Preliminary Report

The investigation work related to this occurrence is in progress..

This Report is intended to present the current status of the notification's processing. Its content may still be changed and does not necessarily bind the conclusions that will be published in the Final Report of the Investigation.

The Aeronautical Accidents Investigation and Prevention Center (CENIPA), as the central body of the Aeronautical Accidents Investigation and Prevention System (SIPAER), is the Brazilian State authority responsible for conducting investigations into aeronautical occurrences.

The work developed by the CENIPA is aimed solely at preventing accidents, as established in art. 86-A of Law n° 7565/1986 (Brazilian Code of Aeronautics - CBA), as well as § 6, art. 1, of Decree n° 9540/2018 and Annex 13 to the Convention on International Civil Aviation, dated 1944, of which Brazil is a signatory State.

In this sense, the investigations carried out by the CENIPA do not seek to establish guilt or liability, as provided for in § 4, art. 1, of Decree n° 9540/2018, nor are they intended to determine any probable cause of an accident, but indicate possible contributing factors that allow for the elucidation of any technical issues related to the aeronautical occurrence.

Thus, through the issuance of Safety Recommendations, the CENIPA proposes the implementation of measures with the objective of avoiding the recurrence of similar events, seeking to enhance flight safety.

It should be noted that the use of the information contained in this Report, as a means of instruction or evidence in judicial or police proceedings, may hinder the delivery of justice itself, in addition to generating adverse effects on the prevention of aircraft accidents, by undermining trust in the impartiality of the SIPAER investigations and inhibiting voluntary participation.

The completion of this investigation will take place in the least possible time, depending on the complexity of the occurrence and, also, on the need to identify potential contributing factors.

Upon completion of the investigation work related to this occurrence, the pertinent Final Report will be published on the CENIPA's website.

General Information

Classification:	ACCIDENT
Type of Occurrence:	#ICE - FORMAÇÃO DE GELO #LOC-I - PERDA DE CONTROLE EM VOO
Date:	9 August 2024

Date (UTC):	9 August 2024
Time:	16:22
City:	VINHEDO - SÃO PAULO - BRASIL
Aerodrome:	OUTSIDE THE AERODROME
Local:	RESIDENTIAL AREA OF THE CITY
Damage to third parties:	YES

Injuries	Function on Board	Quantity
FATAL	CREW	4
FATAL	PASSENGERS	58

History

At 14:58 UTC, the aircraft took off from SBCA (*Coronel Adalberto Mendes da Silva* Airport, *Cascavel*, State of *Paraná*), bound for SBGR (*Guarulhos - Governador André Franco Montoro* - Airport, *Guarulhos*, State of *São Paulo*) on a public regular passenger transport flight with 04 crew and 58 passengers on board. With the aircraft flying along the route, and after encountering icing conditions, control of the aircraft was lost and it crashed into the ground.

Aircraft Involved

The aircraft is not released for investigation purposes

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Registration marks:	PSVPB
Location of latest takeoff:	SBCA - ADALBERTO MENDES DA SILVA
Location of intended landing:	SBGR - GOVERNADOR ANDRÉ FRANCO MONTORO
Type of operation:	REGULAR
Phase of flight:	CRUISE
Aircraft damage:	DESTROYED
Type of aircraft:	CIVIL
State of Registry:	BRAZIL
Year of manufacture:	2010

Manufacturer:	ATR - GIE AVIONS DE TRANSPORT RÉGIONAL
ICAO Model:	AT75
Model:	ATR 72-212A (500)
Maximum takeoff weight:	22,800kg

Factual Information

Sequence of events

Based on the information collected at the initial field Investigation, as well as recordings from the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR), the Investigation Committee identified the sequence of events preceding the aircraft's collision with the ground. The time reference utilized is UTC (Universal Time Coordinated).

- 14:58:05 - the aircraft initiated takeoff from the runway 15 of SBCA, with 58 passengers and 04 crew on board;
- 15:12:40 - the PROPELLER ANTI-ICING 1 and 2 were turned on;
- 15:14:56 - the Electronic Ice Detector connected to the Centralized Crew Alert System (CCAS) emitted an alert signal upon passing FL130;
- 15:15:03 - the AIRFRAME DE-ICING was turned on;
- 15:15:42 - a single chime was heard in the cockpit. Subsequently, the crew commented on the occurrence of an AIRFRAME DE-ICING Fault;
- 15:15:49 - the AIRFRAME DE-ICING was turned off;
- 15:16:25 - the Electronic Ice Detector ceased emitting the alert signal.
- 15:17:08 - the Electronic Ice Detector emitted an alert signal.
- 15:19:13 - the Electronic Ice Detector stopped emitting the alert signal;
- 15:23:43 - the Electronic Ice Detector emitted an alert signal;
- 15:30:05 - the Electronic Ice Detector stopped emitting the alert signal.
- 16:11:02 - the Electronic Ice Detector emitted an alert signal;
- 16:12:41 - the Electronic Ice Detector stopped emitting the alert signal;
- 16:12:55 - the Electronic Ice Detector emitted an alert signal;
- 16:15:16 - the SIC (pilot Second in Command) made radio contact with the airline's operational dispatcher at *Guarulhos* airport, for coordination of the aircraft arrival;
- 16:16:25 - At the same time of the SIC's coordination with the operational dispatcher, a flight attendant called over the intercom. The SIC asked her to hold on moment and continued speaking with the dispatcher;
- 16:17:20 - the Electronic Ice Detector stopped emitting the alert signal. At this time, the SIC was asking the flight attendant for information that would be passed to the operational dispatcher;
- 16:17:32 - the Electronic Ice Detector emitted an alert signal; at this time, the PIC was informing the passengers about the SBGR local conditions and estimated time of landing;
- 16:17:41 - the AIRFRAME DE-ICING was turned on;
- 16:18:41 - at a speed of 191 kt., the CRUISE SPEED LOW alert was triggered. Concomitantly, the SIC was about to finish relaying some information to the operational dispatcher;
- 16:18:47 - the PIC started the briefing relative to the approach for landing in SBGR. Concomitantly, APP-SP made a radio call, and instructed him to change to frequency 123.25MHz;

- 16:18:55 – a single chime was heard in the cockpit. At this time, the communication with APP-SP was taking place;
- 16:19:07 - the AIRFRAME DE-ICING was turned off;
- 16:19:16 - the crew made a call to APP-SP (*São Paulo* Approach Control) on the frequency 123.25 MHz;
- 16:19:19 - APP-SP requested the PS-VPB aircraft to maintain FL170 due to traffic;
- 16:19:23 - the crew replied to APP-SP that they would maintain flight level and that they were at the ideal point of descent, waiting for clearance;
- 16:19:28 - at a speed of 184 kt., the DEGRADED PERFORMANCE alert was triggered, together with a single chime. The alert was triggered concomitantly with the exchange of messages between APP-SP and the crew;
- 16:19:30 - APP-SP acknowledged the message and requested the aircraft to wait for clearance;
- 16:19:31 - *Passaredo 2283* aircraft reported receipt of the message and thanked ATC;
- 16:19:33 - the PIC resumed delivering the approach briefing;
- 16:20:00 - the Second in Command (SIC) commented, "a lot of icing";
- 16:20:05 - the AIRFRAME DE-ICING was turned on for the third time;
- 16:20:33 - APP-SP cleared the aircraft to fly direct to SANPA position, maintaining FL170, and informed that the descent would be authorized in two minutes;
- 16:20:39 - the crew acknowledged the flight instruction received (last communication performed by the flight crew);
- 16:20:50 - the aircraft started a right turn in order to fly to SANPA position.
- 16:20:57 – during the turn, at a speed of 169 kt., the INCREASE SPEED alert was triggered, in conjunction with a single chime. Immediately afterwards, vibration noise was heard in the aircraft, simultaneously with the activation of the stall alert;
- 16:21:09 - control of the aircraft was lost, and it entered an abnormal flight attitude until colliding with the ground. The aircraft rolled to the left to a bank-angle of 52 degrees, and then rolled to the right to a bank-angle of 94 degrees, performing a 180-degree turn in a clockwise direction. Subsequently, the turn was reversed to an anticlockwise direction, with the aircraft completing five full rotations in a flat spin before crashing into the ground.

Information on the personnel involved.

Flight Experience		
Discrimination	**PIC**	**SIC**
Total	5.248:50	5.143:55
Total in the last 30 days	59:18	02:36
Total in the last 24 hours	02:36	02:36
On this type of aircraft	665:54	3.543:55
On this type in the last 30 days	59:18	02:36
On this type in the last 24 hours	02:36	02:36

Obs.: the Pilot in Command (PIC) and the SIC held valid ratings for AT47 Type Aircraft (which included the ATR 72-212A), and IFRA (IFR Flights - Airplane).

<u>Qualification and experience in the type of flight</u>

Both pilots had performed theory and practice training, in addition to being submitted to exams of proficiency in flight simulators, which contemplated emergency training and, especially, flight management in icing conditions.

Composing the crew of the PS-VPB, there were also two flight attendants. Both of them held flight attendant licenses (CMS) and held valid AT 47 ratings.

All the members of the crew were qualified and had experience in the type of flight. Their CMAs (Aeronautical Medical Certificates) were valid.

Aircraft information.

The SN 908 aircraft ATR 72-212A, commercially designated as ATR 72-500, was a product manufactured by GIE - Avions de Transport Régional in 2010, and registered in the Public Regular Air Transport Category (TPR).

The aircraft was incorporated in the operator`s fleet on 29 September 2022.

The CVA (Certificate of Airworthiness-Verification) of the aircraft was valid.

Pneumatic System

The aircraft had a pneumatic system capable of supplying other systems with the pressurized air necessary for their operation, such as the Environmental Control System (ECS), the electronic equipment ventilation system, and the De-Icing system.

The pressurized air utilized by the systems was bled from the compressor of both engines (bleed air), in two distinct points of each engine, one of Low Pressure (LP) and the other of High Pressure (HP).

The pressurization, air conditioning, and regulation of the air for the passenger-cabin and for the flight deck was effectuated by means of a set of different pieces of equipment, which comprised a Unit known as Pack.

The aircraft had two Packs, one of which was fed by the bleed air from the left-hand engine (Pack 1), whereas the other one was fed by the bleed air from the right-hand engine (Pack 2).

