Serious incident to the ATR72-212A registered **F-ORVS** on Monday 4 April 2022 at Hiva-Oa-Atuona (French Polynesia - Marquesas Islands)

Time	22:43[1]
Operator	Air Tahiti
Type of flight	Passenger commercial air transport
Persons on board	Captain (PM[2]); co-pilot (PF); 2 cabin crew; 53 passengers
Consequences and damage	Landing gear slightly damaged
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	

Non-stabilised approach, windshear, opposite dual inputs, hard landing, balked landing

[1] Except where otherwise indicated, the times in this report are in Coordinated Universal Time (UTC). Ten hours should be subtracted to obtain the legal time applicable in French Polynesia on the day of the occurrence.

[2] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on the on-board CVR and FDR, and statements.

On the ground, before taking off from Nuku-Hiva airport, the crew asked the AFIS officer for the latest wind information regarding the destination airport, Hiva-Oa-Atuona. The AFIS officer replied that the wind was easterly with significant variations in direction and strength at the two ends of the runway (02 and 20). The crew took off at 22:09 and climbed to FL 110. They envisaged and prepared an RNP approach to runway 20 due to the tailwind component reported for runway 02 (the preferential runway according to the operator's Operations Manual (OM)).

En route, the crew contacted the Hiva-Oa-Atuona AFIS officer several times to obtain up to date wind information for the airport. The tailwind component for runway 02 was confirmed with the reported direction continuing to be variable. Gusts were measured at both QFUs. The AFIS officer confirmed that it was preferable to land on runway 20. The captain informed the Tahiti approach controller that the co-pilot was going to carry out the RNP20 approach (see **Figure 1**, point 1).

The crew extended the flaps to the first detent position (point 2). The indicated airspeed was 171 kt. The crew controlled the extension of the landing gears and then, around 40 s later, the flaps were set to FULL. The indicated airspeed was 135 kt for an approach speed (V_{APP}) of 118 kt. The co-pilot informed the captain that the aeroplane was passing the FAF, FMN20 (point 3). The Hiva-Oa-Atuona AFIS officer advised the crew that the mean wind was from 150°, varying between 010° and 200°, of 10 kt with gusts of 20 kt.

From 22:41:35 (point 4), the aeroplane entered a zone of turbulence and the load factor varied between 1.25 g and 0.76 g. The aeroplane descended through 3,260 ft, level with the north coastline of Hiva-Oa island at 4 NM from the threshold of runway 20. The captain and co-pilot discussed the turbulence encountered and decided for this reason, to hold the speed above V_{APP}.

At 22:42:15, the co-pilot disengaged the autopilot (point 5). The aeroplane descended through 2,630 ft (1,100 ft AAL) at 2.5 NM from the threshold of runway 20. Between this moment and passing over the runway threshold:

- the variations in load factor increased in both frequency and amplitude. The values on the vertical axis oscillated between 1.6 g and 0.5 g;
- the indicated airspeed continuously varied between 118 kt (V_{APP}) and 139 kt (V_{APP}+21);
- the engine torques oscillated between 0 and 58%;
- the mean descent rate was 950 ft/min with values varying between 500 ft/min and 1,500 ft/min;
- the calculated wind on the longitudinal axis of the aeroplane showed variations between a 10 kt headwind and a 12 kt tailwind.

At 22:43:20, the aeroplane encountered windshear when descending through 1,610 ft (90 ft AAL) (point 6). The calculated wind direction passed from 140° to 067°. The wind strength on the longitudinal axis of the aeroplane varied between a 4 kt headwind and a 10 kt tailwind in three seconds. The indicated airspeed decreased from 130 kt to 109 kt in five seconds.

The captain called out to the co-pilot asking for power, "*Puissance puissance puissance!!*" The aeroplane was at a height of 46 ft. The co-pilot reacted by moving the power levers forward from 47° to 67° and then reduced power to the 40° position for one second. The engine torques briefly increased from 8% to 19% and then decreased.

