COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 036/CENIPA/2017

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-MEY**
MODEL:	**S-76C**
DATE:	**01MAR2017**

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 01MAR2017 accident with the S-76C aircraft model, registration PR-MEY. The accident was classified as “[ARC] ABNORMAL RUNWAY CONTACT – Abrupt Landing”.

During the approach of the helicopter for landing, an excessive sinking occurred, followed by a sudden landing, culminating in its overturning on the helideck.

The aircraft had substantial damage.

The Second in Command (SIC), seven passengers and one person on the platform suffered minor injuries.

The Pilot in Command (PIC) and a passenger left unharmed.

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

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

9PFC	ICAO Location Designator – P-37 Platform
AAFD	Final Approach and Take-off Area
ANAC	Brazil's National Civil Aviation Agency
AOB	Angle of Bank
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
DPC	Directorate of Ports and Coasts
FAF	Final Approach Fix
HFDL	Helicopter Flight Data Monitoring
HIGE	Hover In Ground Effect
HLL	Helideck Limitation List
HMS	Helideck Monitoring System
HOGE	Hover Out Ground Effect
IFR	Instrument Flight Rules
IFRH	Instrument Flight Rating - Helicopter
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LDP	Landing Decision Point
METAR	Meteorological Aerodrome Report
MGO	General Operations Manual
MPFDR	Multi-Purpose Flight Data Recorder
NORMAM	Maritime Authority Standards
P/N	Part Number
PCH	Commercial Pilot License – Helicopter
PIC	Pilot in Command
PLAH	Airline Pilot License – Helicopter
PPH	Private Pilot License – Helicopter
RA	Radio Altimeter
RBAC	Brazilian Civil Aviation Regulation
RDI	Detailed Investigation Report
RFM	Rotorcraft Flight Manual
S/N	Serial Number
SBFS	ICAO Location Designator - Farol de São Tomé Aerodrome, Campos dos Goytacazes - RJ
SBMM	ICAO Location Designator - P-20 Platform, Macaé - RJ

SGSO	Safety Management System
SIC	Second in Command
SIPAER	Aeronautical Accident Investigation and Prevention System
TMX	Terminal Control Area
UM	Maritime Units
UMAR	Flotel Maritime Unit - City of Araruama
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

1. FACTUAL INFORMATION.

Aircraft	**Model:** S-76C **Registration:** PR-MEY **Manufacturer:** Sikorsky Aircraft	**Operator:** OMNI Air Taxi S/A
Occurrence	**Date/time:** 01MAR2017 - 1708 UTC **Location:** P-37 Platform (9PFC) **Lat.** 22º29'43"S **Long.** 040º05'50"W **Municipality – State:**	**Type(s):** "[ARC] ABNORMAL RUNWAY CONTACT" **Subtype(s):** Abrupt Landing

1.1 History of the flight.

The aircraft took off from the Farol de São Tomé Aerodrome (SBFS), Campos dos Goytacazes - RJ, to the P-37 platform (9PFC), at 1635 (UTC), in order to transport personnel, with two crewmembers and eight passengers on board.

On the approach for landing on the P-37, the aircraft sank excessively, followed by an abrupt landing, culminating in its overturning on the helideck.

The aircraft had substantial damage.

The SIC, seven passengers and one person on the platform suffered minor injuries.

The PIC and a passenger left unharmed.

Figure 1 - Aerial view of the aircraft at the scene of the occurrence.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor	1	7	1
None	1	1	-

1.3 Damage to the aircraft.

The aircraft had substantial damage to the main rotor, tail rotor, landing gear and internal engine damage due to the sudden stop of the rotors, in addition to deformations in the fuselage.

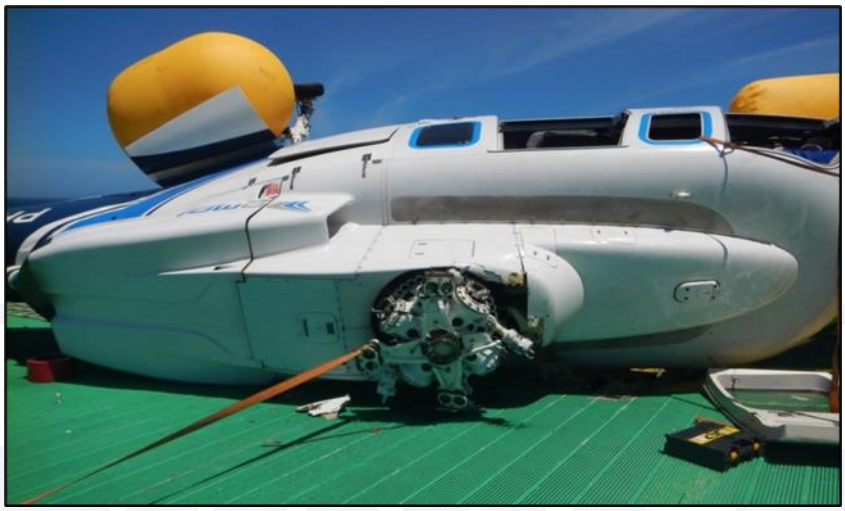

Figure 2 - View of the aircraft, highlighting the damage to the main rotor head.

1.4 Other damage.

The helideck had some damage from the impact of the aircraft, such as torn non-slip net and damaged floor.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours		
	PIC	SIC
Total	7.500:00	3.396:39
Total in the last 30 days	16:08	78:59
Total in the last 24 hours	03:13	03:13
In this type of aircraft	947:48	564:30
In this type in the last 30 days	16:08	78:59
In this type in the last 24 hours	03:13	03:13

N.B.: The data related to the flown hours were obtained from the pilots themselves.

1.5.2 Personnel training.

The PIC took the PPH course at the Master-*Escola de Aviação Civil* Ltd., São Paulo - SP, in 2000.

The SIC took the PPH course at the Helisul *Escola de Aviação Civil*, Curitiba - PR, in 2004.

1.5.3 Category of licenses and validity of certificates.

The PIC had the PLAH - License and had valid SK76 aircraft type Rating and IFRH Rating.

The SIC had the PLAH - License and had valid SK76 aircraft type Rating 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, model S-76C, version S-76C++, serial number 760766, was manufactured by Sikorsky Aircraft, in 2009 and was registered in the TPX Category.

The CA was valid.

The airframe and engine logbook records were updated.

The last inspection of the aircraft, of the “50 hours” type, was carried out on 27FEB2017 by the operator’s own maintenance organization, in Farol de São Tomé, Campos dos Goytacazes - RJ, with the aircraft having flown 6 hours and 30 minutes after the inspection.

The last major inspection of the aircraft, of the “1,500 hours” type, was carried out on 25FEB2017 by the operator’s own maintenance organization, in Farol de São Tomé, Campos dos Goytacazes - RJ, with the aircraft having flown 11 hours and 40 minutes after the inspection.

1.7 Meteorological information.

The Platform P-37 had a radio station for take-off and landing, which was operating normally.

The conditions were favorable for the visual flight, with visibility above 10km, no clouds, wind with a direction of 029º and an intensity of 15kt.

The Helideck Report, issued at 1511 (UTC), was received well in advance for flight planning. It had a wind of 15 kt of intensity and direction of 029° magnetic and 004° in relation to the ship's bow.

It also recorded the following values of helideck movement: pitch of 0.5°, roll of 2.0°, heave of 0.9 m, heave rate of 0.2 m/s and inclination of 2.1°.