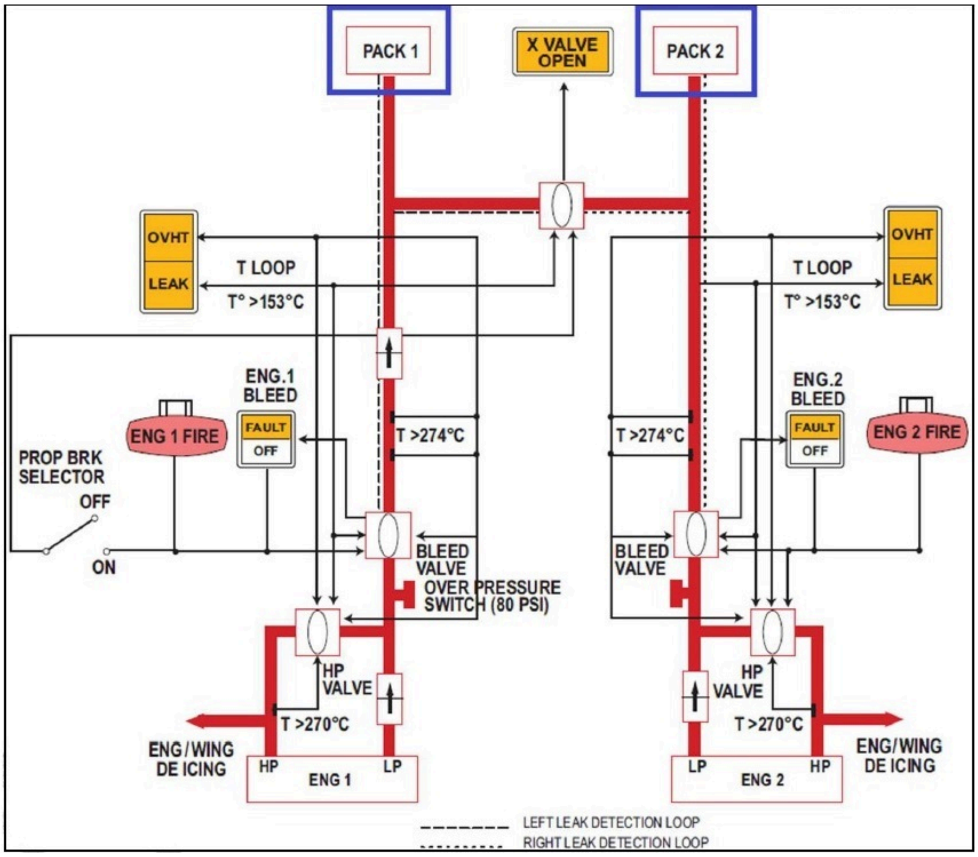

Figure 1 - Pneumatic System.
Source: Systems_42-500_72-500 ATR Training & Flight Operations Services.

Protection Systems related to Icing

The ATR 72-212A aircraft was certified and equipped with systems which allowed operation in adverse weather conditions, including atmospheric conditions conducive to icing.

2 Kinds of Operation

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The aircraft is certified in the transport category for day and night operations, in the following conditions when the appropriate equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition:

- VFR and IFR
- Flight in icing conditions
- Reverse thrust taxi (single or twin engine).

Figure 2 - Excerpt from the Airplane Flight Manual (AFM).

The systems that provided aware and protection against ice build-up on the aircraft (ice accretion) had the following subdivisions:

- Ice detection system;
- Anti-Icing system;
- De-Icing system; and
- Aircraft Performance Monitoring (APM).

Ice Detection system

The Ice Detection System utilized two main components:

- An Ice Evidence Probe (IEP); and
- An Eletronic Ice Detector.

The IEP was located on the left side of the aircraft fuselage, externally to the cockpit. It provided a visual indication, and was the principal means for the identification of the ice build-up condition on the aircraft (Figures 3 and 4).

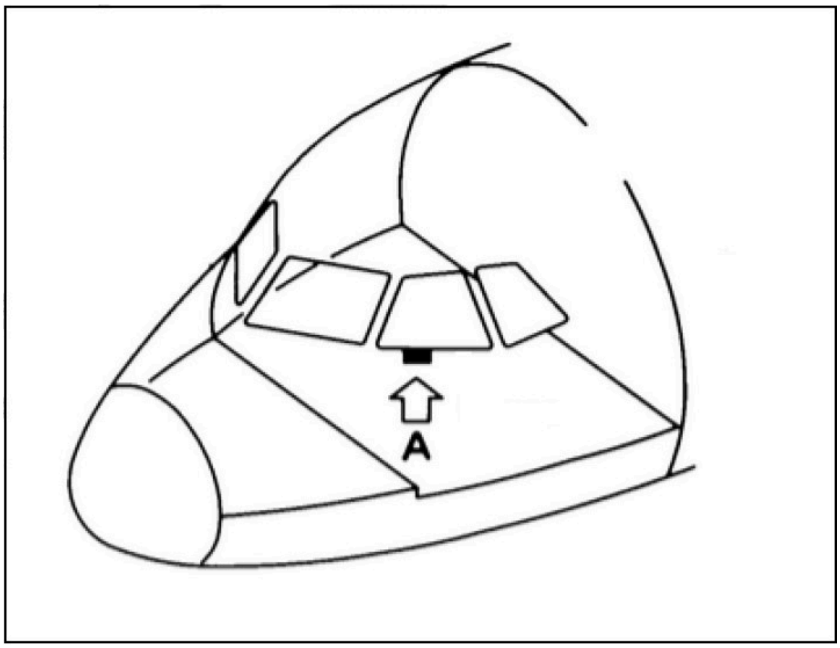

Figure 3 - (A) Indication of the IEP (Ice Evidence Probe) position-.
Source: ATR`s Line Maintenance Manual (ATA 30).

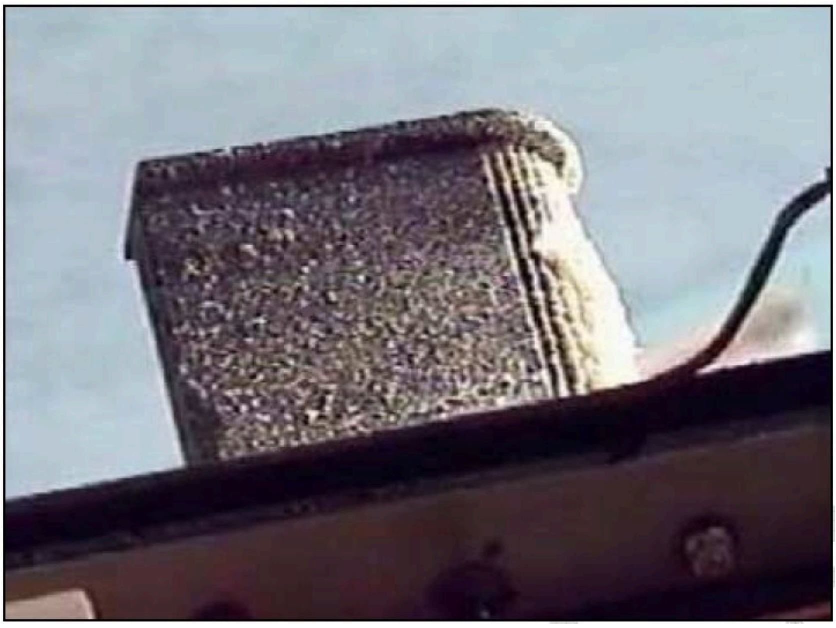

Figure 4 - View of the IEP from the left-hand piloting position.
Source: Ice & Rain, ATR Training Centre.

The IEP was designed to retain ice accumulation while all other surfaces of the aircraft were still ice-free. Therefore, the IEP was supposed to be the first one to accumulate ice, and the last to become free of it. In other words, the IEP provided the pilots with:

- Visual information on the onset of ice accumulation; and
- Visual information that the aircraft was free from ice.

The Airplane Flight Manual (AFM) of the ATR 72-212A highlighted that an aircraft could only be considered clear of ice when the IEP was completely free of the ice accumulation.

Note

The aircraft is considered clear of ice when IEP is free of ice.

Figure 5 - Note extracted from the procedure related to Icing Conditions of the ATR 72-212A AFM.

In addition, the aircraft was equipped with an Electronic Ice Detector installed on the underside of the left-hand wing.

The Electronic Ice Detector possessed a sensor capable of indicating that the aircraft was in a condition favorable for the formation of ice, leading to the emission of an amber alert on the ICE DETECT panel of the central panel of the cockpit, and of the Centralized Crew Alert System (CCAS), followed by a single chime.

The ICE DETECT panel also had an ICING AOA light, which would illuminate in green whenever one of the HORN buttons of the Anti-Icing panel was pushed, informing the pilot that the aircraft was under a new angle of attack limit for the activation of the Stall Warning.

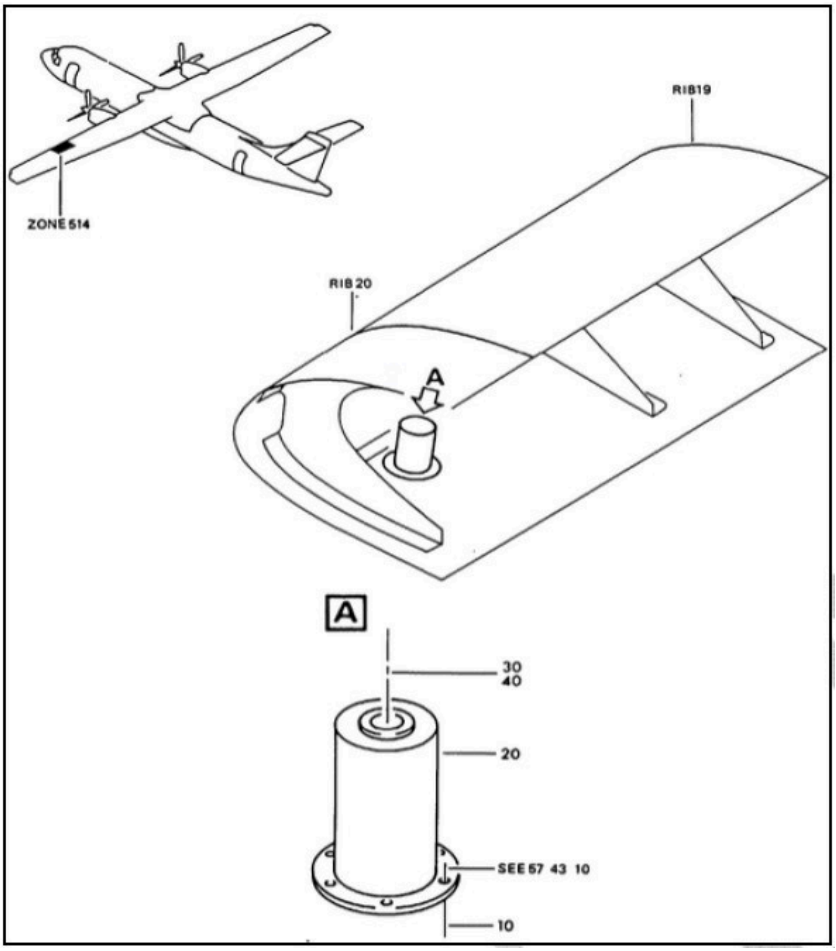

Figure 6 - Indication of the Ice Detector position.
Source: Line Maintenance Manual of the ATR, ATA 30.

