to persons.....	6
1.3 Damage to the aircraft.....	6
1.4 Other damage.....	6
1.5 Personnel information.....	7
1.5.1 Crew's flight experience.....	7
1.5.2 Personnel training.....	7
1.5.3 Category of licenses and validity of certificates.....	7
1.5.4 Qualification and flight experience.....	7
1.5.5 Validity of medical certificate.....	7
1.6 Aircraft information.....	7
1.7 Meteorological information.....	7
1.8 Aids to navigation.....	8
1.9 Communications.....	8
1.10 Aerodrome information.....	8
1.11 Flight recorders.....	8
1.12 Wreckage and impact information.....	8
1.13 Medical and pathological information.....	10
1.13.1 Medical aspects.....	10
1.13.2 Ergonomic information.....	10
1.13.3 Psychological aspects.....	10
1.14 Fire.....	10
1.15 Survival aspects.....	10
1.16 Tests and research.....	10
1.17 Organizational and management information.....	13
1.18 Operational information.....	13
1.19 Additional information.....	14
1.20 Useful or effective investigation techniques.....	14
2. ANALYSIS.....	14
3. CONCLUSIONS.....	15
3.1 Facts.....	15
3.2 Contributing factors.....	16
4. SAFETY RECOMMENDATION.....	16
5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.....	16

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

9PCI	ICAO Location Designator – FPSO RIO DE JANEIRO
9PSL	ICAO Location Designator – P-07 Platform
AFA	Air Force Academy
CA	Airworthiness Certificate
CFOAV	Aviation Officer Formation Course
CMA	Aeronautical Medical Certificate
DCTA	Department of Science and Airspace Technology
FPSO	Floating Production Storage and Offloading
IFRH	Helicopter Flight IFR rating
METAR	Aviation Routine Weather Report
MGB	Main Gearbox
NSCA	Aeronautics Command System Standard
PCH	Commercial Pilot License – Helicopter
PLH	Private Pilot License – Helicopter
PPH	Private Pilot License – Helicopter
RBAC	Brazilian Civil Aviation Regulation
RBHA	Brazilian Aeronautical Certification Regulation
SERIPA III	Third Regional Aeronautical Accident Investigation and Prevention Service
SIGWX	Significant Weather
TPX	Aircraft Registration Category of Non-Regular Public Air Transport
UTC	Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	Model: BELL 412	Operator: <i>Líder Táxi Aéreo S.A. - Air Brasil</i>
	Registration: PT-HUW	
	Manufacturer: Bell Helicopter	
Occurrence	Date/time: 27MAR2013 – 1329 UTC	Type(s): “[LOC-I] Loss of Control in Flight”.
	Location: Bacia de Campos	
	Lat. 22°45'30"S Long. 041°41'00"W	Subtype(s): NIL
	Municipality – State: Macaé – RJ	

1.1 History of the flight.

The aircraft took off from platform 9PCI (FPSO RIO DE JANEIRO) to the platform 9PSL (P-07), at about 1310 (UTC), in order to transport cargo, with two crewmembers and one passenger on board.

At the time of the final approach for landing on the P-07 platform, the pilots reported hearing a noise followed by a strong vibration in the aircraft.

A camera installed on the platform registered the helicopter in an attitude of high pitch up. Afterwards, the crew made a right turn, aborting the landing and starting a descent for emergency landing in the water.

After touching the surface of the sea, with the rotors still spinning, the helicopter tilted to the left, colliding the main rotor blades against the water.

The floats were automatically activated and the helicopter remained floating in the back position.

The three occupants evacuated the aircraft without external assistance and were subsequently rescued.

The aircraft was destroyed. The three crewmembers left unharmed.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor	-	-	-
None	2	1	-

1.3 Damage to the aircraft.

The aircraft, during the water withdrawal maneuver, had its main transmission sectioned from the fuselage, which sank and was not recovered from the bottom of the sea, making it impossible to analyze the damage from the occurrence.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours		
	Pilot	Copilot
Total	6.000:00	1.800:00
Total in the last 30 days	20:00	45:00
Total in the last 24 hours	05:30	05:00
In this type of aircraft	1.000:00	200:00
In this type in the last 30 days	20:00	23:00
In this type in the last 24 hours	05:30	05:00

N.B.: The data related to the flown hours were obtained through the pilots' statements.