There was not a specific field in the Helideck Reports provided by the Maritime Units (UM) to the companies that performed the flights for the helideck height information. Some UMs included this information in the observation field of that bulletin. The information provided by the P-37 did not include the height of the helideck.

The UMAR was attached to the P-37, positioned on its starboard beam. This information was included in the notes field of the P-37 Helideck Report: “UM connected to the starboard side of the unit”.

The UMAR helideck was in an obstacle-free position and aligned with the prevailing wind.

The UMAR Helideck Reports at 1450 (UTC) and 1715 (UTC) showed winds of 006°/28kt and 360°/24kt, respectively.

After the accident, there were several reports from other aircraft that the prevailing wind in that region had gusts of up to 40 kt.

The METAR from the Platform P-20 (SBMM), at 1600 (UTC), presented a wind of 28kt and did not indicate the existence of gusts. Helideck Reports from two nearby UMs, P-35 and P-08, indicated wind with 28 kt and 26 kt, respectively.

The confirmation of the meteorological conditions at the UM and the release of the helideck for landing, when the aircraft contacted the P-37 Radio Operator, took place five minutes after landing. At that moment, the crewmembers received information about the following wind conditions: 023° of direction with 16 kt of intensity.

1.8 Aids to navigation.

All navigation and landing aids operated normally at the time of the aircraft approach and landing.

1.9 Communications.

All communications foreseen and necessary for the operation were carried out normally.

1.10 Aerodrome information.

According to the RBAC nº 01, helideck meant a helipad located in a structure over water, fixed or floating, which could be public or private. It was also called an off-shore helipad.

Its registration and certification followed the NORMAM, and at the time of the occurrence, NORMAM-27/DPC, 2014, Rev 1 Mod 2, published by the Directorate of Ports and Coasts of the Brazilian Navy was in force.

The P-37 platform helideck was privately owned and managed by the Petrobras and had technical conditions for helicopter take-offs and landings during the day and for emergency take-offs and landings at night. It was located at the stern of the ship and in a lower position in relation to the vertical structures of the platform (Figure 3).

Figure 3 - View of the helideck at the stern of the P-37 platform.

The height of the P-37 helideck, according to information available on the Petrobras website, was 34 meters (or 113 ft).

The height of the P-37's helideck, according to the printed version of the HLL, a document available to offshore aviation companies for flight coordination, was 19 meters (or 63 ft).

The Helideck height information may vary due to possible variations in the ship loading.

1.11 Flight recorders.

The aircraft was equipped with a flight data and voice recorder, Multi-Purpose Flight Data Recorder (MPFDR) 120 Solid-State, Part Number (P/N) 1603-02-12 and Serial Number (Y/N) 2321.

In addition, it had equipment for monitoring and acquiring flight data, aiming at a better maintenance of the aircraft, called Helicopter Flight Data Monitoring (HFDM), manufactured by Penny & Giles, P/ N D51615-102 and S/N 008740-004, which was used in this investigation.

The HFDM and the MPFDR readings were performed by the investigators at the headquarters of Omni Air Taxi S/A.

1.12 Wreckage and impact information.

The impact occurred in the central part of the helideck, with no evidence of a previous impact. The distribution of the wreckage was of the concentrated type.

The landing took place in a left roll attitude (approximately 5°), causing the left landing gear to touch the helideck before the right one. Then there was the tip-over of the helicopter on the right and the breakage of the main rotor and tail rotor blades, as well as damage to the aircraft structure.

After tipping over, the helicopter moved horizontally over the helideck, with a slight tail turn to the left, until it came to a complete stop within the limits of the helideck.

The landing gear, of the retractable type, was in the lowered position.

The floats were activated.

The aircraft's final approach and the landing were captured by cameras located on the platform's helideck (Figures 4 to 7).

Figure 4 - Frame of the footage, highlighting the aircraft approach for landing on the helideck.

Figure 5 – Frame of the footage, highlighting the moment when the aircraft touched the helideck.

Figure 6 – Frame of the footage, highlighting the overturn of the aircraft after the hard landing.

Figure 7 – Frame of the footage, highlighting the overturned aircraft and the collision of the main and tail rotor blades against the helideck surface after the hard landing.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Nil.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Nil.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

After the rotors stopped, the crewmembers and the passengers evacuated the aircraft, with the help of the P-37 personnel.

1.16 Tests and research.

Through the analysis of the data recorded in the flight recorders and in the HFDM of the aircraft, it was found that the engine had normal operating parameters.

Tests were carried out to verify wind intensity and direction on the helideck of the P-37 and at the place where the windsock was installed at the UM, using smoke signals, and there was a discrepancy between the information observed.

The tests showed that, while the wind indicated on the windsock presented a constant direction and intensity, the wind at the helideck touch point presented many variations in direction and intensity.

Such discrepancies were caused by the different positioning of the windsock and the helideck. While the windsock was positioned at a high point of the ship, receiving a “clean” wind (without interference from obstacles), the helideck was positioned close to several obstacles that caused the turbulence of the air present at the landing site.

No evidence of failure or malfunction was found in the emergency float drive system.

1.17 Organizational and management information.

Nil.

1.18 Operational information.

The aircraft took off from SBFS, at 1635 (UTC), to the P-37, with eight passengers and two crewmembers. The estimated flight time was 33 minutes.

The weight of the aircraft at takeff from SBFS was calculated at 11,353.2 lb, considering:

- Basic empty weight: 7,901.4 lbs;
- Crew weight: 385.8 lb;
- Passenger/baggage weight: 1,767 lbs; and
- Fuel: 1,299 lbs.

The weight of the aircraft at the time of landing on the P-37 was calculated, considering an estimated fuel consumption of 420 lb/h. Thus, the aircraft would have 880 lbs of fuel and a total weight of 10,934.2 lbs at the time of landing.

Considering the Maximum Takeoff and Landing Gross Weight CAT A chart on page 4-13, figure 4-8, part 1 of the RFM of the S -76C++, it was verified that, both on take-off from SBFS and on arrival at P-37, the aircraft was within the limits of CAT A takeoff and landing operation (Figure 8).

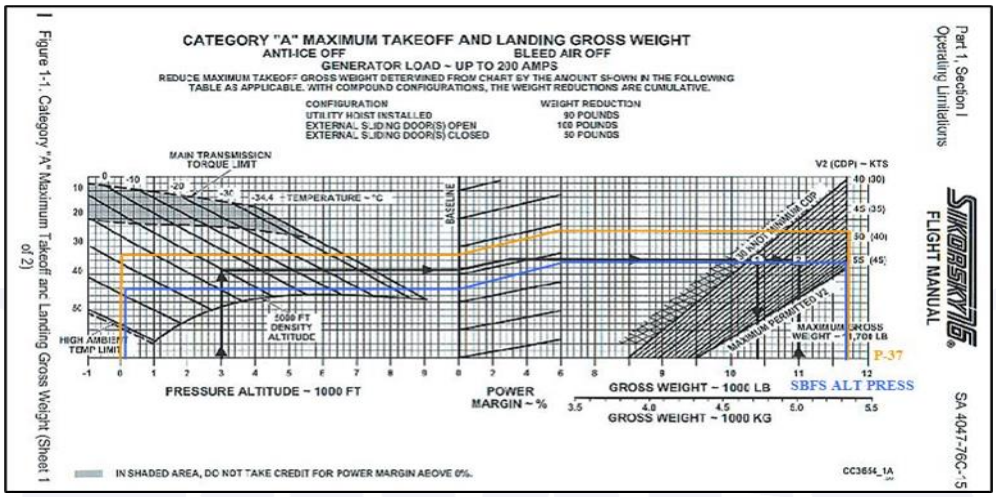

Figure 8 - CAT A Maximum Take-off and Landing Gross Weight graph of the S-76C++ aircraft.