Figure 7 - Electronic Ice Detector.
Source: Systems_42-500_72-500 ATR Training & Flight Operations Services.

Figure 8 - Indication of the ICE DETECT panel with the amber light illuminated, showing an "ICING" condition.
Source: ATR Training Centre.

The ICING light would blink with the detection of an Icing condition and the Anti-Icing and/or De-Icing (AIFRAME) were not selected to ON, followed by single chime. The light would remain illuminated in a continuous fashion with the systems turned on.

Anti-Icing e De-Icing systems

The Anti-Icing functions were energized electrically, whereas the De-Icing ones were provided by means of pneumatic pressure.

The manufacturer`s design philosophy was based on three levels of ice protection, two of which were Anti-Icing (with utilization of electric heating), and the other one De-Icing (with utilization of a system of boots inflatable by pneumatic pressure).

a) Permanent Anti-Icing Protection. Provided by means of electrical heating, which comprised:

- 3 pitot tubes;
- 6 static ports;
- 2 temperature sensors (Total Air Temperature - TAT);
- 2 Angle of Attack sensors (Angle of Attack probes - AOA); and
- windshield

b) Anti-Icing for use under icing conditions). Provided by electrical heating, which comprised:

- leading edges of the propeller blades;
- horns of the ailerons, rudder, and elevators; and
- side windows of the cockpit.

c) De-Icing. Provided by pneumatic pressure, which comprised:

- boot of the left-hand engine air intake;
- boot of the right-hand engine air intake;
- gas path;
- boots of the wing leading-edges; and
- boots of the horizontal tailplane leading-edges.

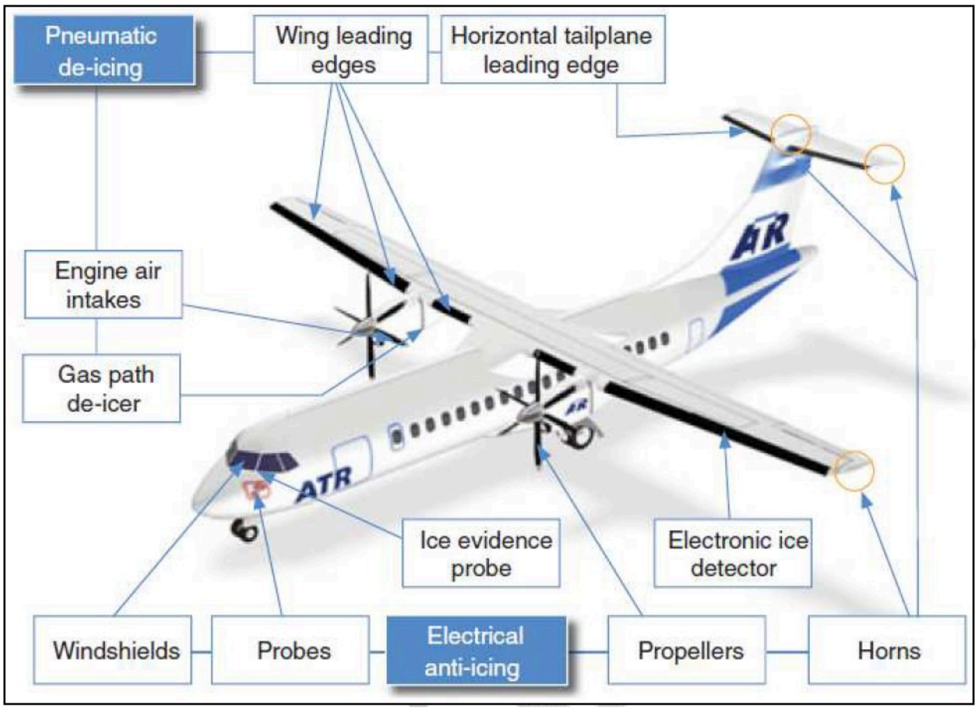

Figure 9 - Identification of the position of the Ice-related Protection System's components.
Source: Cold Weather Operations, ATR Training Centre.

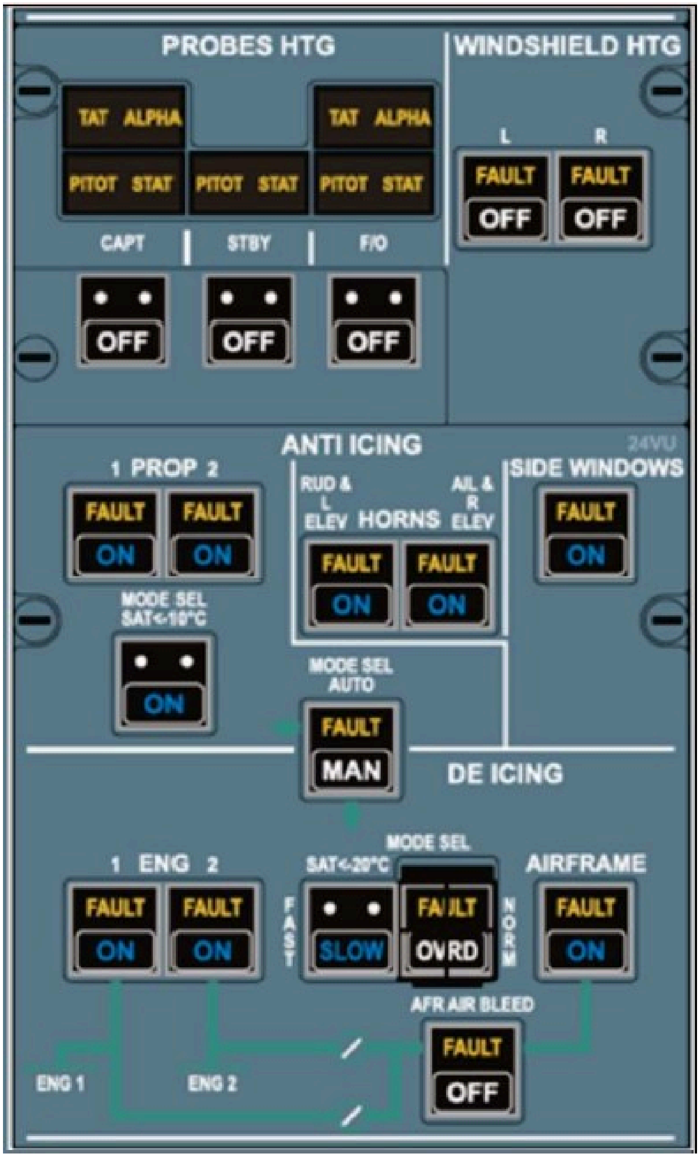

Figure 10 - Anti-Icing and De-Icing panel located on the Overhead Panel.
Source: ATR Training Centre.

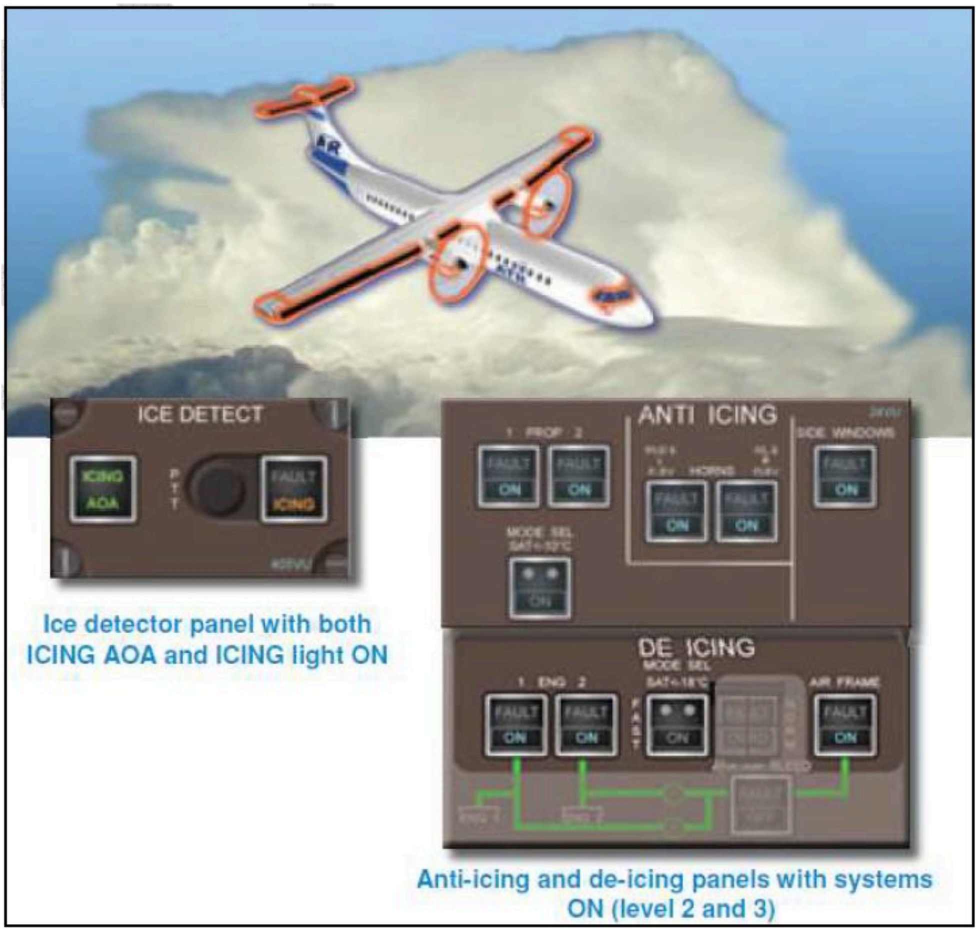

Figure 11 - Indication of the Ice-Detect, Anti-Icing, and De-Icing panels with all the protections activated. Source: Cold Weather Operations, ATR Training Center

Aircraft Performance Monitoring (APM)

The APM used aircraft and engine parameters to monitor aerodynamic drag under conditions of ice accretion, in order to alert the crew about the risk of performance degradation when flying in icing conditions.

The APM monitored the aircraft's performance to enhance the crew's situational awareness regarding the risk of severe icing conditions. The cruise speed was monitored to alert the crew about any abnormal decrease under icing conditions, ensuring the aircraft remained above the minimum maneuver speed for a icing condition (Minimum Maneuver Speed, in Low Bank Flap 0º in Icing Condition - VMLB0 ICING)

For the APM to calculate the theoretical drag of the aircraft and compare it with its performance in flight, the calculated takeoff weight needed to be entered by the pilots right after engine start (before takeoff). The weight was entered using a rotary knob located on the APM panel.