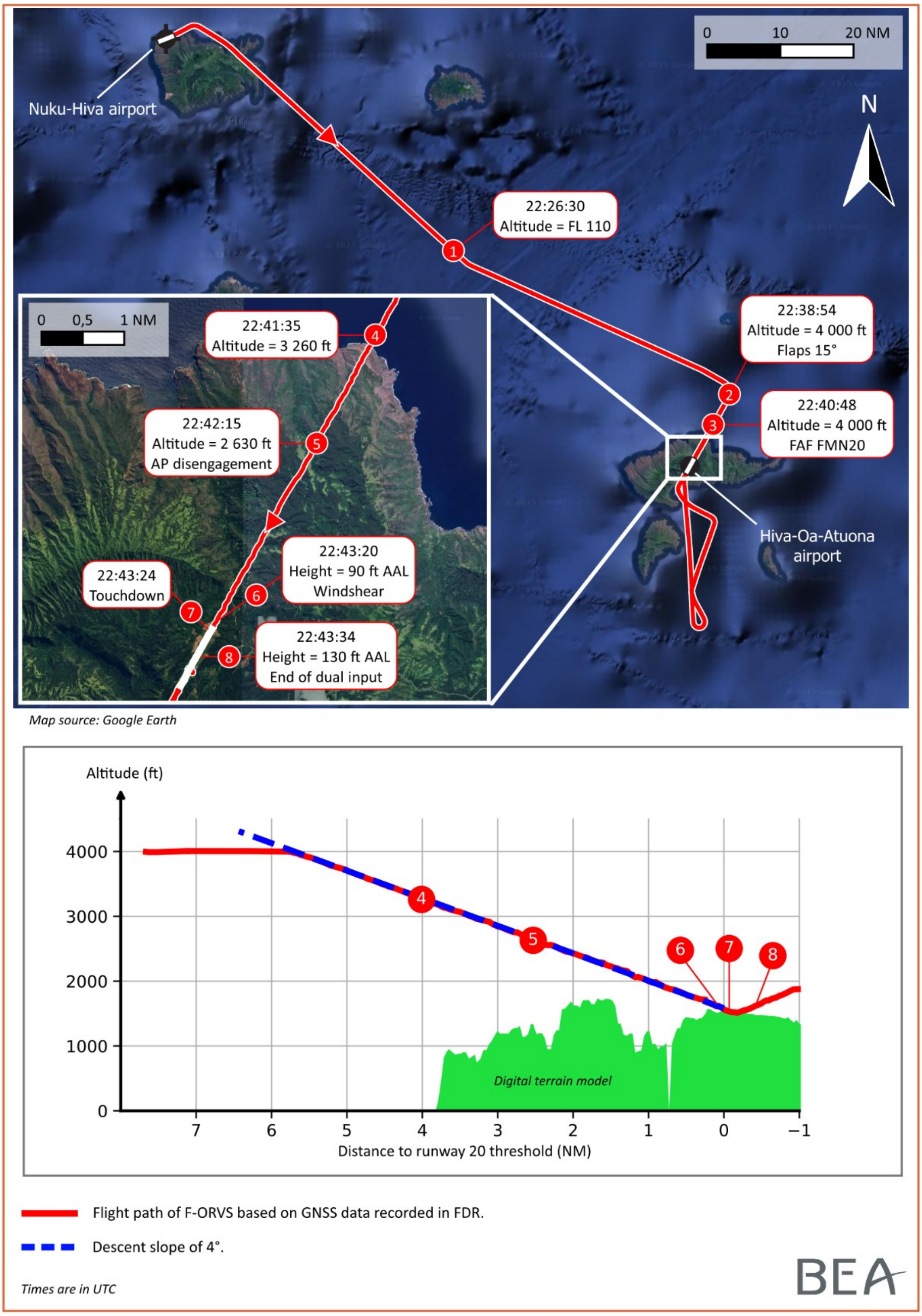


Figure 1: flight path of F-ORVS (source: BEA)

Two seconds later, when the aeroplane passed over the runway threshold at a height of 25 ft with a pitch attitude of -2°, the co-pilot started the flare, characterised by taking a nose-up attitude and reducing power with the levers. The captain made an input on the control column whose position changed from 4.2° nose up to 13.8° nose up (maximum limit) in less than half a second. The co-pilot then made a nose-down input while the captain increased the load applied for the nose-up input. The difference in load increased until the elevators decoupled (see paragraph 2.7) at around 100 daN. The aeroplane's pitch attitude passed from -1.5° to 3.5°.

Less than one second later, the wheels of the main landing gear touched down hard on the runway. The recorded vertical load factor increased up to 2.97 g (point 7). The aeroplane bounced. The captain called out that he was taking the controls and starting a go-around. At the same moment, the PITCH DISC procedure was displayed on the central screen and the MASTER WARN aural and visual alert was activated. The co-pilot and the captain continued to make opposite dual inputs on their respective control columns for 11 s.

At 22:43:34, the co-pilot asked the captain if he had the controls. The captain confirmed the role change and asked for the flaps to be retracted to position 1 (15°) (point 8). The landing gears were then raised and the flaps retracted to obtain a clean configuration. When the aeroplane passed over the threshold of runway 02 at a height of 440 ft, the go-around guidance mode and then the autopilot were engaged.

The captain asked the co-pilot if he wanted to take the controls with a view to landing. The latter accepted and asked if it would not be preferable to land on runway 02. The captain informed the AFIS officer that they were going to carry out a visual landing on runway 02. Around four minutes later, when the crew were on the final approach, the AFIS officer reported a mean wind from 140°, varying between 070° and 240°, of 8 kt with gusts of up to 18 kt and possibly windshear[3].

The crew landed on runway 02 at 23:00 with a tailwind component of approximately 5 kt.

2 ADDITIONAL INFORMATION

French Polynesia is governed by the principle of "legislative specificity" which means that the applicability of legislative texts is subject to the adoption of an express extension provision. The regulations listed below fall within this framework and are applicable in French Polynesia.

2.1 Flight crew information

2.1.1 Captain

The 43-year-old captain held an ATPL (A) licence obtained in 2006 along with the ATR 42/72 type rating, a TRI (FSTD[4]) instructor rating and IR/PBN ME ratings.

- Operator Conversion Course (OCC): February 2004
- Last Recurrent Training (RT): October 2021

On the date of the serious incident, he had logged a total of 11,061 flight hours, including 9,775 flight hours on type. He had carried out 13 landings in 2018 and 11 in 2019 at Hiva-Oa-Atuona.