Similarly, using the HOGE graph on pg. 4-32, figure 4-21, Part 1 of the S76C++ RFM, it was verified that, both on take-off from SBFS and on arrival at P-37, the aircraft was within the weight and balance limits, and in conditions to perform the Hover In and Out of Ground Effect (HOGE) and Hover In Ground Effect (HIGE) (Figure 9).

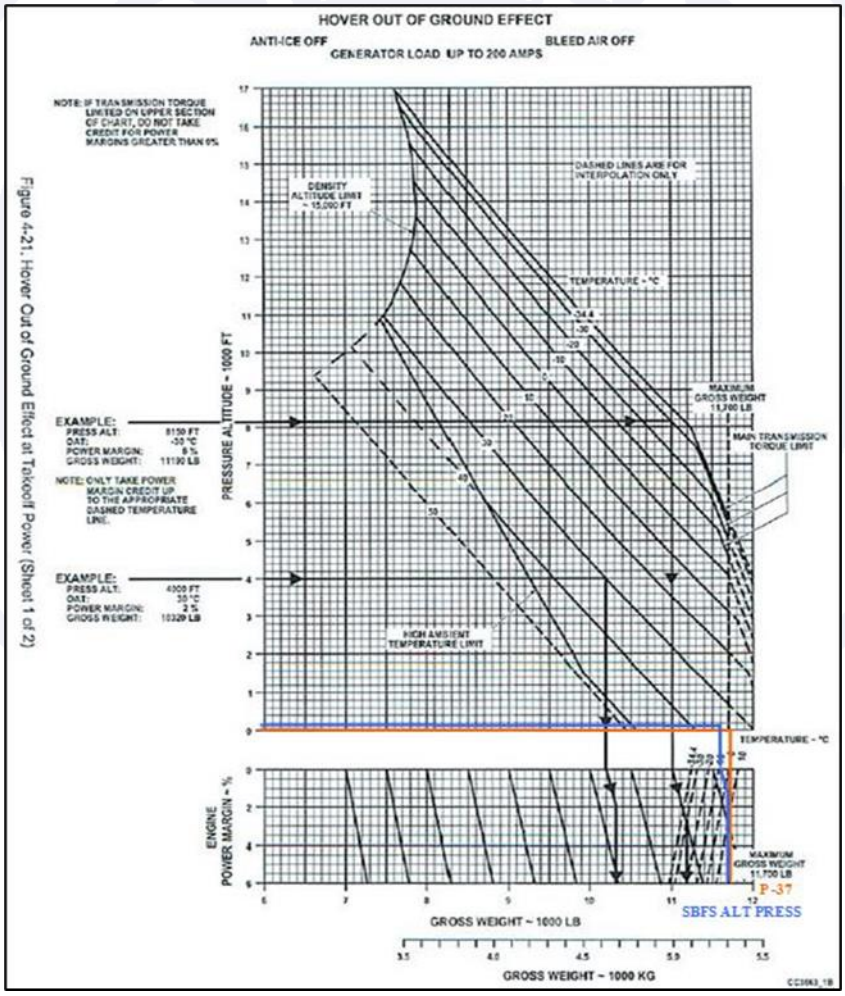

Figure 9 - Hover Out of Ground Effect graphic of the S-76C++ aircraft.

During the en-route flight, the crew did not notice any abnormalities in the aircraft systems.

The crew made normal contacts with the control agencies and the UM.

Five minutes before the scheduled time for landing, the crew was cleared for landing, and informed of the conditions of the helideck.

Then, the crew complied with the procedures for identifying the platform and for the Offshore Helideck Pre-Landing check, and informed Radio *Marlim* and P-37 that they had entered the final approach.

The MPFDR audio recording registered that the crew complied with all the items provided for in the checklist before landing, as well as highlighted a briefing carried out by the PIC, in which he alerted the SIC to the possibility of facing turbulence on the approach to landing and about the helideck.

The warning about the possibility of facing turbulence on the approach given by the PIC to the SIC was based on his previous experience, as he had already noticed turbulence on other occasions of approach and landing, on that and other platforms with similar characteristics, namely: helideck located at the stern of the ship and in a lower position in relation to the vertical structures of the platform.

The PIC performed an approach parallel to the longitudinal axis of the platform, on its side, since it acted as pilot flying.

According to the aircraft's RFM, an approach was considered stabilized when the following criteria were met:

- aircraft on the correct approach trajectory;

- only small changes of heading (less than 5°) required to maintain the ideal trajectory;

- aircraft speed in the following parameters:

    * final approach speed VFR between 75 and 85 kt; and

    * final approach speed IFR between 80 and 100 kt.

- aircraft in the correct landing configuration;

- rate of descent less than 1,000 ft/min and a maximum of 500 ft/min below 500 ft height;

- selection of power appropriate to the aircraft configuration;

- all checks and briefings carried out;

- on ILS approach, maximum deviation of one “dot” from the glide slope and/or localizer;

- loss of height concomitant with reduced speed on approach;

- change of aircraft attitudes in accordance with the provisions of the respective RFM, avoiding sudden movements; and

- in the final part of the approach, rate of descent equal to or less than 350 ft/min.

Also, according to the same RFM, the following minimum heights were recommended for an aircraft to have a stabilized approach:

- when in IFR or under IMC conditions, 1,000 ft above the landing point or altitude determined by the Final Approach Fix (FAF), whichever comes first; and

- when in VFR or in VMC conditions, 500 ft above the landing point.

The same manual also established the procedures for landing on an elevated helideck, as shown in Figure 10 and the subsequent translated description.