The human-machine interaction of the APM system was conducted by means of three panels: the APM panel, located at the right-hand cockpit station, and two APM alert panels located in front of the pilots at the left- and right-hand cockpit stations.

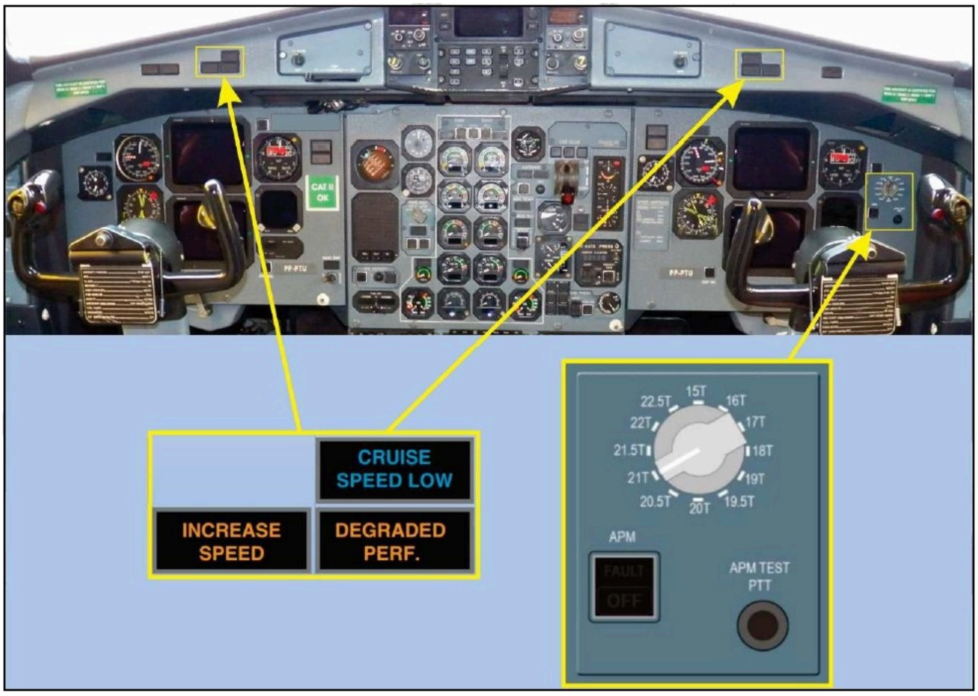

Figure 12 - Position of the interface Human-Machine components of the APM.
Source: ATR.

The APM system needed to be checked by the crews on a daily basis, and in case of a failure, an amber-colored FAULT message would illuminate on the APM panel.

If the aircraft's drag increased due to ice accumulation and performance was degraded, resulting in loss of cruise speed, alerts in three levels were triggered and presented to the pilots on both alert panels of the APM, as follows:

- 1st Level - CRUISE SPEED LOW.
  The blue-colored message would indicate performance degradation of around 10%, with reduction of the Indicated Air Speed (IAS) during the cruise phase by at least 10 kt. below the speed computed by the APM. This alert would be triggered only during the cruise phase.
- 2nd Level - DEGRADED PERFORMANCE.
  The amber-colored message would be followed by a single chime and a master caution alert, indicating a significant performance degradation in the range between 22% and 28%, induced by a significant increase in aerodynamic drag, causing a drop in cruise IAS of around 15 to 20 knots below the speed computed by the APM. This alert could be triggered during climb, cruise, or descent.
- 3rd Level - INCREASE SPEED.
  The amber-colored message would appear flashing, followed by a single chime and a master caution alert, indicating that the degraded performance condition had worsened , reaching an IAS value below the ICING BUG + 10 kt. This alert could be triggered during climb, cruise, or descent.

<u>Icing Bug - VMLB0</u>

In addition to the speed alerts (emitted by the APM), the airspeed indicators of the left- and right-hand cockpit stations had BUGS for reference, particularly for minimum speed maneuvers at low bank, flaps 0°, and icing conditions (VMLB0 ICING), The said BUGS could be adjusted manually.

The ICING BUG needed to be adjusted by the pilots for each flight in accordance with the aircraft's weight, in order to indicate the minimum speed for a flight in icing conditions and with flaps retracted. The VMLB0 ICING value was equivalent to the ICING BUG.

Figure 13 - Illustration of the ATR 72-212A's IAS gauge showing the ICING BUG.

During the execution of the procedures, the crew mentioned that the ICING BUG would be adjusted to the speed of 165 kt., a speed consistent with the calculations performed by the Investigation Committee.

Procedures for flights in icing conditions.

In case of Identification of conditions favorable for icing, the manuals of the aircraft prescribed the execution of procedures in accordance with the level of severity encountered.

In accordance with the Quick Reference Handbook (QRH), at the first moment of detection of an icing condition, the following procedures needed to be executed:

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PROCEDURE FOR ICING CONDITIONS

► IAS : MAINTAIN AT OR ABOVE ICING BUG
► ANTI ICING systems...ON
► ICE ACCRETION : MONITOR
- **When ice accretion is observed/detected**
  - ► DE ICING systems...ON
  - **In FLAPS 0 configuration**
    - ► IAS : MAINTAIN AT OR ABOVE ICING BUG +10 kt
  - ► IAS & V/S : MONITOR

Note
Refer to AFM - SEVERE ICING DETECTION for severe icing indications information.

- **If any severe icing indication**
  - ► SEVERE ICING procedure (E99.08) ....APPLY
- **When leaving icing conditions**
  - ► ANTI ICING & DE ICING systems...................TURN OFF AS RQRD
- **When aircraft is visually verified clear of ice**

  Note
  The aircraft is considered clear of ice when IEP is free of ice.

  - ► ICING AOA pb ....OFF
  - ► NORMAL SPEED : USE

Figure 14 - Procedure for Icing Conditions extracted from the aircraft's QRH.

This procedure required the pilot to maintain the speed equal to, or greater than, the ICING BUG speed, to turn on the Anti-Icing systems, and to monitor ice accretion.

When ice accretion was identified, the De-Icing system had to be turned on. The speed of the aircraft ought to be maintained equal to, or greater than, ICING BUG +10 kt. with flaps at 0º, and the IAS and the rate of climb ought to be monitored. A note referred to the procedures related to the detection of severe icing listed in the aircraft manual.

In case of severe-icing indication, the procedures listed in the E99.08 (Figure 16) ought to be performed.

When the aircraft was no longer under icing conditions, the Anti-Icing and De-Icing systems would be turned off, as required.

When the absence of ice was visually verified by means of the IEP, the ICING AOA was to be turned off, and normal speeds could be utilized.

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SEVERE ICING DETECTION A30.17

SEVERE ICING main indications :

- **Ice covering all/substantial parts of unheated side window (visual cue)**
- **Unable to maintain IAS above ICING BUG +10 kt**
- **Unable to maintain V/S above 100 ft/min AVERAGE at icing bug +10 kt**
- **Abnormal vibrations**

■ **If any severe icing indication :**

► SEVERE ICING procedure (E99.08) .... APPLY

Supplementary indications:

- Water splashing/streaming on the windshield
- Unusual extensive ice accreted on the airframe in areas not normally observed to collect ice
- Accumulation of ice on the lower surface of the wing aft of the protected areas
- Accumulation of ice on propeller spinner farther aft than normally observed

Weather conditions that can result in severe in-flight icing:

- Visible rain at temperatures close to 0 °C (SAT)
- Droplets that splash or splatter on impact at temperature close to 0 °C (SAT).

Figure 15 - Procedures related to Severe Icing Detection extracted from the aircraft QRH.

The QRH listed the following indications of severe icing:

- ice covering substantial parts of non-heated lateral windows;
- inability to maintain the IAS above the ICING BUG +10 kt.;
- inability to maintain average rate of climb greater than 100 ft.\min at the speed of ICING BUG +10 kt.; and
- abnormal vibrations.

Should there be any indication of severe icing, the procedures listed in E99.08 (Figure 16) needed to be applied.

Other secondary indications referred to:

- water splashing and running down the windshield;
- extensive ice accumulation in areas of the structure where it was not normally observed;
- ice accumulation on the forward part of the lower surface of the wing in protected areas; and
- ice accumulation on the propeller spinner, further aft than normally observed.

The following weather conditions would be conducive to severe-icing formation:

- visible rain at temperatures close to 0ºC Static Air Temperature (SAT); and
- drops that spread or splash at impact, at temperatures close to 0°C SAT.

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SEVERE ICING E99.08

- ► IAS : ICING BUG + 30 kt (or ICING BUG IF FLAPS 15 EXTENDED)
- ► PWR MGT .... MCT
- ► PL 1+2 .... ADJUST
- ► CL 1+2 .... 100 % OVRD
- ► DESCENT .... INITIATE
- ► MEA / RECOMMENDED MAXIMUM ICING FLIGHT LEVEL .... CHECK

CAUTION

Firmly hold control column and wheel to avoid non-expected aircraft movements at AP disengagement

- ► AP .... DISENGAGE

■ **If not able to accelerate and maintain IAS above ICING BUG + 30 kt with flaps 0**

- OR -

■ **If not able to accelerate and maintain IAS above ICING BUG with flaps 15**

- ► LOW BANK .... SET
- ► SEVERE ICING CONDITION .... ESCAPE
- ► ATC .... NOTIFY

■ **If abnormal aircraft roll behavior**

- ► STALL procedure (E99.09) .... APPLY

● **As long as aircraft is not clear of ice**

- ► FLAPS : DO NOT RETRACT
- ► TCAS .... TA ONLY

● **For landing**

- ► APPROACH CONFIGURATION .... FLAPS 15

HIGH BANK CAN BE SET

- ► REDUCED FLAPS LANDING procedure (A27.05) .... APPLY

Note

Refer to PRO.NNO.ABN.30.6.ICE.2.A30.17 SEVERE ICING DETECTION for information on severe icing indications.

Figure 16 - Procedures prescribed for severe icing conditions, extracted from the aircraft's QRH.

In case of severe icing conditions, the prescribed procedures were the following:

- maintain the speed of ICING BUG + 30 kt. (or ICING BUG, with flaps extended to 15);
- select continuous maximum power;
- ajustar os manetes de potência;
- select CL to 100% NP;
- start descent, verifying the minimum enroute altitude;
- hold the control column firmly to avoid unexpected aircraft movements upon autopilot disengagement;
- disengage autopilot.