[3] The AFIS officer had no windshear detection system.

[4] Flight Simulation Training Devices.

2.1.2 Copilot

The 43-year-old co-pilot held an ATPL (A) licence obtained in 2019 along with the ATR 42/72 type rating and IR/PBN ME ratings.

- Operator Conversion Course (OCC): September 2016
- Last Recurrent Training (RT): May 2021

On the date of the serious incident, he had logged a total of 3,203 flight hours, including 2,673 flight hours on type. He had carried out 16 landings in 2018 and 13 in 2019 at Hiva-Oa-Atuona.

2.1.3 Specific crew training to access Hiva-Oa-Atuona airport

Hiva-Oa is a category C, restricted-use airport (see paragraph 2.4). The AIP specifies, in its Operating Conditions, that pilots shall have followed in a complete and satisfactory manner, theoretical and practical training given by a designated instructor or authorized to do so by the SEAC/PF. This training is based on the specificities of the airport, in particular its aerology, and must cover all the procedures for using the airport under VFR and, where applicable, IFR, as well as the associated instructions and limitations. The practical training will be carried out on the type or class of aircraft concerned. The instructor will endorse the pilot's logbook with the words "*Authorized for access to Hiva-Oa airport*" or will formalize the authorization in the form of a certificate on completion of the training. The authorization to use this airport is kept current subject to the pilot having used the airport as captain in the previous twelve months. If the use of the airport is carried out in a multi-pilot environment, the captain shall meet all the above requirements, and the co-pilot shall have received at least the required theoretical training. To be the PF, the pilot shall have met all of the above requirements.

The Air Tahiti OM incorporates these provisions and describes them in Part D (Training Manual). In particular, it states that during the OCC, each pilot receives theoretical training as well as specific initial training on the simulator (FFS). Each pilot then follows a specific training module during Recurrent Training (RT).

2.1.4 Statements

The captain and the co-pilot reported that during the cruise they discussed the actual aerological conditions at the destination airport. They stated that, based on their experience of landing at Hiva-Oa-Atuona, they decided that the flight was feasible and that the RNP 20 approach was possible.

They added that the flight was uneventful until the approach, which turned out to be very turbulent in the final part. The co-pilot explained that he felt windshear on descent, at a height of around 100 ft, followed by a downdraft as he flared. He then heard the "*Pitch disconnect*" warning during the missed approach. He had not been aware that they were both making opposite dual inputs.

The captain recalled that the speed trend bar showed variations of around twenty knots during the approach. He added that the co-pilot was constantly adjusting the pitch and power to hold the specified 4° approach slope.

He explained that, in agreement with the co-pilot, they decided to maintain a high approach speed, with a planned reduction on short final, to give themselves a margin to maintain control of the aeroplane. The turbulence ceased, the airspeed decreased towards Vref and a strong downdraft pushed the aeroplane towards the ground. The captain remembered calling out for power, and that the co-pilot had anticipated this request. Judging that contact with the runway was inevitable, the captain pulled back the control column to its maximum deflection in a reflex action. After the bounce, he called out that he had the controls for a visual go-around.

They then completed the "*After TO*" and "*Pitch disconnect*" checklists, and discussed their strategy, namely a diversion or a new approach to Hiva-Oa-Atuona. Given the information available to them, they opted for a visual approach to runway 02.

2.2 Meteorological information

2.2.1 Organisation of meteorological information

2.2.1.1 Requirements for the provision and use of meteorological information

Annex V of regulation (EU) 2018/1139 indicates that a flight must not be commenced unless it has been ascertained by reasonable means available, that information regarding meteorological conditions for departure, destination and, where applicable, alternate aerodromes, as well as en-route conditions, are available to the flight crew. Special attention must be given to potentially hazardous atmospheric conditions. Annex VIII indicates that the data used as a source for aeronautical meteorological information shall be of sufficient quality, complete and current. It is also mentioned that it shall be of adequate integrity and unambiguous in order to meet the needs of airspace users and that it shall be from a legitimate source.

Consolidated regulation (EU) No 965/2012, known as AIR-OPS, lays down technical requirements and administrative procedures related to air operations. AMC5 CAT.OP.MPA.182 stipulates that the operator may select an aerodrome as a destination or alternate aerodrome only when the appropriate weather reports and/or forecasts indicate that, for a period beginning one hour before and ending one hour after the estimated time of arrival at the aerodrome, weather conditions will be equal to or better than the applicable landing minima, particularly as regards RVR and visibility. CAT.OP.MPA.245 specifies that on IFR flights, the captain shall only commence take-off when information is available indicating that the expected weather conditions, at the time of arrival, at the destination and/or required alternate aerodrome(s) are at or above the planning minima. Furthermore, the captain shall only continue towards the planned destination aerodrome when the latest information available indicates that, at the expected time of arrival, the weather conditions at the destination, or at least one destination alternate aerodrome, are at or above the applicable aerodrome operating minima.