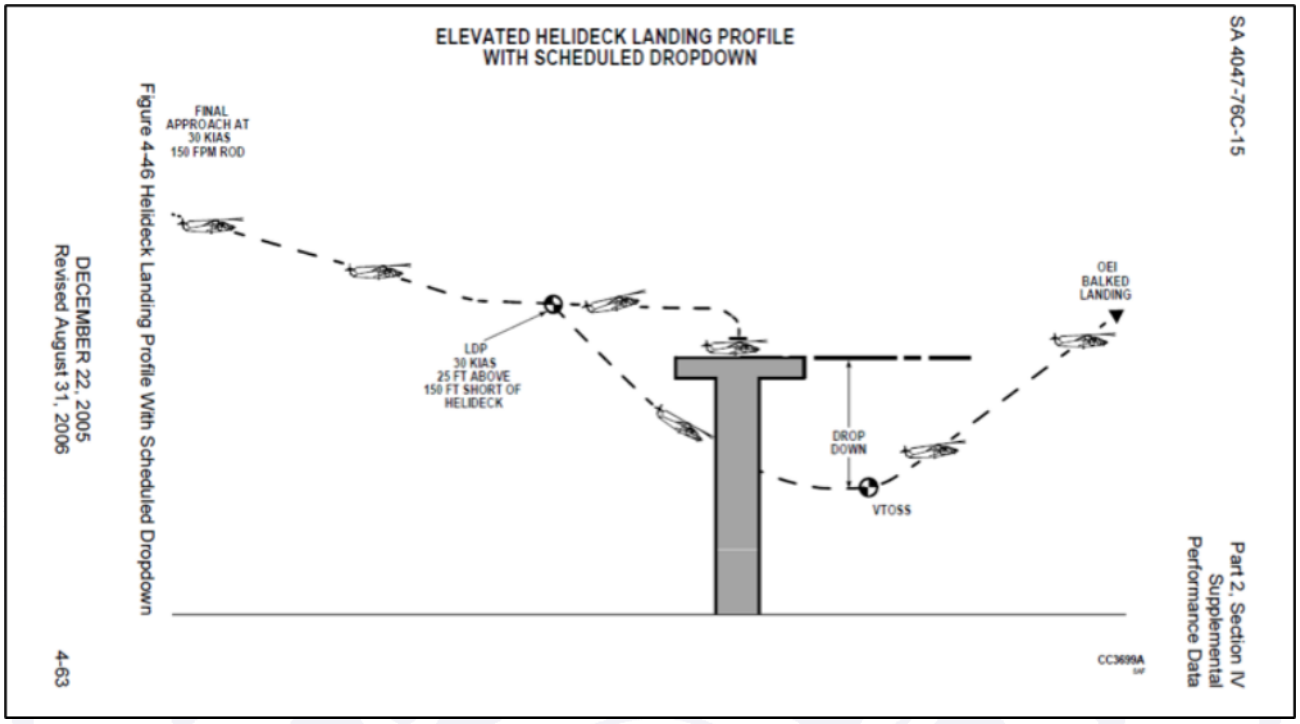

Figure 10 - Illustration of procedures for landing on an elevated helideck.

The approach started with a speed of 45 kt and a height of 400 ft above the landing surface. The indicated speed of the aircraft on the final approach (45 kt), for wind components up to 20 kt, should be increased by half the component value, while for wind components above 20 kt, it should be increased by 10 kt, in addition to adjustment for wind components up to 20 kt.

When passing 100 ft above the helideck, the approach angle should be reduced to a rate of descent not exceeding 150 ft/min at 30 kt, plus adjustment for the headwind component, if necessary.

The descent would continue until reaching the LDP: a point 25 ft above, 25 ft to the left or right and 150 ft before the helipad, where the aircraft would flare to reduce speed. During the flare, the flying pilot would maneuver the aircraft over the helipad and either complete the vertical landing or transition to hover as ground speed was reduced to zero.

The data from the recorders showed that the trajectory and the approach profile performed by the crew were compatible with the RFM stabilized approach parameters and with the wind conditions reported by the ship, up to the LDP.

According to the data recorded in the HFDM, the pilot flying performed the approach for landing in a parallel route to the ship, approaching from the stern sector at an approximate height of 500 ft. Upon reaching 400 ft of Radio Altimeter (RA), the aircraft was at 68 kt of indicated speed and descent rate of 200 ft/min, then crossing 300 ft of RA with 65 kt and descent rate of 300 ft/min.

When the aircraft reached 200 ft, it was at 57 kt and a descent rate of 176 ft/min. Soon after, it reached 163 ft with 45 kt and a descent rate of 100 ft/min. Pilot flying stopped the descent at 130 ft and 36 kt, allowing the LDP to be reached at 120 ft and 29 kt.

During the final approach to the LDP, the pilot flying should maintain an obstacle-free ramp and a heading that would allow for a safe go-around procedure in the event of failures, including the loss of an engine.

The pilot flying kept the heading constant throughout the descent until reaching 175 ft. From that height, he varied the heading to the left by about 10° until he reached the LDP.

According to information from the HFDM, at the time of the LDP, the aircraft was at a shorter distance from the landing site than predicted in the RFM profile (150 ft) and practically on the side of the helideck.

Considering the information on the height of the helideck of 34 meters, available on the Petrobras website, the LDP of 137 ft (112 ft + 25 ft) was calculated.

Considering the 19-meter helideck height information, as per the 63 ft HLL, the LDP was calculated at 88 ft (63 ft + 25 ft). During Field Action, it was estimated that this height was more compatible with the ship's loading situation.

The LDP announced by the commander at 120 ft high was 32 ft higher than the calculated LDP.

In accordance with the experience acquired in offshore operations and internationally adopted standards, a higher approximation was recommended for situations where there was a forecast of encountering a turbulent environment.

The commander decided to make a lateral approach, in order to allow a better view of the landing site during the move to the touchdown point and minimize the exposure time to possible turbulence.

The weight, the temperature and pressure conditions considered at the time of landing on the P-37 allowed sufficient performance to guarantee a safe maneuver, given the wind conditions and helideck inclination reported in the meteorological bulletin.

According to the HFDM data, it was possible to verify an application of a cyclic command to the right with a maximum and momentary inclination of 6º, in the period between the LDP and the beginning of the displacement to the helideck.

The HFDM records of five other approaches from different aircraft to the P-37, with wind conditions close to those of the day of the PR-MEY accident, indicated that an average application of cyclic was used (to the right or to the left, depending on the approach side), close to the moment of the beginning of the displacement to enter the helideck, with an AOB of at most 5° (Figure 11).

AERONAVE	VENTO	APROAMENTO DO NAVIO	UM	AOB	COL	TQ	RAZÃO DE DESCIDA MÉDIA (ft/min)	PESO ANV
PR-MEY	029/15	025°	P-37	+6	61	81	370	10.670 LB
VOO 1	028/22	036°	P-37	+4	51	88	408	10.544 LB
VOO 2	030/22	031°	P-37	+3	49	84	347	10.944 LB
VOO 3	031/14	022°	P-37	+5	48	83	206	10.823 LB
VOO 4	169/15	161°	P-37	+4	47	77	468	10.544 LB
VOO 5	065/16	069°	P-37	+4	48	85	240	10.544 LB

Figure 11 - Table with cyclic application data in other five approaches for the P-37.

According to the HFDM data, close to the LDP and on the approach for landing on the helideck, the aircraft's heading indicated a North direction, varying between 010º (final approach) and 358º (immediately before touching the helideck), combined with an application of pedal (yaw) to the left just before touching the helideck.

The P-37's video camera, positioned laterally and inclined in relation to the longitudinal line of the ship and at the height of the helideck floor, demonstrated that the aircraft was inclined to the left. The HFDM data indicated a tilt of the aircraft to the left, with application of a gradual tilt up to a maximum of 8º.

The video image also indicated that the aircraft's heading, when arriving over the helideck, was oriented slightly to the left, using the UM name painted on the helideck

"PETROBRAS 37" as a reference, which was perpendicular to the heading of the ship at 025º, as informed in the Helideck Report (Figure 12).

Figure 12 - P-37 camera footage frame, highlighting the aircraft's tilt to the left during the approach.

HFDM data recorded that the indicated speed at the time of the start of the flare was 39 kt and, at the end, and at the beginning of the lateral approach, it was 21 kt. In addition, the recorder also registered that the torque was 45%.

The HFDM records of the aforementioned previous approaches to the P-37 indicated average torque utilization between 77 and 88%, close to the moment of landing (between LDP and landing). The HFDM recorded that the torque applied immediately before the PR-MEY touched the helideck was 91%.