If not possible to accelerate and maintain the IAS above the ICING BUG + 30 kt. (with flaps at 0°) or IAS above the ICING BUG (with flaps at 15°) the following procedures were prescribed:

- select LOW BANK mode;
- escape from icing condition; and
- notify ATC (Air Traffic Control).

If the aircraft presented an abnormal rolling behavior, the prescribed stall-related procedure needed to be applied.

According to the referred procedure, the crew was supposed to not retract the extended flaps until the surface of the aircraft fuselage was clear of ice, and the TCAS ought to be set to TA ONLY mode.

A note referred to procedure 30.17 (Figure 15) for information related to identification of severe icing.

In addition, based on the alerts emitted by the APM, the Quick Reference Handbook (QRH) prescribed the procedures shown below:

1 Cruise Speed Low

Cruise Speed Low

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CRUISE SPEED LOW

- ICING CONDITIONS : MONITOR
- SPEED : MONITOR

Figure 17 - Procedures prescribed for the Cruise Speed Low condition, extracted from the aircraft's QRH.

Upon triggering of the CRUISE SPEED LOW warning, the icing condition and the speed needed to be monitored.

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A30.15 DEGRADED PERF

- IAS : MAINTAIN ABOVE ICING BUG +10 kt
- IAS & V/S : MONITOR
- FLIGHT PATH : AMEND

Note

- *It is recommended to accelerate above icing bug + 30 kt.*
- *Refer to OPSDATA to determine recommended maximum icing Flight Level.*

If in icing condition

- ANTI ICING systems ....CHECK ON
- DE ICING systems ....CHECK ON

If not able to accelerate and maintain IAS above icing bug +30 kt

- AP ....OFF
- LOW BANK....................SET

Note

Refer to PRO.NNO.ABN.30.6.ICE.2.A30.17 SEVERE ICING DETECTION for severe icing indications information

If any severe icing indication

- SEVERE ICING procedure (E99.08) ....APPLY

As long as DEGRADED PERF amber light is ON

- TCAS ....TA ONLY
- ICING CONDITIONS : MONITOR

Figure 18 - Procedures prescribed for the Degraded Performance condition, extracted from the Aircraft's QRH.

If the DEGRADED PERFORMANCE alert was triggered, the following procedures were prescribed:

- maintain IAS above the ICING BUG + 10 kt.;
- monitor IAS and rate of climb; and
- amend flight path.

A note contained a recommendation to increase the speed to a value above the ICING BUG + 30 kt. and consult the documentation for determining the flight level recommended for icing-conditions avoidance.

With the aircraft flying in icing conditions, the crew needed to check that both the Anti- Icing and De-Icing systems were ON.

If not possible to increase the IAS above the ICING BUG + 30 kt., the autopilot needed to be disconnected and the LOW BANK mode had to be selected.

A note referred to the 30.17 procedure (Figure 15) for information on the identification of severe icing.

Should there be indication of severe icing, the procedure listed in E99.08 (Figure 16) needed to be applied.

In case the DEGRADE PERF amber light remained illuminated, the TCAS had to be kept in the TA ONLY mode, and the icing conditions had to be monitored

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A30.16 INCREASE SPEED

- ► IAS : ICING BUG +30 kt
- ► SEVERE ICING procedure (E99.08) .... APPLY

Figure 19 - Procedure prescribed for the Increase Speed condition, extracted from the aircraft's QRH.

If the INCREASE SPEED alert went off, the IAS needed to be kept in ICING BUG + 30 kt., and the E99.08 procedure (Figure 16) had to be applied.

In the event of a failure in the airframe De-Icing system, icing conditions needed to be avoided, or abandoned if already present, and the airframe De-Icing system had to be turned off.

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DE ICING AIRFRAME FAULT A30.07

- ► ICING CONDITIONS : LEAVE AND AVOID
- ► DE ICING AIRFRAME.. OFF
- ■ **As long as aircraft is not clear of ice**
- OR -
- ■ **If in icing conditions**
  - ► IAS (Refer to QRH - PER.3 - OPSDATA)....NOT LESS THAN icing bug + 15 kt
  - ► V_{APP} (Refer to QRH - PER.3 - OPSDATA).... NOT LESS THAN V_{REF} + 15 kt
  - ► LDG DIST (Refer to QRH - PER.7.1 - Landing Distance)....MULTIPLY BY 1.25
  - ► STEEP SLOPE APPROACH (≥ 4.5 °) : PROHIBITED

Figure 20 – Procedure prescribed for De-Icing airframe fault.

As long as the aircraft was not free of accumulated ice or flying in icing conditions:

- speed parameters needed to be observed, but not lower than ICING BUG + 15 kt.;
- VAPP could not be lower than VREF + 15 kt.;
- the landing distance had to be multiplied by 1.25; and
- landing approaches at angles equal to or greater than 4.5° were prohibited.

<u>Maintenance records of the aircraft</u>

Preliminarily, the Investigation Committee verified that the latest revision (type "2YE") of the aircraft began on 01 January 2023 and ended on 24 June 2023, date of its Return-to- Service Approval. The maintenance was performed by Passaredo Transportes Aéreos (Maintenance Organization Certificate – COM – 0701-04/ANAC) in Ribeirão Preto, State of São Paulo. On the occasion, the aircraft had a TSN (Time Since New) of 15,289 hours and 10 minutes of flight, whereas its CSN (Cycles Since New) was 9,593.

The latest routine inspection of the aircraft (Type "Daily Check") was performed by the abovementioned maintenance organization on 09 August 2024, in Ribeirão Preto, State of São Paulo. On the occasion, the aircraft had a TSN of 17,289 hours and 40 minutes of flight, and a CSN of 11,198.

According to the records collected from the aircraft's Technical Logbook, referring to the technical situation of the aircraft, the Pack 1 had been inoperative since 05 August 2024.

A failure or malfunction in one of the Packs was not an impediment for the aircraft to be dispatched for a flight, provided that certain conditions were met, as prescribed in the Minimum Equipment List (MEL), shown in Figure 21.

21-50-01 Pack

ALL

EASA - APPROVED

RI	NI	NR	PLACARD	O	M
C	2	1	YES	YES	NO

One may be inoperative provided:
(a) Flight level is limited to FL 170,
(b) Associated pack is selected OFF, and

See Operational procedure MOP.21.50-01P Pack (O)

Figure 21 - Excerpt of the MEL relative to the Pack.
Source: adapted from Rev 08 of the operator´s MEL, dated 20FEB2024.

In this particular case, for dispatching the aircraft with the Pack inoperative, the MEL required the following parameters to be observed:

- (1) Item number - identified the system by means of the ATA, a code created by the Air Transport Association and used in aviation worldwide to organize technical maintenance information into numbered categories. The number 21-50-00 identified the Pack item;
- (2) Title - highlighted the name of the related item;
- (3) Rectification Interval (RI) - identified the category in which the item was classified to define the maximum time for rectifying of the condition. Category "C" referred to the period of 10 consecutive days or 240 hours, excluding the day on which the failure or malfunction condition was detected;
- (4) Number Installed (NI - number of items installed in the aircraft) - indicated the number of pieces of equipment, components, systems or functions installed, corresponding to the type-certified configuration of the aircraft;
- (5) Number Required (NR) - specified the minimum quantity of pieces of equipment, components, systems, or functions that had to be operational for a dispatch, in accordance with the MEL requirements;
- (6) Placard - the dispatch condition could demand that inoperative components be clearly marked in the cockpit. The word "YES" indicated that there had be signage in the cockpit;
- (7) Operacional Procedures (O) - an inoperative piece of equipment could refer to an operational procedure. The word "YES" informed that there was a reference to an operational procedure, indicated in the parameter (10);
- (8) Maintenance Procedures (M) - an inoperative piece of equipment could refer to a maintenance procedure. The word "NO" indicated that there was no reference;
- (9) References - indicated the dispatch requirements that had to be be met. In the case in question, they were the following:
  - Flight level limited to FL170; and
  - Associated pack selected as OFF.
- (10) MEL Operational Part (MOP) reference code - the code identified the operational procedures that should be used for dispatching the aircraft under the condition of an inoperative Pack.

The MOP 21-50-01P referenced in the MEL for dispatch with an inoperative Pack required the following:

21-50-01P Pack (O)

EASA - APPROVED

ALL

As an in-flight failure could imply total loss of pressurization, fuel consumption at FL 100 must be taken into account to compute the trip fuel.

Note

With a pack selected OFF, engine torque parameter of the related side will increase.

○ PL (affected engine)..ADJUST TO OTHER ENGINE

Figure 22 - MOP 21-50-01P Operational Procedure - Pack (O).

The operating procedure included the following:

- need to calculate fuel considering aircraft consumption at flight level 10,000 ft. (FL100);

- a note highlighting that the engine torque related to the inoperative Pack would increase; and
- Power Lever (PL) adjustment was required for the affected engine.

Meteorological information.

Images from the Geostationary Operational Environmental Satellite (GOES) 16 on channel 13 (thermal infrared channel centered at 10.3 µm), between 14:56 UTC and 16:26 UTC on 09 August 2024, showed the presence of an extensive band of clouds over the states of *Mato Grosso do Sul* (MS), southwest of *Mato Grosso* (MT), north-central and east of *Paraná* (PR), *São Paulo* (SP) and extreme south of *Minas Gerais* (MG), as illustrated in Figure 23.

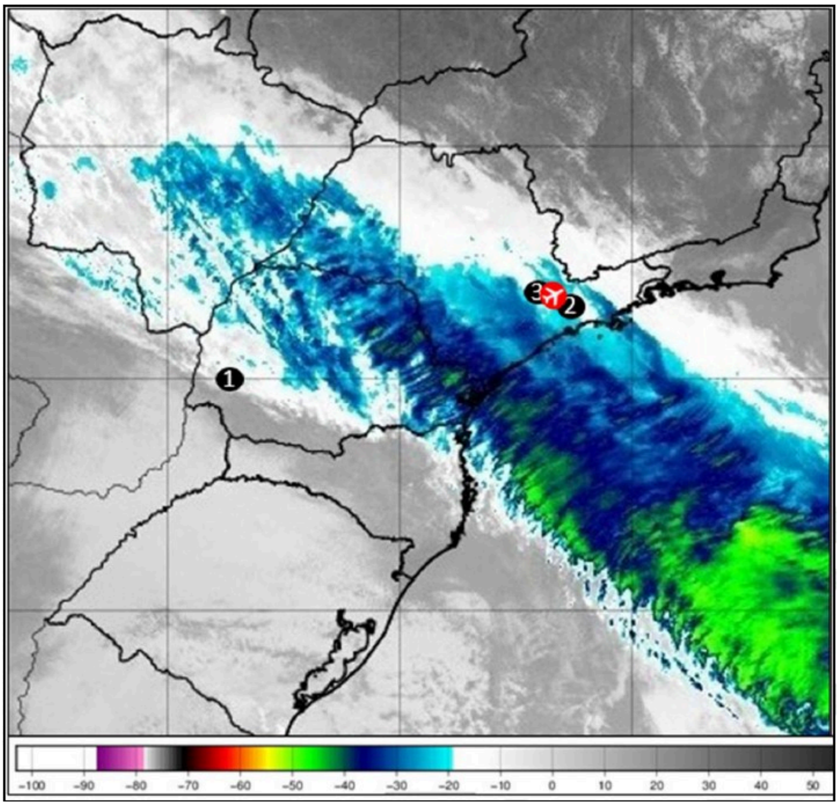

Figure 23 - GOES-16 Satellite image. Numbers show the locations of aerodromes; number "1" - SBCA; number "2" - SBGR; and number "3" - SBKP. The red circle highlights the location of the aeronautical occurrence.
Source: adapted from CPTEC.