1.5.2 Personnel training.

The pilot took the CFOAV at the Air Force Academy (AFA), in Pirassununga – SP, in 1978.

The copilot took the PCH course at EDAPA – Aviation School, Campinas - SP, in 1999.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PLH License and had valid BH41 aircraft type Rating (which included the BELL 412 model) and IFRH Rating.

The copilot had the PCH License and had valid BH41 aircraft type Rating (which included the BELL 412 model) and IFRH Rating.

1.5.4 Qualification and flight experience.

The pilots were qualified and had experience in the kind of flight.

1.5.5 Validity of medical certificate.

The pilots had valid CMAs.

1.6 Aircraft information.

The aircraft, serial number 33183, was manufactured by Bell Helicopter, in 1988, and it was registered in the TPX category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe and engine logbooks records were updated.

The last inspection of the aircraft, the "25H/30DAYS" type was carried out on 12MAR2013 by the maintenance organization *Líder Táxi Aéreo*, in Macaé - RJ, with the aircraft having flown 18 minutes after the inspection.

The last overhaul of the aircraft, the "3.000H/5years" type was carried out on 27MAY2011 by the maintenance organization *Líder Táxi Aéreo*, in Macaé - RJ, with the aircraft having flown 1.649 hours and 10 minutes after the overhaul.

1.7 Meteorological information.

The crew had available weather information for the route and also the landing site on the platform.

At the time of the event, it was raining, with continuous wind of 360° and 25kt, and clouds at 2,500ft, according to the meteorological information of the area where P-07 was located. On approaching the platform, close to the landing area, the weather conditions deteriorated, impairing visibility.

The SIGWX of 1200 (UTC) in South America presented the possibility of cloud formations in the region where the occurrence happened, in addition to rain, as highlighted in Figure 1.

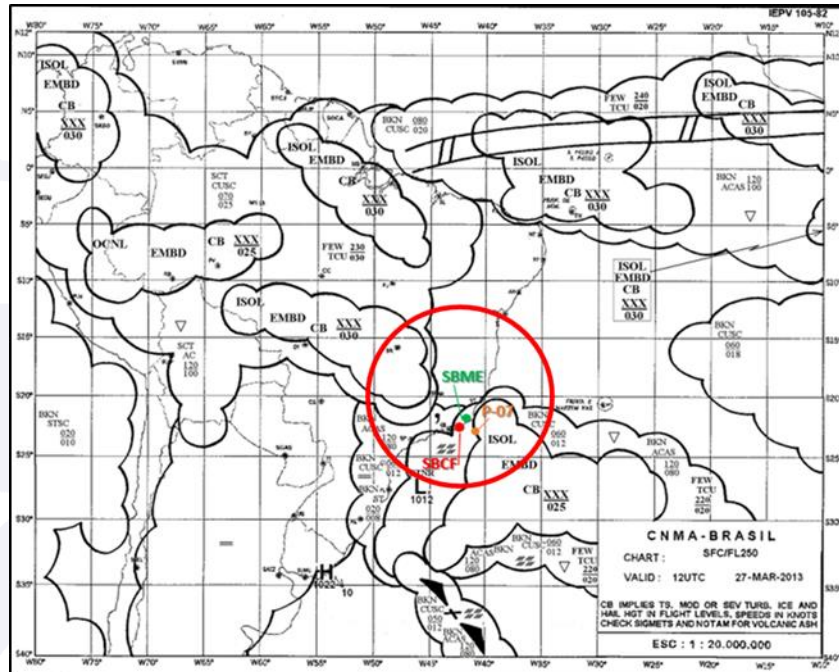


Figure 1 - SIGWX weather chart.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place outside the Aerodrome.

1.11 Flight recorders.

It was not possible to recover the equipment from the bottom of the sea.

1.12 Wreckage and impact information.

The accident occurred in the open sea, during the final approach to the P-07 platform, with no previous impact. After the ditching, the wreckage was concentrated.

The camera positioned on the platform's helideck filmed the collision against the water surface.

The impact occurred with low rate of descent and low speed of horizontal displacement. Upon touching the marine surface, the aircraft rolled to the right and the main rotor crashed into the water.