When approaching the ship's structure, the PIC stated that he was surprised by an abrupt increase in the aircraft's lateral speed and descent rate and that he observed, through peripheral vision, the rapid passage of the existing windows in the ship's houses. He also said that he applied the cyclic and collective commands in an attempt to mitigate the increase in lateral speed and rate of descent, but he did not get a response from the aircraft.

Through the MPFDR audio recording, it was possible to verify that the crew noticed the excessive sinking of the aircraft in the last moments of the final approach. HFDM data indicated that the aircraft sank over the helideck at a descent rate of 3,250 ft/min, varying the height from 89 ft to 9 ft in just 2 seconds.

HFDM records from the same previous approaches from different S-76C aircraft to the P-37 indicated that an increase in the rate of descent occurred near the time of landing, with an average of 1,038f t/min (Figure 13).

PR-MEY 01MAR2017	VOO 1	VOO 2	VOO 3	VOO 4	VOO 5
-3250	-1064	-1024	-928	-1328	-848
MÉDIA: -1038 ft/min					

Figure 13 - Table with rate of descent data from five other approaches to the P-37.

The aircraft made a hard landing on the helideck, with the left landing gear touching before the right one, followed by a dynamic roll to the right. After the aircraft overturned, it slid to the right until it came to a complete stop, remaining on the helideck.

During the sliding of the aircraft over the helideck, the emergency floats were activated. Neither the PIC nor the SIC recall having activated the emergency floats during the aircraft's slide over the helideck.

The PIC reported in an interview that, after the aircraft overturned, he acted on the engine cut-off levers, activated the rotor brake and turned off all the electrical system switches. On the other hand, the SIC did not seem to remember details in those few seconds.

After the rotors and engines stopped, the crewmembers and passengers evacuated the aircraft.

1.19 Additional information.

Previous Occurrence.

On 26AUG2011, the PR-SEC aircraft, operated by Senior Air Taxi, made a sudden landing on the helideck of the P-35 platform, causing structural damage to the aircraft.

It is noteworthy that the P-35 had similar characteristics to the P-37 (Figure 14).

Figure 14 - View of the P-35 platform ship, highlighting the helideck at the stern of the ship.

The occurrence was classified as a Serious Incident by the CENIPA.

In the Final Report of the investigation, there is information that one of the contributing factors to the occurrence was the airport infrastructure, since, during the investigation, it was inferred that the air mass that passed through the structure of the ship arrived whirled on the helideck, or caused the appearance of descending gusts of wind, making it difficult to control the aircraft in the short final.

Furthermore, in Petrobras' Detailed Investigation Report (RDI) No. 008/2011 of 30JUL2011, the company described as a causal factor the "turbulence and downdraft caused by the air flow that ascends when the wind strikes the structure ahead of the helideck, becoming descending and swirling after passing the structure, interfering with the approach ramp".

At the time, Petrobras adopted, as an initial mitigating action, the temporary reduction of the payload for the P-35 helideck.

Landing and Take-off Envelope.

The development of specific take-off and landing envelopes for the various UM, which contain restrictions for the operation to be carried out safely, is a complex task. There was

a need for in-depth studies on the aerodynamic forces that acted on each different type of helideck, as well as analysis of the flight profile of each aircraft that operated in these units.

There was no specific take-off and landing envelope for the P-37, which would restrict the operation, especially when strong winds enter the ship's bow, a situation that could cause wind alteration effects or turbulence on the helideck.

The S-76C aircraft manual did not establish wind limits for take-offs and landings, only wind limits for hovering:

> Maximum airspeed for sideward flight or crosswind hover is 35 knots. Maximum airspeed for rearward flight or tailwind hover is 35 knots.

The Brazilian Navy, by way of comparison, had specific take-off and landing envelopes for certain aircraft and selected ships. However, so that the entire fleet of aircraft, in all available helidecks, could be safely operated, it also had a generic flight envelope, which contained wind limitations (Figure 15).

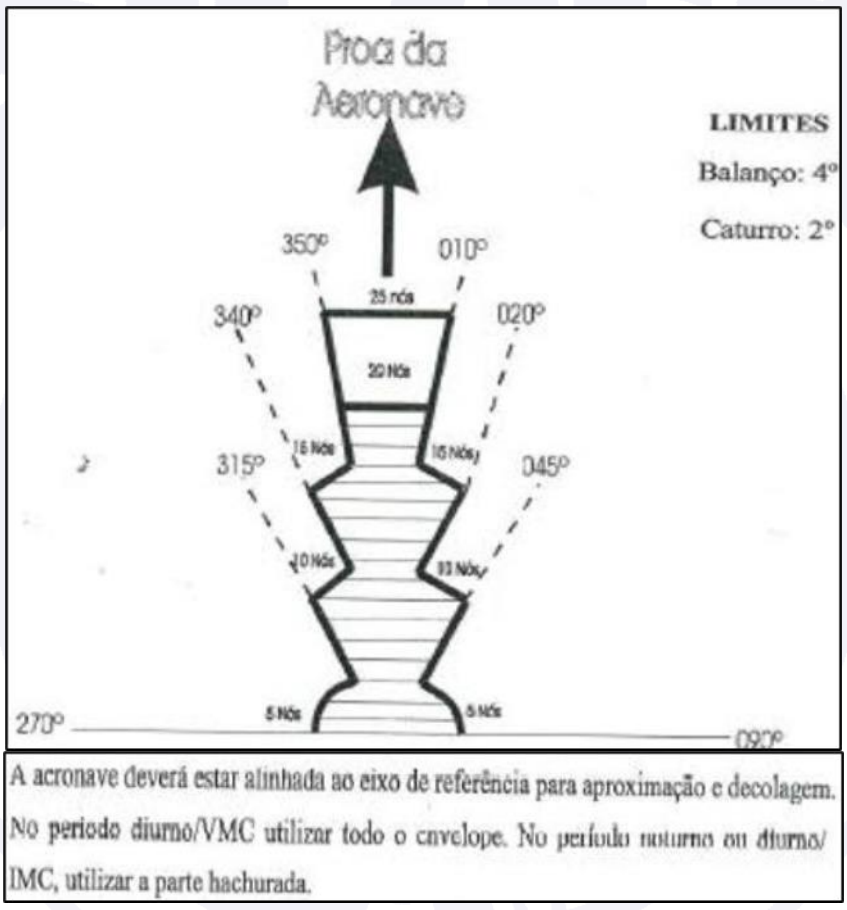

Figure 15 - Generic flight envelope used by the Brazilian Navy.

The operating company's MGO also established generic wind limits.

> Except in an emergency or life-saving operation, at the Commander's discretion, no OMNI pilot shall land or takeoff when the wind speed exceeds 45 knots for ships or 55 knots for platforms.

Training in Flight Simulator and Turbulence Simulation.

The PIC carried out training in a flight simulator in January 2017 and the SIC in June 2016.

In the simulator sections, there was no provision for training in turbulent environments in the vicinity of maritime installations.

During the investigation period, the operator's Director of Operations determined the verification of the possibility of simulating turbulence in the training of the crew.

In the tests performed, approximations were performed for a UM of the simulator database, with a bulkhead structure close to the helideck, a characteristic similar to the helideck of the P-37, but theoretically less critical compared to this one, and wind adjusted to 35 kt coming from behind this structure.