These clouds were formed by the advance of a cold front, which was associated with a low-pressure center located in the Atlantic Ocean, near the coast of the State of *Santa Catarina* (SC)

As illustrated in Figure 23, clouds with tops presenting temperatures between 0°C and -35°C (light gray to dark blue tones) predominated, indicating the existence of medium altitude clouds of the altocumulus and altostratus types. The presence of Towering Cumulus (TCU) clouds was observed in scattered points and embedded in the medium cloud layer, between the east-central region of the State of *Paraná* and the south of the State of *São Paulo*, with temperatures between -35°C and -45°C (dark green to light green tones). The set of cloudiness spots shown also favored the presence of convective clouds of the Cumulonimbus (CB) type, however in isolated points of the State of *Mato Grosso do Sul* and over the Atlantic Ocean, with temperatures between -45°C and -55°C (light green tones tending to yellow).

Upper-air atmospheric data from radiosondes showed the atmospheric vertical profile from the surface to the tropopause (layer of the atmosphere at an altitude of around 20 km) highlighting thermodynamic behavior, presence of air masses, air humidity, wind direction and speed.

In the region of interest, there were three High Altitude Meteorological Stations (EMA) with analyses carried out at 12:00 UTC on 09 August 2024. They were located at the aerodromes of SBFI (*Foz do Iguaçu*, PR), SBCT (*Curitiba*, PR), and SBMT, (*Campo de Marte*, SP).

In order to provide a better understanding of the conditions in the vicinity of the crash site, an analysis of the SBMT EMA data is shown below.

From the data obtained by the SBMT EMA, it was possible to verify that the atmosphere was very humid (T-Td < 2°C and the mixing ratio > 1g/kg) at average levels, between 670 hPa (FL110) and 420 hPa (FL230), evidencing the presence of extensive cloudiness with significant thickness.

Since the air temperature only reaches the 0°C isotherm at 650 hPa (FL120), severe High Altitude Icing (HAF) occurs between FL120 and FL230. The wind at FL170 was predominantly from the West (W) with 46 kt., and the air temperature was -9°C. A maximum wind (*jet stream*) from the West at a speed of 100 kt. was identified around 250 hPa (FL340), as shown in Figure 24.

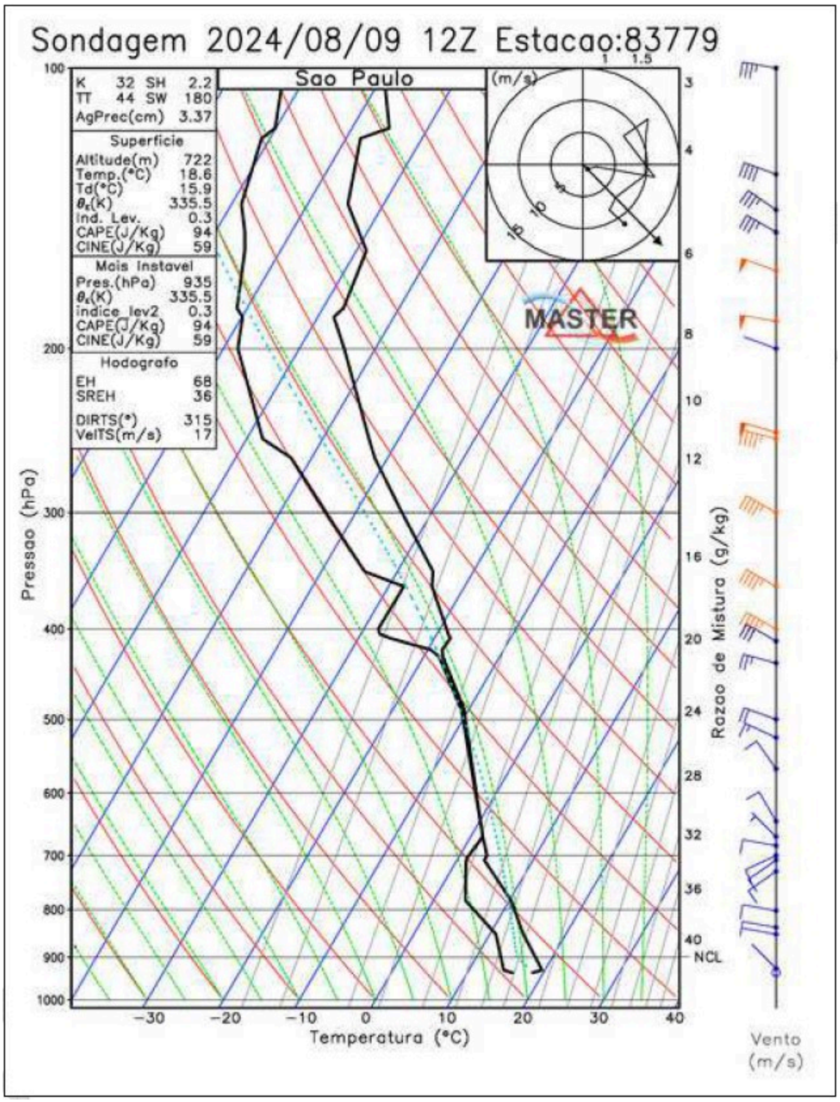

Figure 24 - Skew-T log-p diagram with winds aloft data of SBMT 12:00 UTC 09 August 2024.

In the diagram of Figure 24, the continuous black line on the right indicates the air temperature, whereas the continuous black line on the left indicates the dew point temperature. Arrows on the right-hand side of the diagram indicate wind direction and speed.

SIGMET messages related to severe-icing forecast were issued on 09 August 2024 for the Flight Information Regions of *Curitiba* (CW) and *Brasília* (BS), with validity from 15:30 UTC to 19:30 UTC (respectively, SBBS SIGMET 2 and SBCW SIGMET 9), as shown in the Figure 25 below.

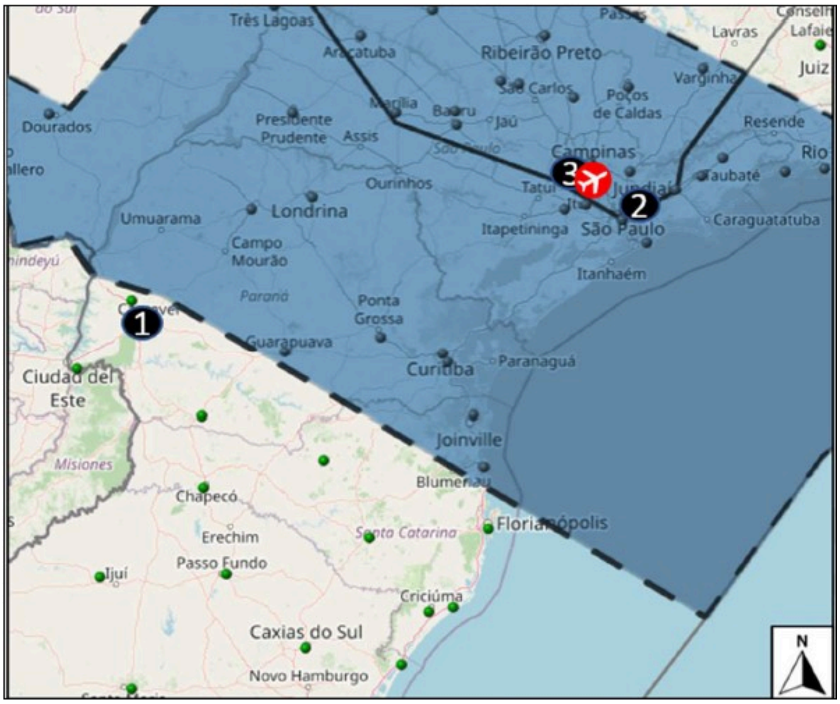

Figure 25 - Areas related to the Severe Icing SIGMET message issued for FIR-CW and FIR-BS (blue hatched highlight). Numbers show the locations of aerodromes: "1" - SBCA, "2" - SBGR, and "3" - SBKP. The red circle indicates the crash site.

The referred SIGMET messages forecasted the occurrence of severe FGA (SEV ICE), with base at FL120 and top at FL210, with no apparent movement and no change in intensity, as shown below:

> SBBS SIGMET 2 VALID 091530/091930 SBBS - SBBS BRASILIA FIR SEV ICE FCST WI S1809 W05326 - S2020 W05127 - S2220 W04955 - S2307 W04734 - S2338 W04639 - S2314 W04552 - S2248 W04546 - S2140 W04452 - S1804 W05226 - S1809 W05326 FL120/210 STNR NC= SBCW SIGMET 9 VALID 091530/091930 SBCW - SBCW CURITIBA FIR SEV ICE FCST WI S2024 W05806 - S2204 W05801 - S2221 W05549 - S2359 W05525 - S2349 W05440 - S2418 W05416 - S2422 W05417 - S2439 W05316 - S2848 W04527 - S2645 W04345 - S2356 W04006 - S2140 W04452 - S2248 W04546 - S2314 W04552 - S2338 W04639 - S2307 W04734 - S2220 W04955 - S2020 W05127 - S1809 W05326 - S1823 W05638 - S2045 W05321 - S2209 W05437 - S2024 W05806 FL120/210 STNR NC=

The 18:00 UTC 09 August 2024 Significant Weather Chart (SIGWX) prepared by the Integrated Center for Aeronautical Meteorology (CIMAER), covering from the surface to FL250, and valid from 15:00 UTC to 21:00 UTC, forecasted the following meteorological conditions for the region of interest (Figure 26):