Due to the automatic activation of the floats, the helicopter did not sink and remained floating in the back position (Figure 2).



Figure 2 - Helicopter floating in the back position.

There was no detachment of the Tail Boom or Tail Rotor (Figure 3).



Figure 3 - Tail Boom and Tail Rotor connected to the aircraft.

During an attempt to remove the aircraft from the water, there was a section between the fuselage and the Main Rotor Assy, the Main Gearbox and the Driveshaft (Figure 4).

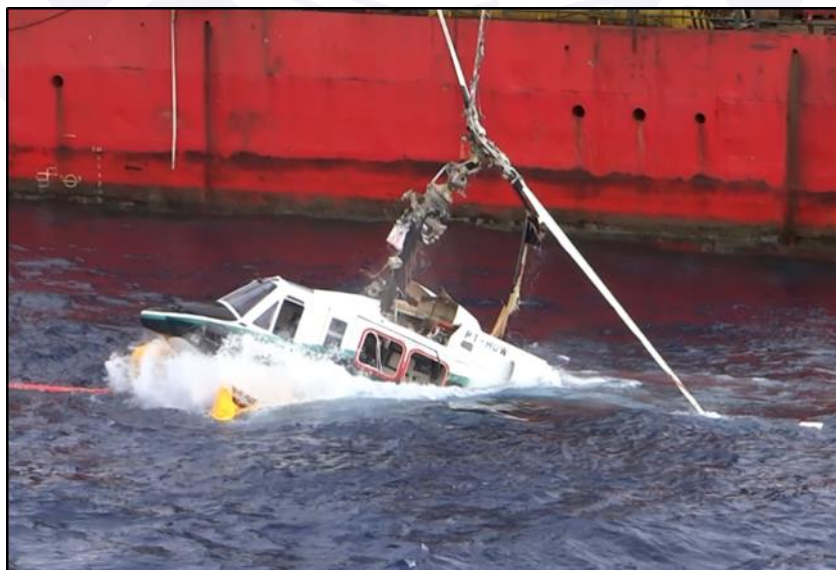


Figure 4 - Moment of the section between the fuselage and the Main Rotor Assy, the Main Gearbox and the Driveshaft.

Thus, only these pieces were removed from the water. The rest of the wreckage sank until it reached the sea floor at 111 meters of depth, not being recovered.

The fact that almost the entire aircraft remained on the bottom of the sea prevented the collection of evidence and the analysis of its systems.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Not investigated.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

The impact of the aircraft against the marine surface did not cause injury to the aircraft occupants, who used the emergency exits to evacuate the helicopter, without the aid of external assistance. Then, the occupants were removed from the water by the P-07 emergency team.

All occupants had the salvage course.

1.16 Tests and research.

Because most of the wreckage was submerged, it was only possible to perform tests on the Main Rotor Assy, Main Gearbox (MGB) and Driveshaft components, which were rescued at the accident site.

The head, mast and main rotor transmission were disassembled, all showing normality for the event, except the Tail Rotor Drive Quill and the Flexible / Coupling of the Main Driveshaft, at the connection end with the MGB. The coupling of the Tail Rotor Drive Quill had rubbing marks (Figures 5 and 6).



Figure 5 - Rubbing marks on the coupling of the Tail Rotor Drive Quill.

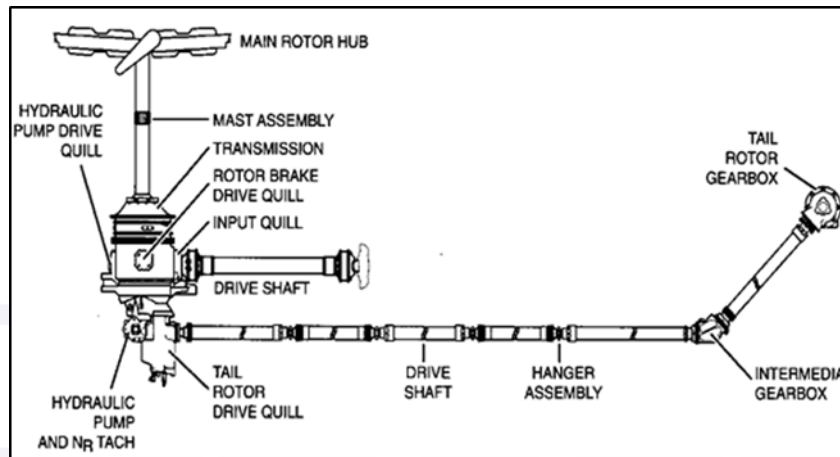


Figure 6 - Position of the Tail Rotor Drive Quill on the power transmission system diagram.