However, there was no practical effect, as the simulator software did not recognize the structures as something real, which could interfere with the wind in a way to whirl it. Next, the instructor suggested using normal swirl while the aircraft was approaching and introducing severe swirl at the exact moment the aircraft entered the region, very close and over the helideck, where it would suffer from the swirling wind.

It was possible to conclude, based on the simulations, that a severe whirlwind increased the workload and the degree of difficulty of the operation, but it was not possible to simulate the loss of lift caused by the air whirl over the helideck.

Pilots' experience in the P-37 or similar UM.

In the last ninety days before the occurrence, the PIC had made one landing on P-37 and three landings on the UM with similar characteristics (P-33, P-47 and P-53). The SIC had performed three landings on the P-37 and six landings on the UM with similar characteristics (P-31 and P-38).

The PIC of the aircraft had already faced a situation of turbulence near the helideck in the P-37 and in other UM with similar characteristics.

There were several reports from pilots about turbulence on approach and landing in some UM, among them, the P-37.

Training and Instruction.

The company's training and instruction program warned about the types of threats that could cause a flight path deviation in the offshore operation, among which the threat of "adverse environmental conditions" was identified, encompassing the action of turbulence, as a result of the wind passing through the structure of the ship, and the interference of the exhaust of hot gases on the helidecks.

However, there was no official instruction or training document, with procedures to be performed by the crew in case of turbulence on the helidecks in offshore operations.

Ship's Helideck Monitoring System (HMS) equipment.

The P-37 Helideck Report, at 1511 (UTC) on the day of the occurrence, reported the following UM movement conditions: 0.5° of pitch, 2nd of roll, 0.9 m of heave, 0.2 m/ s of heave rate and 2.1º of inclination.

Considering the ship's helideck class (class 1) and the aircraft category (category B), the parameters were within the limits (Figure 16).

Helicóptero	Período de Operação	Helideque											
		Classe 1				Classe 2				Classe 3			
		B/C	Inc	VArf (m/s)	Arf (m)	B/C	Inc	VArf (m/s)	Arf (m)	B/C	Inc	VArf (m/s)	Arf (m)
Categoria A	Diurno	+/- 3°	3,5°	1,3	5,0	+/- 2°	2,5°	1,0	3,0	+/- 2°	2,5°	1,0	3,0
	Noturno	+/- 3°	3,5°	1,0	4,0	+/- 2°	2,5°	0,5	1,5	+/- 1°	1,5°	0,5	1,5
Categoria B	Diurno	+/- 4°	4,5°	1,3	5,0	+/- 3°	3,5°	1,0	3,0	+/- 3°	3,5°	1,0	3,0
	Noturno	+/- 4°	4,5°	1,0	4,0	+/- 2°	2,5°	0,5	1,5	+/-1,5°	2,0°	0,5	1,5

B/C	Balanço e caturro (roll e pitch)
Inc	Inclinação
VArf	Velocidade de Arfagem - Velocidade média do centro do helideque, quando se desloca entre o máximo e o mínimo da maior oscilação vertical ocorrida nos últimos 20 minutos de intervalo.
Arf	Arfagem - Deslocamento vertical do centro do helideque

Figure 16 - Table with helicopter operation limits in relation to the UM movements.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a flight intended to transport eight passengers between SBFS and the P-37 platform.

The crewmembers had valid CMAs, were qualified and had experience in the type of flight. The aircraft CA was valid and the maintenance records were considered adequate.

The weight of the aircraft at the time of the take-off from SBFS and at the time of landing on the P-37 was considered within the weight and balance limits for the operation.

Meteorological conditions were favorable for visual flight, both in SBFS and P-37. According to the information contained in the Helideck Report received by the crew, considering the ship's helideck class 1 and the aircraft category B, the parameters were within the limits.

During the en-route flight, the crewmembers did not notice any abnormalities in the aircraft systems. The crew made normal contacts with the control agencies and the UM, including a last contact, five minutes before the scheduled time for landing, when the crew received clearance for landing and the conditions of the helideck.

At that moment, the crew received information about the following wind conditions: 023° of direction with 16 kt of intensity. Then, he complied with the procedures and checks provided for the identification of the platform and informed the entry on the final approach.

The audio registered on the aircraft's recorders highlighted a briefing carried out by the pilot flying, in which he alerted the other pilot to the possibility of facing turbulence on the approach to landing and on the P-37's helideck.

The warning about the possibility of facing turbulence on the approach was based on his previous experience, as he had already noticed turbulence on other occasions of approach and landing, on that and other platforms with similar characteristics, namely: helideck located at the stern of the ship and in a lower position in relation to the vertical structures of the platform.

The risk of this type of operation on helidecks with such characteristics was already well known, due to the several reports of pilots about turbulence on approach and landing on some platforms, as well as due to the occurrence with the PR-SEC aircraft, on 26AUG2011, when a sudden landing was made on the helideck of the P-35 platform (with characteristics similar to those of the P-37), causing structural damage to the aircraft.

In the CENIPA's Final Report for that event, classified as a Serious Incident, the participation of the airport infrastructure was included as one of the contributing factors for the occurrence, as it was inferred that the air mass that passed through the structure of the ship arrived whirled on the helideck or caused the appearance of descending gusts of wind, making it difficult to control the aircraft in the final approach.

In a Detailed Investigation Report on the case, Petrobras highlighted the turbulence and descending wind currents caused by the air flow that ascends when the wind hits the structure ahead of the helideck, becoming descending and turbulent after the structure passes, interfering with the approach ramp. At the time, as an initial mitigating action, the temporary reduction of the payload for the P-35 helideck was adopted.

However, the development of specific take-off and landing envelopes for the various UM, which contained restrictions for the operation to be carried out safely, would be a complex task. There was a need for in-depth studies on the aerodynamic forces that acted on each different type of helideck, as well as analysis of the flight profile of each aircraft that operated in these units.

It is likely that the mitigating action adopted by Petrobras for the landing and take-off operations on the P-35 helideck was preceded by an in-depth analysis, however, most likely, such complex studies only occurred due to the previous incident that occurred.

Similarly, measures were not adopted to restrict the operation with the incidence of strong winds entering the bow of the ship, a situation that could cause effects of wind alteration or turbulence on the helideck.

The S-76C aircraft manual did not establish wind limits for take-offs and landings, but only the limit of 35 kt of wind in the hover flight. The operating company's MGO established generic wind limits for take-offs and landings, at 45 kt and 55 kt, for ships and platforms, respectively.

The Brazilian Navy, by way of comparison, had specific take-off and landing envelopes for certain aircraft and selected ships. However, for the entire fleet of aircraft to be operated safely on all available helidecks, it also had a generic flight envelope, which contained wind limitations.

The PIC of the aircraft performed an approach parallel to the longitudinal axis of the platform, on its side, since it acted as pilot flying. Data from the recorders showed that the trajectory and profile of the approach performed by the crew were compatible with the parameters of a stabilized approach described in the RFM and with the wind conditions reported by the ship.

During the final approach to the LDP, the pilot maintained an obstacle-free ramp and a heading that would allow for a safe go-around procedure. By analyzing the data recorded in the flight recorders and in the HFDM of the aircraft, it was found that the engines had normal operating parameters.

The pilot flying kept the heading constant throughout the descent until reaching 175 ft of RA. From that height, the heading varied to the left about 10° until reaching the LDP. In the LDP, the aircraft was, according to information from the HFDM, at 150 ft.