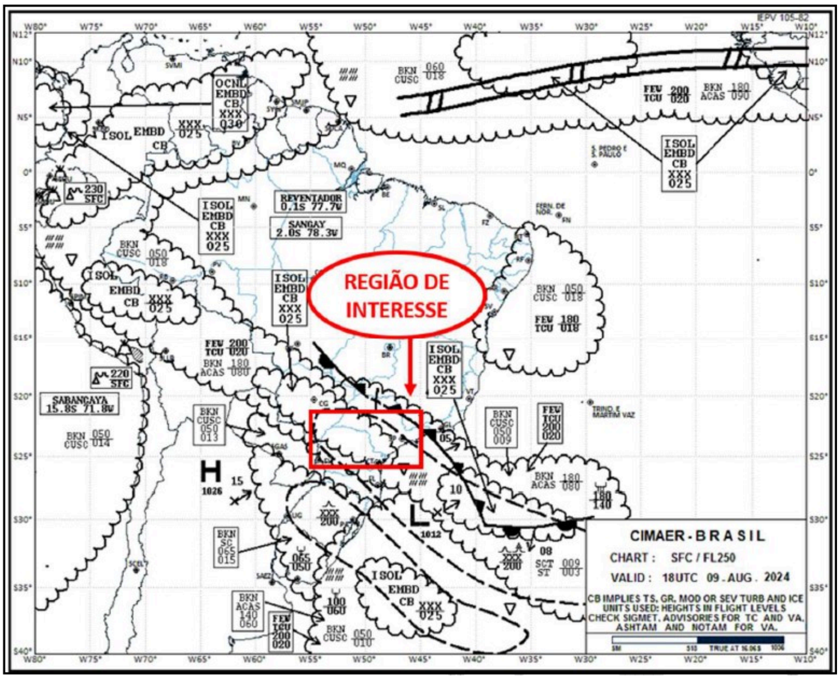

Figure 26 - 09 August 2024 18:00 UTC SIGWX from the surface to FL250. Region of interest highlighted in the red polygon.

- cold front crossing the state of São Paulo, associated with a low atmospheric pressure center of 1012 hPa located approximately at 29°S 043°W;
- TCU clouds, with base at 2,000 ft and top at 20,000 ft, covering 1 to 2 oktas sky (FEW);
- isolated embedded Cumulonimbus (CB) clouds, with base at 2,500 ft and top above FL250;
- low layers of Stratus clouds (ST), with base at 300 ft. and top at 900 ft., covering 3 to 4 oktas of the sky (SCT);
- low cloudiness formed by the combination of cumulus and stratocumulus clouds (CUSC), with base at 900 ft. and top at 5,000 ft., covering 5 to 7 oktas of the sky (BKN);
- medium altitude cloudiness formed by a combination of Altocumulus (AC) and Altostratus (AS) clouds, with base at 8,000 ft. and top at 18,000 ft., covering 5 to 7 oktas of the sky (BKN);
- howers of rain and/or continuous rain;
- severe icing, with base a 14,000 ft. and top at 18,000 ft.;
- moderate to severe turbulence, with base at 20,000 ft. and top above FL250.

Based on the information presented, it was possible to identify that a cold front associated with a jet stream at high levels formed a band of predominantly stratiform clouds, with convective nuclei of TCU/CB type clouds in scattered points, as well as embedded, covering an extensive region, ranging from the south of the State of *Mato Grosso*, passing through the State of *Mato Grosso do Sul*, State of *São Paulo*, south of the State of *Minas Gerais*, north-central and eastern regions of the State of *Paraná*, until getting to a low- pressure center located in the Atlantic Ocean, off the coast of the State of *Santa Catarina*.

The configuration of this low-pressure center, together with a high-pressure center in northern Argentina, favored the influx of cold polar air, leading to a drop of the temperatures in the central-southern regions of Brazil.

At the location of the aeronautical occurrence, the frontal system produced light rain, which resulted in temporary reductions of horizontal visibility from the surface to up to 4,000 meters, as well as a layer of low clouds ranging from few (FEW) with base at 500 ft. to overcast (BKN) with base at 3,500 ft., along with an extensive and persistent layer of medium altitude clouds configuring cloudy/overcast (BKN/OVC) with base at 7,000 ft.

Based on the upper-air atmospheric data, it was possible to identify the presence of lots of humidity combined with air temperature below 0°C, which favored the occurrence of severe icing in altitude, from the north-central region of the State of *Paraná* to the State of *São Paulo*, initially affecting the altitude block between FL120 and FL140, with its top reaching FL230 at the front edge of the system over the State of *São Paulo*.

Communications.

From the transcripts of the radiotelephony communication between the PS-VPB aircraft and ATC, one verified that the crew maintained radio contact with APP-SP.

The call sign of the flight PTB2283, operated by the VoePass PS-VPB aircraft, was *Passaredo 2283*.

In order to clarify the sequence of events that preceded the crash, the Investigation Committee highlighted some transmissions that may be of help in understanding the dynamic of the accident. The time reference used herein is UTC.

- 16:05:56 - *Passaredo 2283* made the first call to APP-SP on the frequency 120.025 MHz.
- 16:06:00 - APP-SP answered the call, instructing the aircraft to maintain flight level FL170.
- 16:06:05 - *Passaredo 2283* acknowledged the instruction received.
- 16:14:21 - APP-SP requested span class="italico">Passaredo 2283 to call on frequency 135.75 MHz.
- 16:14:28 - *Passaredo 2283* read back the message.
- 16:14:36 - *Passaredo 2283* made a call on frequency 135.75 MHz, informing that they had information SIERRA.
- 16:14:40 - APP-SP asked the aircraft about the quality of reception on that frequency. *Passaredo 2283* replied that there was an echo in the transmission.
- 16:14:49 - APP-SP requested *Passaredo 2283* to return to the frequency of 120.925 MHz. *Passaredo 2283* confirmed that they would return to that frequency.
- 16:14:59 - *Passaredo 2283* made a call on the frequency 120.925 MHz.
- 16:15:02 - APP-SP answered, instructing the aircraft to maintain FL170.
- 16:15:08 - *Passaredo 2283* acknowledged and said they would maintain flight level.
- 16:18:21 - *Passaredo 2283* reported ideal point for descent.
- 16:18:25 - APP-SP instructed the aircraft to maintain FL170, and *Passaredo 2283* read back the message.
- 16:18:53 - APP-SP instructed *Passaredo 2283* to call São Paulo Control on frequency 123.25 MHz.
- 16:19:01 - *Passaredo 2283* replied that they would call on the frequency informed.
- 16:19:07 - *Passaredo 2283* made an initial call to APP-SP on 123.25 MHz, but received no answer.
- 16:19:16 - *Passaredo 2283* called APP-SP again.
- 16:19:19 - APP-SP answered the call, and requested the aircraft to maintain FL170 due to traffic.
- 16:19:23 - *Passaredo 2283* replied that they would maintain flight level and said that were at the ideal point of descent, awaiting authorization.
- 16:19:30 - APP-SP answered, instructing the aircraft to wait for the clearance.
- 16:19:31 - *Passaredo 2283* acknowledged the message and thanked the controller.

At that moment, *Passaredo 2283* was at FL170 at a distance of approximately 3 NM from the GR249 fix. There was traffic temporarily restricting their descent (GLO 1455, which was performing STAR DOSPI 1A, and was at a 10 o'clock position from *Passaredo 2283*, 2.7 NM away, heading south, and passing FL149, descending (Figure 27).

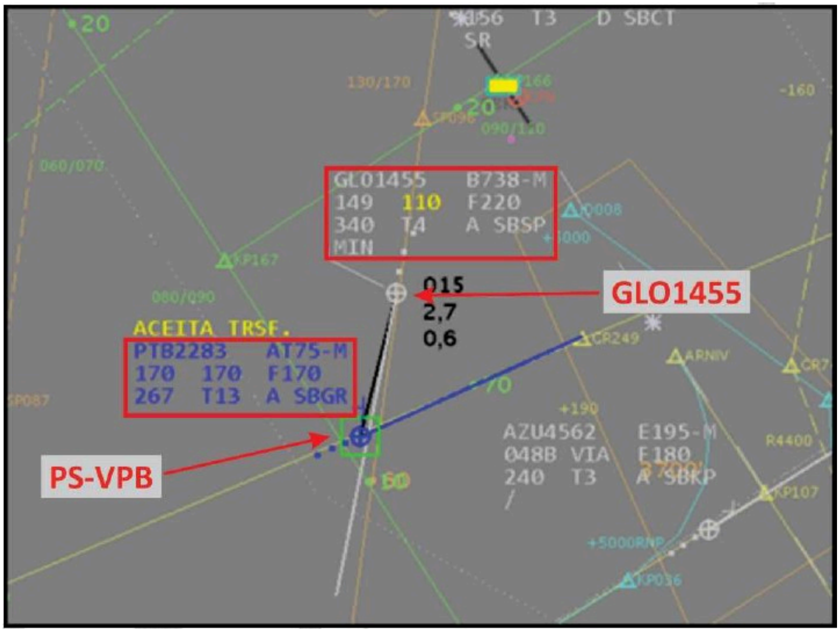

Figure 27 - RADAR rerun of the moment at which the PS-VPB had its traffic restricted by GLO 1455.

- 16:20:33 - APP-SP cleared *Passaredo 2283* to fly directly to the SANPA position, still maintaining FL170. The controller added that their descent would be authorized in two minutes.
- 16:20:39 - *Passaredo 2283* acknowledged the message received from APP-SP (last communication made by the aircraft).

At that moment, *Passaredo 2283* was passing over the waypoint GR249, maintaining FL170, with the traffic of TAM3230 restricting its descent at the 2 o'clock relative position, distance 5.8 NM, leveled at FL150 and heading North (Figure 28).

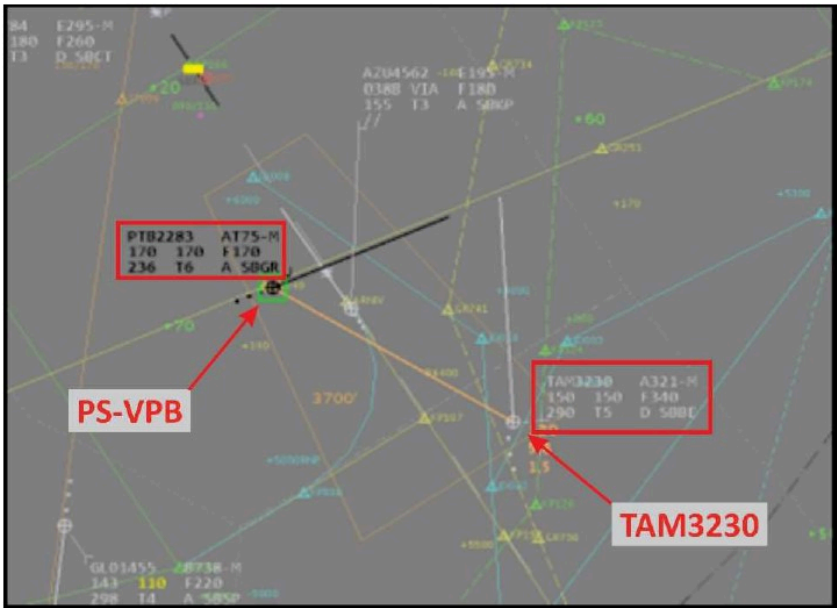

Figure 28 - RADAR rerun of the moment at which the PS-VPB had its traffic restricted by TAM 3230.