The Main Driveshaft was sent to the DCTA for analysis. As stated in the report issued, the Flexible Coupling had marks on the teeth of the gear and fractures at its ends (Figures 7, 8, 9 and 10).



Figure 7 - Flexible Coupling.



Figure 8 - General aspect of the gear. The white arrow indicates the sequence of marks observed on the gear teeth.

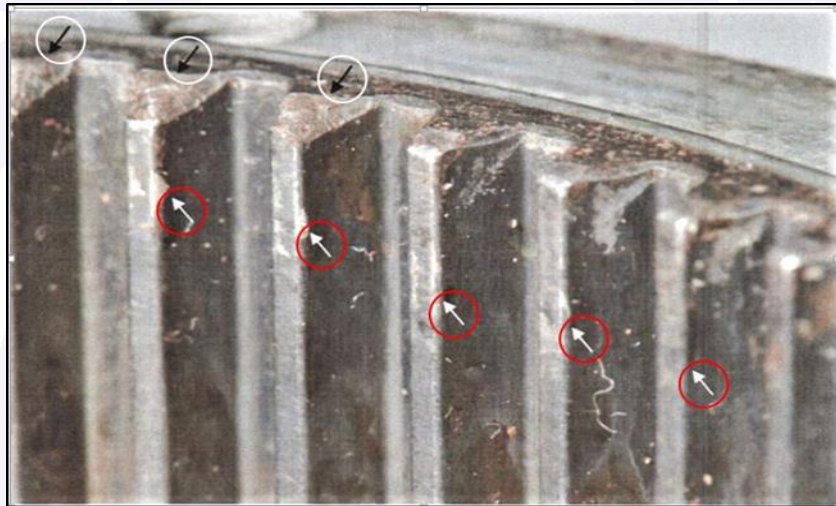


Figure 9 - Detail of the previous figure showing the marks on the gear teeth (white arrows) and fractures on the tips of the teeth (black arrows).

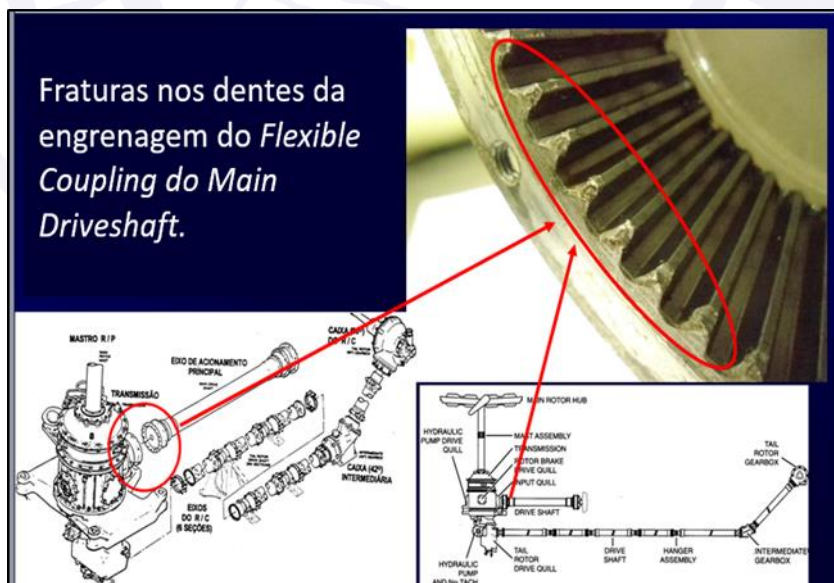


Figure 10 - Fractures in the tips of the teeth of the Flexible Coupling of the Main Driveshaft, at the connection end with the MGB.