Considering that the PIC had the purpose of better visualizing the landing site during the move to the touchdown point and minimizing the exposure time to possible turbulence, he decided to perform a lateral approach, parallel to the ship's axis.

Considering also the height of the helideck of 63 ft, recorded in the HLL, the LDP announced by the PIC at 120 ft in height was 32 ft higher than the predicted LDP of 88 ft (63 ft + 25 ft) in the manual of the aircraft.

This finding is consistent with the commander`s plan to make a higher approach for situations where there was a forecast of finding a turbulent environment, according to his experience and in accordance with internationally adopted standards in offshore operations.

The weight, temperature and pressure conditions, considered at the time of landing on the P-37, allowed sufficient performance to guarantee a safe maneuver, given the wind conditions and inclination of the helideck, informed in the Helideck Report.

According to the HFDM data, there was an application of a cyclic command to the right with a maximum and momentary inclination of 6º, in the period between the LDP and the beginning of the displacement to the helideck.

Similarly, HFDM data and video camera footage from the P-37's helideck indicated that, close to the LDP and on approach for landing, the aircraft's heading indicated a northerly direction, combined with a yaw application to the left and gradual inclination to the left, up to a maximum of 8°, at the moment before touching the helideck.

The HFDM also recorded that the indicated speed at the time of the start of the flare was 39 kt and, at the end, and at the beginning of the lateral approach, it was 21 kt.

Furthermore, the torque applied to the LDP was 45%, while at the moment immediately before the PR-MEY touched the helideck it was 91%.

The HFDM records of five other approaches from different aircraft to the P-37, with wind conditions similar to those on the day of the PR-MEY accident, indicated that average cyclic amplitudes were used (to the right or to the left, depending on the approach side), close to the moment of displacement to enter the helideck, with a maximum inclination angle of 5°. Regarding the collective command, the data indicated an average torque utilization between 77% and 88%, close to the moment of landing (between the LDP and the landing).

Therefore, based on the recorded registers and on previous approaches, under similar conditions, it can be concluded that the application of commands performed by the PR-MEY PIC was adequate and considered normal for the flight phase.

When approaching the structure of the ship, the PIC stated that he was surprised by an abrupt increase in the lateral speed and rate of descent of the aircraft. He also said that he acted in the cyclic and collective commands in an attempt to mitigate the increase in lateral speed and rate of descent, but he did not get a response from the aircraft.

Through the audio recording of the MPFDR, it was found that the crewmembers noticed the excessive sinking of the aircraft in the last moments of the final approach. However, considering the HFDM data regarding the descent rate of 3,250 ft/min suffered by the aircraft, it was inferred that the corrective actions taken by the crew were not sufficient to reverse that condition.

The company's training and instruction program contemplated the types of threats that could cause a deviation from the flight path in the offshore operation, among which the threat of "adverse environmental conditions", encompassing the action of turbulence, as a result of the wind passing through the structure of the ship, and the interference of the exhaust of hot gases on the helidecks.

However, there was no official instruction document or specific training for situations with the presence of turbulence on the helidecks in offshore operations, nor procedures to be carried out by the crew when faced with any of the threats described, in order to allow an approach and a possible evasive maneuver in time to avoid more drastic consequences.

Although both pilots had their respective training in a flight simulator valid, this type of training did not address the risk in question, as simulated training in turbulent environments in the vicinity of maritime facilities was not foreseen.

During the investigation period, the possibility of simulation was verified in the synthetic approach trainer for the UM with a bulkhead structure close to the helideck, in order to create a turbulence as found in the accident. However, there was no practical effect.

Then, a normal turbulence was used while the aircraft was approaching and a severe turbulence at the exact moment when the aircraft entered the region where it would suffer from the turbulent wind, that is, very close and on the helideck.

It was possible to conclude, based on the simulations, that a severe whirlwind increased the workload and the degree of difficulty of the operation, but it was not possible to simulate the loss of lift caused by the air whirl over the helideck, which may have occurred with the PR-MEY.

It is likely that the aircraft encountered a swirling wind very close to the helideck, with greater intensity, despite the information received from the Radio Operator of 16 kt of intensity.

The UMAR, which was coupled to the P-37 and was in an obstacle-free position and aligned with the prevailing wind, presented wind of 28 kt and 24 kt of intensity, at 1450 (UTC) and 1715 (UTC), respectively.

Corroborating this analysis, the information from the SBMM METAR at 1600 (UTC), which presented a wind of 28 kt and two other nearby the UMs, P-35 and P-08, which indicated a wind of 28 kt and 26 kt, respectively. .

Thus, it was concluded that the wind was with even greater intensity, at that exact moment of the accident, as there were reports, from other aircraft, of gusts of 40 kt of intensity, soon after the accident.

Faced with the possibility of a whirl wind contribution to the accident, tests were carried out to verify the intensity and direction of the wind on the P-37 helideck and at the place where the windsock was installed at the UM, shortly after the accident, using smoke signals. The test results proved the existence of considerable discrepancy between the observed information. While the wind indicated on the windsock presented a constant direction and intensity, the wind, in the place where it touched the helideck, presented multiple variations of direction and intensity.

Such discrepancies were due to the positioning of the windsock, which was at a high point of the ship, receiving a “clean” wind (without interference from obstacles), while the helideck was located close to several obstacles, which caused the air to swirl on its surface.

Despite the attempt to anticipate a scenario of turbulence on the helideck, when performing a higher LDP than usual and performing a side entry, aiming to reduce the time of exposure to turbulence, the PIC was surprised by more intense environmental conditions than those expected, which caused the loss of lift and the sudden sinking of the aircraft.

Faced with the impossibility of the crewmembers to reverse the situation, the aircraft made a hard landing in a left roll attitude (approximately 5°), causing the left landing gear to touch before the right in the central part of the helideck, followed by a dynamic roll to the right.

After the aircraft overturned, the main rotor and tail rotor blades broke, as well as damage to its structure.

During the slide over the helideck, the emergency floats were activated, however, neither the PIC nor the SIC remember having activated them. It is possible that one of the crewmembers inadvertently activated the emergency floats.

3. CONCLUSIONS.

3.1 Facts.

a) the pilots had valid CMAs;

b) the pilots had valid SK76 and IFRH Ratings;

c) the pilots were qualified and had experience in the type of flight;

d) the aircraft had a valid CA;

e) the aircraft was within the weight and balance limits;

f) the airframe and engine logbook records were updated;

g) the aircraft was carrying passengers offshore from SBFS to the P-37 platform;

h) the P-37 Helideck Report informed the UM movement conditions within the operating limits;

i) the helideck was located at the stern of the ship and in a lower position in relation to the vertical structures of the platform;

j) there were discrepancies in wind intensity and direction between the P-37 helideck and the windsock installation site;

k) the crewmembers complied with all items provided for in the checklist before landing;

l) the PIC performed an approach parallel to the longitudinal axis of the platform, on its side, while acting as pilot flying;

m) the trajectory and approach profile performed by the crew were compatible with the RFM stabilized approach parameters and with the wind conditions reported by the ship;

n) the LDP announced by the commander at 120 ft height was 32 ft higher than the calculated ideal LDP;

o) there was no specific take-off and landing envelope for the P-37;

p) the S-76C aircraft manual did not establish wind limits for take-offs and landings, only wind limits for hovering flight;

q) the operating company's MGO established wind limits for take-off and landing operations of 45 kt and 55 kt, for ships and platforms, respectively;

r) HFDM data indicated that the aircraft sank over the helideck at a rate of descent of 3,250 ft/min, varying the height from 89 ft to 9 ft in 2 seconds;

s) training in turbulent environments in the vicinity of maritime facilities was not provided for in the flight simulator training program;

t) the aircraft made a hard landing on the helideck, with the left landing gear touching the helideck before the right one, followed by a dynamic roll to the right;

u) after tipping over, the aircraft slid to the right until it came to a complete stop, remaining on the helideck;

v) the aircraft had substantial damage;

w) the SIC, seven passengers and one person on the platform suffered minor injuries; and

x) the PIC and a passenger left unharmed.