- 16:21:36 - APP-SP cleared *Passaredo 2283* to descend to FL 090, heading for SANPA position.
- 16:21:54 - APP-SP requested *Passaredo 2283* to confirm the heading they were maintaining.

From 16:22:02 UTC to 16:22:49 UTC, APP-SP made 5 calls to *Passaredo 2283*, but received no answer.

Furthermore, according to the transcripts of the radiotelephony communications between the PS-VPB and the ATC agencies, no emergency calls were made.

Flight Recorders.

The aircraft was equipped with an FA2100 FDR L3 digital FDR, model 2100-2/4043, Part Number 2100-4043-00, Serial Number 000585479, with a maximum capacity of 256 words per second, ARINC 573/717 communication bus. The Flight Data Acquisition Unit (FDAU) installed in the aircraft had the Part Number ED34A350.

Figure 29 - Flight Data Recorder installed in the PS-VPB.

Additionally, the aircraft was equipped with an FA2100 CVR L3 digital CVR, PN 2100- 1020-02, SN 01753, with software PN 840-E1657-01, capable of recording three High Quality channels of 30 minutes each, one High Quality Combined channel of 30 minutes each, and two Standard Quality channels of 120 minutes each.

Figure 30 - Cockpit Voice Recorder installed in the PS-VPB.

The readout work of both recorders was done at the Flight Recorder Data Readout and Analysis Laboratory (LABDATA) on the CENIPA's premises.

The Crash Survivable Memory Unit (CSMU) was opened, as there were serious damage to the recorders due to the nature of the occurrence, making it necessary to extract the memories from the CSMU for readout in the dedicated chassis (Golden Chassis) of the LABDATA.

With respect to the CVR, during its opening, the following aspects were noted: apparent absence of moisture, intact silica and memory, and preserved temperature indicator point. In order to proceed with the readout, a continuity test was performed, making it possible to verify that the flat connection cable was intact.

As for the FDR, according to the procedure adopted with the audio recorder, one verified the following: apparent absence of humidity, intact silica and memory, and preserved temperature indicator point. To continue with the readout, a continuity test was performed, showing that the flat connection cable was intact.

The readout process was performed with support from a compatible Golden Chassis, updating the firmware in accordance with the Part Number of the recorder in which each memory was located

Given the PS-VPB aircraft configurations, one verified that the FDAU was feeding the FDR at a rate of 128 words per second, and 313 flight hours were retrieved from the recorder.

Based on the document *DFDR recorder parameters decoding law* Service Letter n° ATR72-31-6010, page 4 see 9, and information obtained from the aircraft operator, *Data Frame V2b config*. 1 was selected. The software used for data validation and analysis was the *Insight Analysis v4 SP13*.

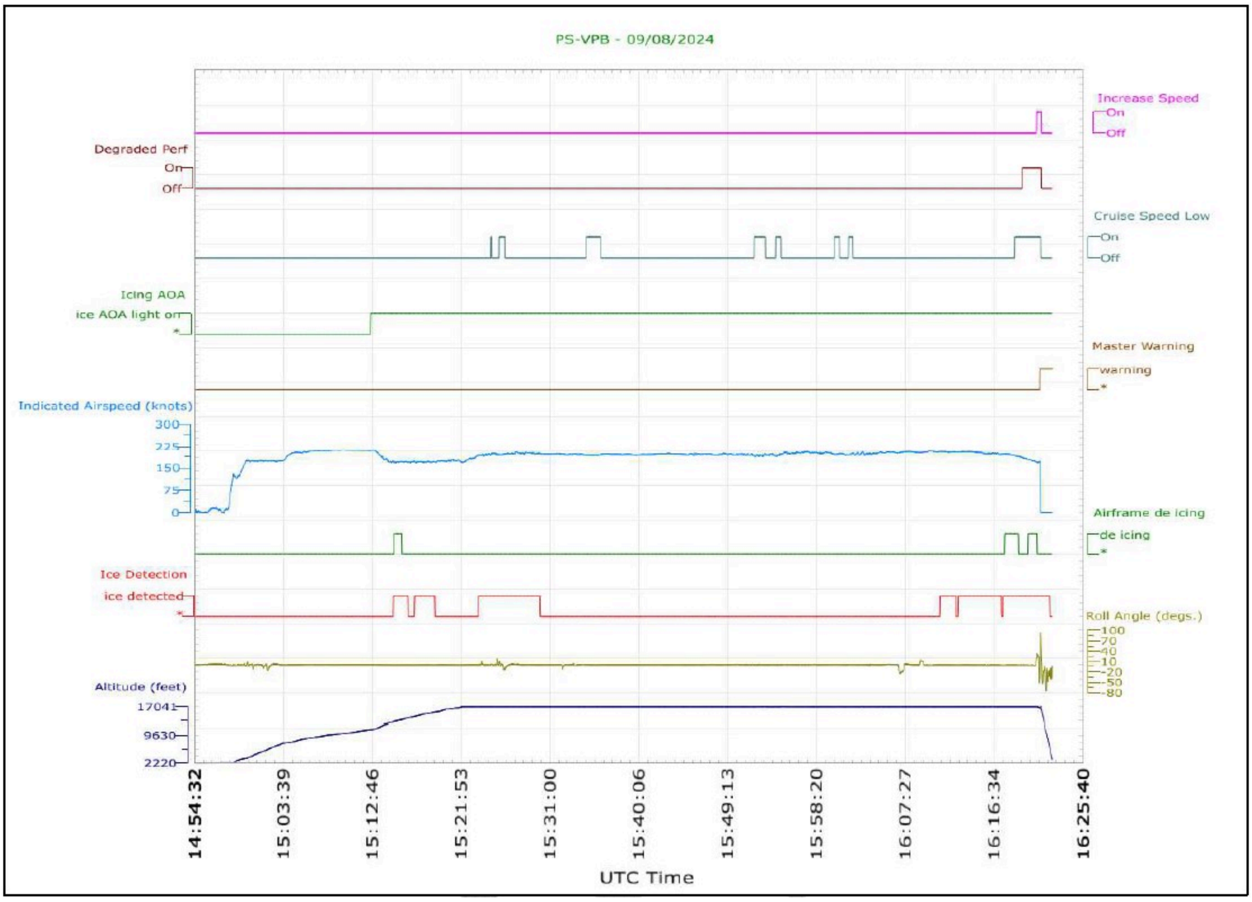

Figure 31 - Parameters collected from the FDR and analized by the Insight Analysis software.

Following the conversion of the file extracted from the FDR, the validation work began, in consonance with the aircraft behavior on previous flights recorded in the FDR.

The procedure for extracting data from the CVR was based on instructions and technical information contained in the manufacturer's manual, Component Maintenance Manual Model Fa2100 CVR Cockpit Voice Recorder. Validation of data was performed through comparison of information from conversations between the pilots and the ATC agencies with identification of the pertinent times and the informed destinations.

Impact and wreckage information.

The wreckage was found in a concentrated pattern at a distance of approximately 38 NM from the destination (SBGR) and 7 NM from SBKP (*Viracopos* Aerodrome, *Campinas*, SP). The aircraft was in cruise flight at FL170 when inflight loss of control occurred, with the aircraft entering a stall condition followed by a flat spin that lasted until the collision with the ground in the municipality of *Vinhedo*, State of *São Paulo*.

The impact occurred in a residential area of a condominium. The aircraft collided with the ground at high vertical speed and low horizontal speed, resulting in a crash site characterized by concentrated debris.

Part of the tail cone separated from the rest of the aircraft at the moment of impact due to a “step”, around 2 meters high, present in the terrain. The remainder of the aircraft came to rest on the lowest part of the terrain, presenting a vertical dent in its entire structure due to the impact, practically vertical in relation to the ground.

At the moment of the impact, the radome was thrown forward, colliding with a wall approximately 30 m away from the impact site. The tip of the right wing was severed by the collision with a tree and was thrown forward from where the rest of the wing had come to a stop. The engines remained in their original positions.

No evidence of in-flight structural separation was found. The wings and tail section of the aircraft were consumed by post-impact fire. The degree of destruction and charring made it difficult to inspect some of the aircraft's parts and systems.

The engines remained attached to the wings, but were further affected by the post- impact fire. All the propellers were fractured due to impact with the ground. The aircraft's tail cone struck a wall and was not consumed by the fire.

The cockpit and flight instruments suffered substantial damage from the collision with the ground but were not affected by the fire.

Figure 32 - Overview of the aircraft after colision with the ground and the post impact fire.

There was no evidence of in-flight fire. The fire started immediately after impact with the ground. The burning material was the aircraft's fuel and the ignition source probably originated from the aircraft's strong friction with the ground.

The fire consumed the wings, engines, and part of the fuselage, from the wings to the tail of the aircraft. Local firefighters attempted to extinguish the fire, but due to the difficulty in controlling the flames, it consumed a large part of the aircraft.

The cockpit and the front seats of the aircraft were not damaged by the fire. In a similar manner, the rudder, the vertical stabilizer and the horizontal stabilizer did not sustain damage caused by the fire.

Progress of the investigation activities.

New factual data is being collected for subsequent validation to support the analyses and ensure the accuracy and reliability of the conclusions that will be presented in the Final Report.

From the data obtained by means of the FDR and CVR recordings, and the information collected from the Aircraft Operator and Aircraft Manufacturer, the investigation will follow three main lines of action:

- Human Factors - exploring the individual, psychosocial, and organizational conditions related to the crew's performance in the situation experienced by them;
- Material Factor - seeking to ascertain the airworthiness condition of the aircraft. Special attention will be given to the aircraft's Anti-Icing, De-Icing and stall protection systems; and
- Operational Factor - analyzing the aspects related to the technical performance of the crew and of the elements related to the operational environment in the context of this accident.

At the conclusion of the investigating process, the CENIPA will publish the Final Report, in accordance with Annex 13 to the Convention on International Civil Aviation, presenting the findings of the SIPAER Investigation regarding the circumstances that contributed or may have contributed to triggering this accident, and also issuing pertinent recommendations for the enhancement of flight safety.

Imprimir

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