Regulation (EU) 2017/373 lays down common requirements for providers of air traffic management/air navigation services. In its article ATS.TR.305, it specifies that the flight information service shall include the provision of information concerning weather conditions reported or forecast at departure, destination and alternate aerodromes. GM1 ATS.TR.305(a); (b); (c) and GM2 ATS.TR.305(a) ; (b) ; (c) also specify the information that an AFIS is supposed to communicate to aircraft pilots before taxiing (GM1) or before joining the runway circuit or starting an approach (GM2), including the existence of moderate or severe turbulence or windshear. These provisions apply without distinction to commercial and non-commercial transport.

2.2.1.2 Aerodrome meteorological services in France

The order of 20 December 2011 designates Météo-France as the exclusive provider of air navigation meteorological services. Consequently, meteorological information can only be transmitted by air traffic controllers or AFIS officers if it comes from sensors approved and maintained by Météo-France, or from weather reports or weather forecasts produced by Météo-France.

At the time of the occurrence, the technical protocol for air navigation meteorological services dated 11 March 2019 between the Air Transport Directorate (DGAC/DTA) and Météo-France applied in France and particularly in French Polynesia.

Appendix 5 of this technical protocol specified the aerodrome meteorological service levels according to the type of operation. It also included the services associated with these service levels, and in particular the definition and scope of specific meteorological products, in application of article 4.4 of the framework agreement between the DGAC and Météo-France.

The minimum level for each aerodrome varied, depending on whether or not it handled:

- aircraft operating under instrument flight rules (IFR);
- commercial flights;
- scheduled or only non-scheduled commercial flights;

or whether it had:

- an aerodrome flight information service (AFIS) or an air traffic control service;
- an instrument approach procedure.

2.2.1.3 Special provisions for French Polynesia

Météo-France has an Interregional Division in French Polynesia, comprising a weather watch centre, an aerodrome weather centre and aerodrome weather stations. Météo-France ensures the "en-route" weather watch in the TAHITI FIR, as well as the weather watch at aerodromes equipped with the necessary operational equipment to provide weather reports and METARs. Seven aerodromes in French Polynesia (including five over which the DSNA is designated as or exercises a functional authority) out of forty-seven have such equipment for sending METARs to crews.

At the time of the occurrence, in accordance with the DGAC/DTA-Météo-France technical protocol of 11 March 2019, Hiva-Oa-Atuona airport, which falls into the category of aerodromes with an AFIS handling IFR, commercial, and scheduled traffic of over 10,000 passengers a year, should benefit from at least level N4 weather information.

The following services are specified for level N4[5]:

- complete local weather report (wind, visibility with calculation of runway visual range if necessary, current weather, clouds, pressure, temperature and dew point, display of meteorological parameters in tower, 24 H METAR);
- aerodrome weather forecast: TAFs according to published ATS opening hours;
- TAFs made available on the AEROWEB-PRO and AEROWEB sites.

In order to increase the service level provided with respect to the existing minimum aerodrome meteorological service levels, the protocol provides for the supplementary provision of the "area overview" (APZ) message. This is an aeronautical weather forecast issued three times a day and valid for a nine-hour period in each of the eleven geographical zones of French Polynesia.

The order of 13 February 2020 on the provision of meteorological services for air navigation purposes specifies in section 2 (FRA-MET.OR.220) that the emission of TAF forecasts is only required for the French Polynesian aerodromes Tahiti Faa'a and Bora Bora. For these other aerodromes, an "area overview" service (APZ) can be established.

[5] By way of comparison, level N3 does not include aerodrome weather forecast information.

These 11 zones cover the 52 aerodromes of the Tahiti FIR. Each zone is defined taking into account the flight links provided and for homogeneous climatological conditions.