3.2 Contributing factors.

- **Training – undetermined.**

Despite both pilots having their respective training in flight simulator valid, the fact that the simulator software does not contemplate training in conditions similar to those found in the event suggests the possibility of a lack of familiarization of the crew with the situation experienced.

- **Airport infrastructure – a contributor.**

The construction characteristics and position of the P-37 helideck, associated with the direction and intensity of the prevailing wind at the time of the occurrence, provided the formation of a microenvironment with turbulent air with accentuated vertical and horizontal wind currents, which influenced the aerodynamic performance of the aircraft, surprising the pilot with the increase in the rate of descent and lateral displacement over the helideck.

In addition, the position of the P-37 windsock did not allow it to indicate the correct wind over the helideck.

- **Instruction – a contributor.**

The lack of an official instruction or training document, specific for situations with the presence of turbulence on the helidecks in offshore operations, did not allow the crew to be prepared and trained to perform the approach or a possible evasive maneuver in time to avoid the sudden landing on the helideck.

- **Support systems – a contributor.**

The lack of landing envelopes designed in function of the incidence of wind direction and intensity on the platform, which could reduce the weight or prevent landing on the platform, contributed to the occurrence, as there were no limitations that favored the establishment of safer operating conditions.

- **Managerial oversight – a contributor.**

There was inadequate supervision of operational planning activities, given the absence of effective risk mitigation mechanisms, such as the establishment of wind and payload limits for the operation, which could reduce the probability of making an approach to land in a helideck subject to turbulence due to the physical characteristics of the UM.

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-036/CENIPA/2017 - 01 **Issued on 08/05/2022**

Disseminate the lessons learned in this investigation to airlines that carry out offshore operations, so that the operations sector adopts measures to mitigate the risks in landing and take-off operations on helidecks with characteristics similar to those of the P-37.

To the Directorate of Ports and Coasts (DPC):

A-036/CENIPA/2017 - 02 **Issued on 08/05/2022**

Analyze the feasibility of requesting Petrobras to carry out a study of the wind environment on the P-37 helideck and other platforms with characteristics similar to those of the P-37, as provided in the observations of item 0202 of NORMAM--27/DPC.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

On 31MAR2017, the OMNI Air Taxi Company published, internally, the Operational Safety Event Investigation Report No. ESO 004/2017 with the following safety recommendations and mitigating actions, which were subsequently complied with:

> To the Operational Safety Manager
>
> a) Establish HFDM events to monitor applied power situations that allow aircraft lift after landing in UM, in order to monitor aircraft stability on the helideck - (Class II - Up to 60 days).
>
> b) Enter in the LOSA process in the field "undesirable state of the aircraft" the "instability of the aircraft on the helideck". (Class II - Up to 60 days).
>
> c) Encourage crewmembers to report whenever they find inconsistency or lack of information in the data provided in the UM weather report, so that the processes are reviewed and the information is updated and available to Pilots. (Class I - Up to 30 days).
>
> d) Establish a Safety Action Group to study best practices for UM approaches in adverse environmental conditions with the purpose of incorporating it into the company's operation, mitigating the risks involved in these operations. (Class II - Up to 60 days).
>
> To the Director of Operations
>
> a) Until specific guidelines are presented, recommend to all fleets that approaches with side entry are not carried out under the same conditions of the accident - helideck aft and in a position below the superstructure and with winds aligned in direction, entering by the heading or even 15° in relation to the ship's bow - using the 45° approach or according to the RFM orientation of each equipment. (Class I - Up to 30 days)
>
> b) Disclose this report to all company crewmembers in order to contribute to the advancement of knowledge through presentations and publication in the company's technical library. (Class II - Up to 60 days)
>
> c) Create an instruction with a study and guidance on adverse environmental factors found in the vicinity and on the helideck: - turbulence, air turbulence, hot and production gases. Information on design and projects of constructions in oil facilities and best practices regarding helideck positioning. (Class II - Up to 60 days)
>
> d) Study the possibility of including in the periodic training of the company's fleets a topic about turbulence and adverse environmental conditions, and the reaction to the scenario in each model respectively. (Class II - Up to 60 days).
>
> e) Ensure that presentations on the main risks (top 10) mapped in the company's Safety Case are present in pilot training, in order to provide continuous improvement of the SGSO. (Class I - Up to 30 days).
>
> f) Include the landing briefing in the before landing checklist. Check if this procedure exists for all the company's fleets. Exemplify which points should be addressed in this briefing (go-around procedure, power, type of approach, traffic in the area, etc.). (Class II - Up to 60 days).

On 10DEC2018, through Ordinance No. 394, the DPC of the Brazilian Navy published NORMAM-27/DPC, 2018, Rev 2 Mod 1 with changes in Chapter 2 - Helideck Design, section 0202, including, in letter c, the requirement to study the wind environment on the helideck for new construction projects, which must take into account CAP 437 - Offshore Helicopter

Landing Areas - Guidance on Standards - UK Civil Aviation Authority, as per the following text:

> a) the location of a helideck on fixed maritime platforms, on merchant ships and on vessels used in offshore operations is almost always a compromise solution between the different basic requirements of the project, such as the limitation of space and the need to perform several functions . The location of the helideck must be carefully chosen to meet these different needs;
>
> b) the AAFD must be positioned, in relation to the other structures, in such a way that there is an obstacle-free sector below the level of the helideck, outside the negative gradient sector, which allows an aircraft to approach and takeoff or perform a go-around procedure safely, even if there is a loss of engine power;
>
> c) the AAFD must also be located in order to minimize the occurrence of turbulence on the helideck, caused by the flow of wind in the structures of the installation; for new construction projects, started from 2018, the ships/platforms must have a study of the wind environment on the helideck in which the helicopters must operate, whose criteria are in the document of item 0103, subparagraph f;
>
> d) there must not be, on the helideck, combustion gases from burners or other equipment that could release hot gases that alter the environmental parameters for which the flight was planned. Sudden increases in ambient temperature can cause a decrease in engine performance and rotor efficiency at a critical stage of helicopter operation. Designers must therefore be very careful with the location and elevation of the gas discharges relative to the AAFD; the ships/platforms must carry out wind tunnel or Computational Fluid Dynamics (CFD) tests of the helideck to determine the wind parameters for the landing and take-off of aircraft;
>
> Note: in projects prior to 2018, the DPC may request the above study to be carried out, when there is a history of turbulence formation on the helideck.

On 10AUG2021, the Helideck Division of the Directorate of Ports and Coasts informed, by means of an electronic message, that, on 17JUN2021, the P-37 unit underwent an inspection to renew the helideck certification, and on that occasion, the calibration of anemometers (performed every 2 years) and positioning of windsocks in order to avoid the influence of eventual turbulence generated by the superstructure.

On August 05th, 2022.