The DCTA's technical report brought as a result of the analysis of the parts presented, that the marks and fractures observed in the Flexible Coupling gear teeth seem to indicate that there was a decoupling between the Flexible Coupling and the gear coupled to it. However, for a greater degree of certainty, it would be necessary to analyze the gear that uncoupled, but it has not been recovered.

The reports produced did not conclude whether the damage observed in the analyzes occurred before or after the impact on the water.

1.17 Organizational and management information.

Nil.

1.18 Operational information.

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

The crewmember took off from platform 9PCI (FPSO Rio de Janeiro) to 9PSL (P-07), with three occupants on board, to carry out a cargo transport flight and was instructed by radio *Enchova* to inform in the final approach for landing in P- 07.

For the landing profile used at the time of the occurrence, the aircraft should make an approach to the helideck using a forward and downward displacement towards the landing area.

On approaching the platform, near the landing area, there was a deterioration of metrological conditions, impairing visibility.

At the time of the occurrence, it was drizzling on the spot, the sea was rough and visibility was impaired due to layers of clouds adjacent to the landing site.

The images from the platform camera recorded a flare, with a large pitch up angle, performed by the helicopter (Figure 11), however, on an interview; the pilot did not manifest having performed such a maneuver.

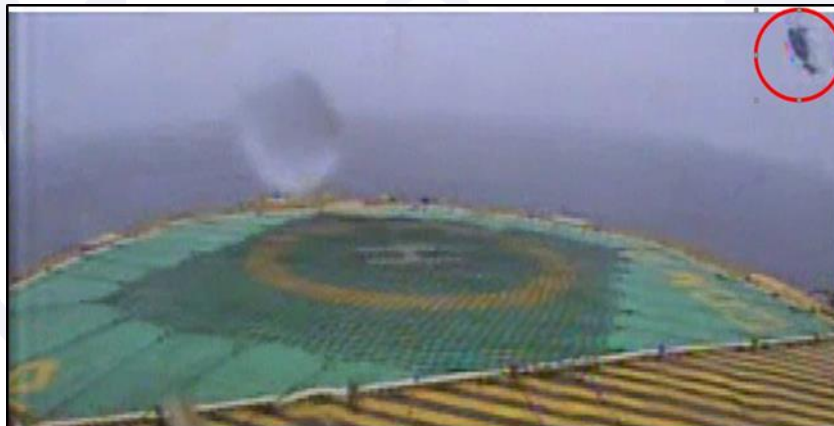


Figure 11 - Image captured from the aircraft approach record.

At the end of the approach, the crewmember heard a noise followed by a strong vibration and a right turn, shortly after, the pilot decided to make a landing in the water, in order to avoid total loss of control of the aircraft and further damage. After touching the sea, with the rotors still spinning, the aircraft toppled to the right.

Due to the images obtained through the video recorded by the vessel where the landing would take place, it is necessary to describe the pitch limitations of the aircraft.

Maneuvering Limitations

Section 1-9-A - PROHIBITED MANEUVERING - of the flight manual established limitations for the BELL 412, prohibiting intentional maneuvers exceeding 50° of roll and pitch in 15° (nose down) and 30° (nose up) , as shown in Figure 12.

1-9. MANEUVERING

1-9-A. PROHIBITED MANEUVERS

Intentional maneuvering resulting in roll attitudes in excess of 50° angle of bank, or pitch attitudes lower than 15° nose down, or higher than 30° nose up are prohibited.

Figure 12 - Description of the manual regarding the prohibition of intentional maneuvers.

After landing in the water, the floats were automatically activated and the aircraft remained floating on its back on the sea surface. The three occupants evacuated the aircraft without external assistance, being rescued by the P-07 team.

1.19 Additional information.

Nil.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The aircraft was carrying out a cargo transport flight, with landing scheduled on platform P-07, with 3 occupants on board.

The commander had the PLH License, had valid IFRH and BH41 qualifications, accumulating a total of 6,000 flight hours, with 1,000 hours on the same helicopter model involved in the accident.

The copilot had the PCH License, had valid IFRH and BH41 qualifications, accumulating a total of 1,800 flight hours, being 200 hours on the same model of aircraft involved in the accident.

The prevailing wind at the destination helideck and at the occurrence site was approximately 25kt in intensity from the 360° direction, according to the meteorological information of the P-07 area.