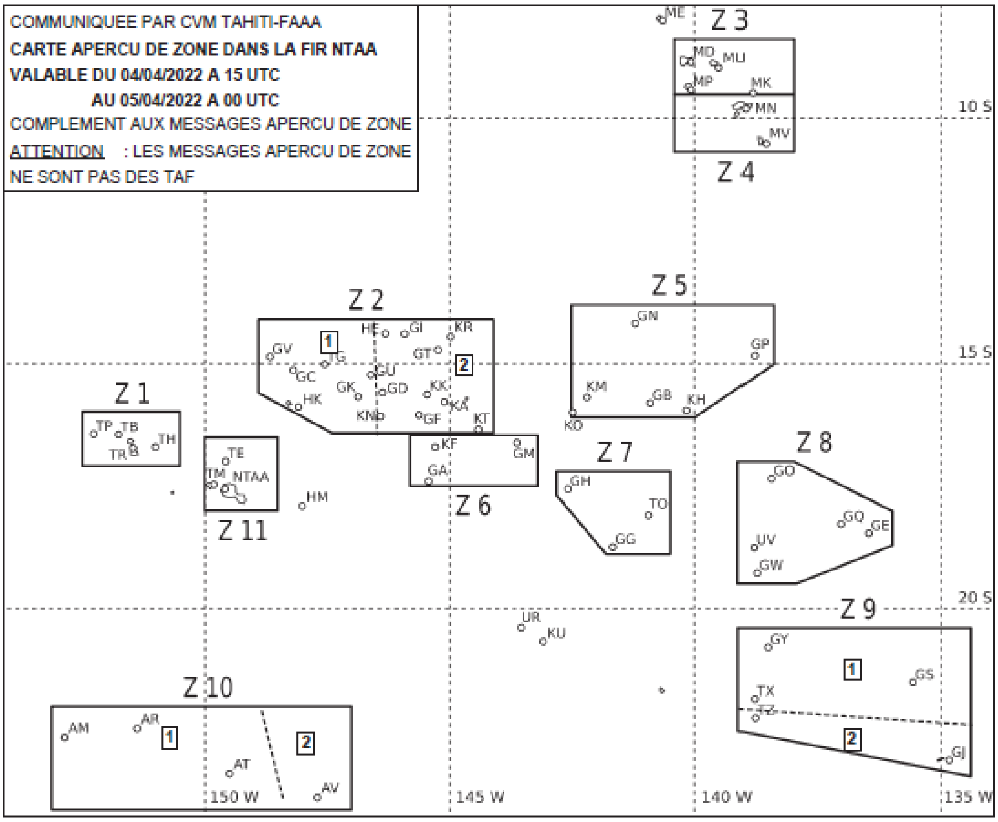


Figure 2: map of APZ zones (source: Météo-France)

The BEA contacted the DSAC's flight crew expertise centre (PN/EPN). The joint analysis found that the APZ bulletin is by nature imprecise given the local conditions within its perimeter, and the frequency at which it is updated. During flight preparation, it is not possible to use the information provided by the APZ to determine access conditions linked to visibility or RVR, at the destination or alternate aerodrome, from one hour before to one hour after the estimated time of arrival.

2.2.1.4 Revision of technical protocol - 11 July 2022 (after occurrence)

The DGAC/DTA-Météo-France technical protocol of July 2022 includes in paragraph 3.2 and Annex 5, the necessity of having a minimum meteorological service level for the French aerodromes where Météo-France has been designated. However in Annex 6 covering special provisions for aerodrome meteorological services, and in particular paragraph 2 concerning specificities in French Polynesia, there is no longer provision for the application of minimum meteorological service levels for AFIS aerodromes, with the exception of Hao, Nuku Hiva, Totegegie and Tubuai Mataura, for which a minimum level N3 service is required, and Huahine, for which the DSNA exercises functional authority. The DGAC/DTA specified, however, that this exclusion of AFIS aerodromes was not intentional, and that the next protocol shall include these aerodromes again.

2.2.2 Meteorological information on Hiva-Oa island

2.2.2.1 Wind direction and strength measured at the Météo-France station in Atuona

The hourly wind measured at a height of ten meters and averaged over ten minutes in April, over the period 1991-2020 is predominantly from the east-south-east (trade winds). The main direction is 100-120° and of around 10 kt.

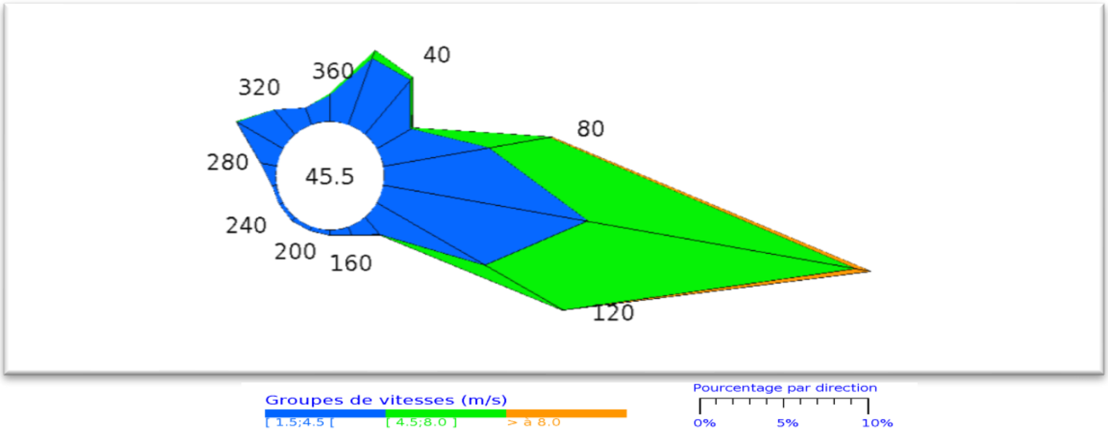


Figure 3: rose of prevailing winds at Atuona (source: Météo-France)

2.2.2.2 Aerodrome meteorological equipment

The airport is equipped with two wind strength and direction data acquisition systems (DEOLIA 396) located near the two runway thresholds. These anemometric systems provide the AFIS officer with wind data averaged over two minutes.

The wind and pressure measurement sensors at Hiva-Oa-Atuona airport were installed and are maintained by the operator. The choice of location is a determining factor in measurement accuracy, depending on the presence of nearby obstacles.

No agreement had been signed for Hiva-Oa-Atuona, between the airport operator and Météo-France. At the time of the occurrence, Météo-France was not responsible for the installation, calibration or maintenance of the equipment.

As a consequence, no meteorological service level as defined in the technical protocol agreed by the DTA and Météo-France was formally available at Hiva-Oa-Atuona.

The DSAC PN/EPN centre underlined the lack of reliability of the weather reports at Hiva-Oa-Atuona. Furthermore, the poorly positioned windsocks (aerology distorted by obstacles) do not provide the wind information expected on short final and in the touchdown zone.