In addition, there was a restriction on the visibility caused by the rain. The SIGWX chart at 1200 (UTC) in South America, also presented the possibility of cloud formations in the region where the accident occurred.

For the landing profile used at the time of the occurrence, the aircraft should make an approach to the helideck using a forward and downward displacement towards the landing area.

Near the platform, weather conditions have deteriorated. At the end of the approach, the aircraft momentarily increased the pitch angle.

According to the images from the camera positioned on the platform helideck, which recorded the moments immediately before the loss of control of the aircraft, it was possible to check the helicopter with a high pitch up angle.

During an interview, the pilot did not say that he had reached a high pitch up during the final approach for landing. Thus, there was no way to determine whether the attitude shown in the video recording was intentionally performed by the pilot or if it was the result of some other factor.

It was not possible to rule out the hypothesis that the meteorological conditions at the time of the aircraft's approach impaired the pilots' visibility. In this way, there may have been a late perception of the helideck approach and, in order to slow the aircraft, the pilot performed a flare with a high pitch up angle. Although the pitch up limits specified in the aircraft's Flight Manual were probably exceeded, it was not possible to associate this attitude with the following events.

According to reports from the crew, on the final approach for landing, they heard a noise followed by a strong vibration, which would have forced the crewmembers to decide for an emergency landing in the water, to avoid total loss of control of the aircraft.

In the examinations performed by the DCTA, in the parts that could be recovered, it was possible to verify that there were rubbing marks in the coupling of the Tail Rotor Drive Quill. However, if the decoupling of this component had occurred during the flight, the helicopter would have been subjected to rotational movements around the vertical axis, due to the loss of the anti-torque effect of the tail rotor, which did not occur.

According to a report issued by the DCTA, in relation to the Flexible Coupling on the Main Driveshaft, the marks and fractures found on the tips of its teeth seemed to indicate a decoupling. However, it also points out that, for a greater degree of certainty, it would be necessary to analyze the gear that it uncoupled, but it got stuck to the part of the helicopter that sank. Thus, it was not possible to conclude whether or not there was an uncoupling of the axis in flight.

The reports cited did not address whether the damage presented occurred before or after the impact with water.

The impossibility of analyzing the other systems of the aircraft, caused by the non-recovery of its wreckage, drastically limited the amount of investigation elements that could indicate the chain of events involved in the accident, therefore, it was not possible to determine the factors that contributed to the occurrence of this accident.

3. CONCLUSIONS.

3.1 Facts.

- a) the pilots had valid CMA's;
- b) the pilots had valid BH41 aircraft type Rating and IFRH Rating;
- c) the pilots were qualified and had experience in the kind of flight;
- d) the aircraft had valid CA;
- e) the aircraft was within the weight and balance limits;
- f) the airframe and engine logbooks records were updated;
- g) the weather conditions were favorable for the flight, but at the time of the approach these conditions degraded significantly;
- h) the aircraft performed a high angle pitch up flare;
- i) the crew reported that there was a perception of intense vibration in the aircraft;

- j) the pilot made an emergency landing in the water;
- k) the crew was rescued by the platform team where the landing should take place;
- l) during the operation to remove the aircraft from the water, there was a section between the main transmission and the fuselage, which sank, not being recovered;
- m) the aircraft was destroyed; and
- n) the occupants left unharmed.

3.2 Contributing factors.

- **Adverse meteorological conditions – undetermined.**

The meteorological conditions at the location of the occurrence may have impaired the crew's situational awareness, making the notion of approaching the helideck difficult.

- **Piloting judgment – undetermined.**

It is possible that there was an inadequate assessment by the pilot about the aircraft's speed and height parameters in relation to the platform at the time of the approach.

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-061/CENIPA/2013 - 01

Issued on 03/29/2021

Disseminate the lessons learned in the present investigation to the platform operators, in order to warn about the risks inherent to flying in adverse weather conditions, concerning the raise of the situational awareness level of its crew.

A-061/CENIPA/2013 - 02

Issued on 03/29/2021

Work with the aircraft operator in order to reinforce the use of appropriate techniques for the conservation of the wreckage of damaged aircraft, with the purpose of preserving them so that they can be analyzed within the scope of the SIPAER.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 29th, 2021.