In addition, there are no windshear detectors at Hiva-Oa-Atuona. These detectors are generally placed on airports where this phenomenon is regularly observed and where traffic is much heavier. The Hiva-Oa-Atuona pressure sensor is not a Météo-France-approved sensor. To carry out RNP (LNAV) type procedures, the crew need to have the local QNH. Some Air Tahiti pilots have reported significant discrepancies between the information provided locally and the available on-board information when they reset their altimeters on the ground by displaying the aerodrome altitude.

2.2.3 Information available for crew

2.2.3.1 During flight preparation

The crew had TAFs and METARs for Tahiti Faa'a and Bora-Bora, and METARs for Hao and Tubuaï, located at a distance of between 550 and 1,000 NM.

They also had the valid SIGWX for this flight, for French Polynesia between ground level and FL 450, which mentioned no significant phenomena for this flight. Cloudy spells were forecast.

The valid WINTEM for this flight gave an easterly wind (trade winds) of 40 kt at FL 100 and 30 kt at FL 050.

The APZ forecast message for zone 4 (including Hiva-Oa-Atuona and of a surface area of approximately 22,000 km^2), issued on Monday 4 April 2022 at 19:42, was as follows:

Z4 042106 11020G35KT V5 SCT020 SCT050=

The wind is the mean wind for each zone. Local effects are not taken into account. The cloud base is the altitude.

2.2.3.2 In flight

During the occurrence flight, the AFIS officer present in Hiva-Oa-Atuona control tower transmitted the following information to the crew:

21:56	Runway 20 in use, wind variable from 040 to 180, 8 kt gusts 18 kt Runway 02, mean wind 190, variable from 010 to 360, gusts 18 kt
22:25	Runway 20, mean wind 160, variable from 080 to 200, 15 kt , gusts 25 kt Runway 02, mean wind 140, variable from 040 to 250, 8 kt , gusts 19 kt
22:26	Runway 20, mean wind 160, 14 kt, gusts 25 kt
22:41	Runway 20, mean wind 150°, variable from 010 to 200°, 10 kt, gusts 20 kt
22:59	Runway 02, wind 140°, variable from 070 to 240, 8 kt, gusts 18 kt, windshear possible

During the approach, the wind directions measured in the vicinity of the threshold of runway 20 varied between 010° and 200° (tailwind, LH crosswind and headwind) with speeds of between 8 and 25 kt. The variability of this measurement made it difficult for crews to use, particularly when choosing a runway, and notably with respect to the aeroplane’s tailwind limitations.

2.2.4 Meteorological conditions at the time of the occurrence

2.2.4.1 Atuona Météo-France station

Météo-France has no data reports for Hiva-Oa-Atuona airport.

The Météo-France readings closest to the airport are from the Atuona weather station, located about three nautical miles south-west of Hiva-Oa-Atuona airport, at an altitude of 51 m.

They indicated that on the day of the serious incident, a strong and quite steady trade wind prevailed. A few cloudy spells, sometimes accompanied by light showers, were observed at the very start of the day and at the very end of the afternoon (2.6 mm of rain were recorded between 03:00 and 05:00 and 1.8 mm between 16:00 and 17:00).

The east-south-east wind, of the order of 15 to 20 kt at the weather station and most probably a little stronger at the runway, combined with the proximity of the mountains, probably caused fairly marked turbulence and windshear.

At 23:00, the QNH was 1,012 hPa, the temperature 29°C, the dew point 22°C and visibility greater than 10 km.

2.2.4.2 Wind and turbulence on final

The recorded flight parameters made it possible to calculate the ground speed and air speed vectors, and to determine the wind vector based on the triangle of speeds. Projecting the wind vector on the aircraft frame of reference revealed the presence of windshear during the final approach. In particular, as the aeroplane flew through 100 ft AAL, a windshear on the aircraft axis of 15 kt, was observed to change from a headwind to a tailwind.

2.2.5 Météo-France aerological study on Hiva-Oa island

To characterise the air mass on the island, in the vertical profile and particularly in the vicinity of the airport, wind on the approach path to the airport was modelled using the Météo-France Meso-NH model, with three overlapping regions with a horizontal resolution of 2 km, 500 m and 100 m. The model concerns the day of 4 April 2022, and was coupled with analyses from the IFS (Integrated Forecast System) model from the European Forecast Centre. The realistic character of the simulations was confirmed by comparing the calculated data with measurements from the Météo-France Hiva-Oa station. However, it was not possible to accurately and thoroughly validate the simulation data due to the lack of dense measurements with the same resolution as the model. The simulations should be considered as giving a realistic but not necessarily totally exact view of the meteorological conditions during the incident.

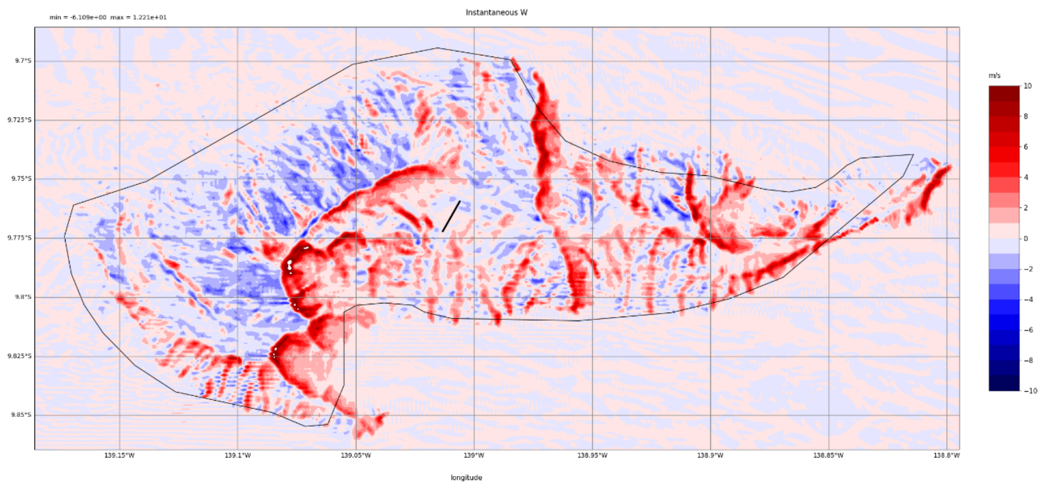


Figure 4: instantaneous vertical speed chart (m.s^{-1}): 4 April 2022 at 23:00 TU. Height 100 ft (source: Météo-France)

The vertical cross-section on the approach path illustrates the presence of ascending and descending air of significant intensity in the vicinity of the aerodrome, extending from the ground to a height of around 1,500 ft at both ends.

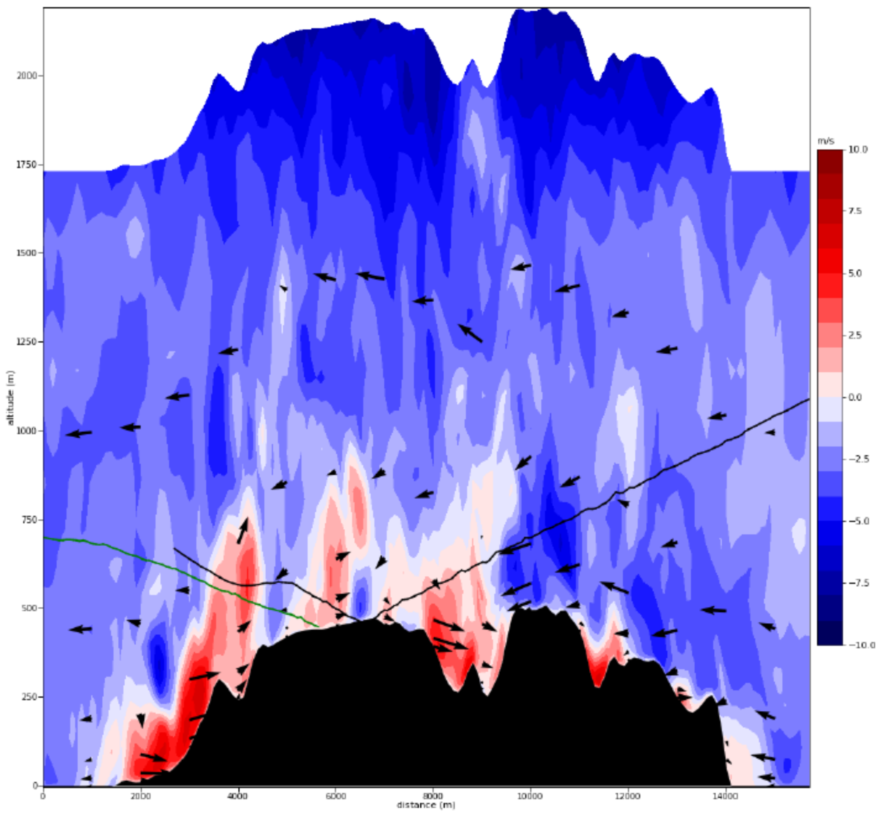


Figure 5: vertical cross-section of vertical wind speeds along the runway axis, APP 20 (black line), APP 02 (green line) – 4 April 2022 at 23:00 UTC (source: Météo-France)

The succession of zones of ascending and subsiding air illustrates the presence of vertical windshear in the lower layers.

It should be noted that these phenomena are dynamic and can vary in time, direction and intensity. The study carried out for the day of the incident is broadly representative of the conditions encountered throughout the year, given the predominance of the easterly trade winds and the aerodrome's position in relation to the terrain. These winds generate ascending and subsiding air when they pass over the island's terrain.

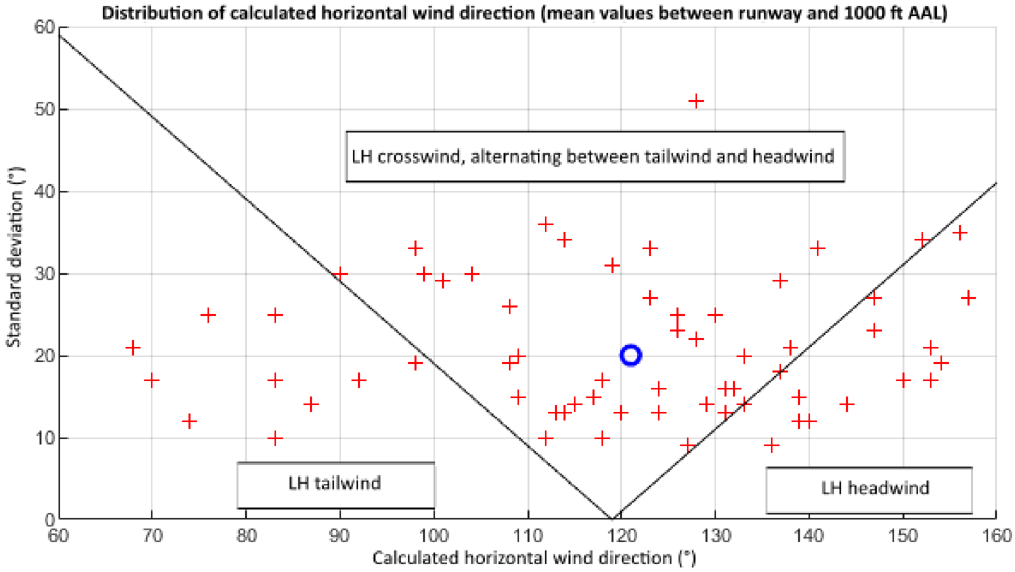
2.2.6 Aerological study based on the analysis of flights on approach 20

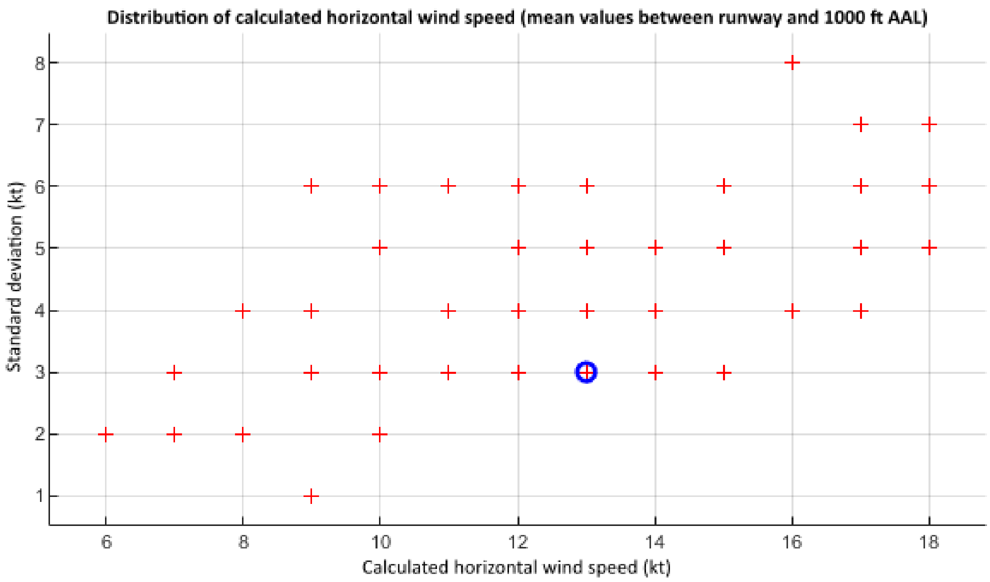
Air Tahiti provided the BEA with the flight data needed to calculate the wind for all the approaches made to runway 20 of Hiva-Oa-Atuona aerodrome in 2023 and the first quarter of 2024, in order to study the aerological conditions on this approach. Sixty-six approaches were analysed.

The wind direction and intensity were determined by calculating the ground speed vector and the air speed vector over the portion of the approach from 1,000 ft AAL to wheel touchdown. The results were projected onto the horizontal profile. On the graphs below, the standard deviation is shown in order to understand the variability of the direction or speed values for each of the approaches studied. The calculation of vertical wind, affected by the ground effect, is not sufficiently precise for it to be used.

This study shows that:

a) aerological conditions on the approach to runway 20 are often turbulent, with wind direction and intensity varying significantly over the portion of the approach path located over the island;
b) for all the approaches analysed, the mean wind was from the south-east (around 120°) which is consistent with Météo-France measurements;
c) no horizontal windshear similar to that encountered on the final approach during the occurrence flight was identified on any of the sixty-six approaches analysed.





The results of the calculations for the occurrence flight (blue circle on previous figures) show that the aerological conditions encountered on the approach between 1,000 ft agl and touchdown were not among the most turbulent of the sixty-six approaches analysed. The average wind direction was 121° (standard deviation 20°), i.e. a left crosswind coming alternately from behind or ahead, with an average intensity of 13 kt (standard deviation 3 kt).

The significant difference with the other approaches is the presence of horizontal windshear between a height of 100 ft and 50 ft.

2.3 Organisational and management information

2.3.1 French Polynesia civil aviation directorate (DAC)

The DAC is a department of the Polynesian administration which is vested with general power for civil aviation, subject to the powers assigned to the State in this field. In particular, it is responsible for operating aerodromes created by French Polynesia or surrendered by the State with the exception of Tahiti Faa'a and Moruroa which belong to the State and restricted use or private aerodromes belonging to companies or individuals, as well as for the maintenance (except for the aeronautical weather sensors for which Météo-France is responsible) and regulatory compliance of these aerodromes and all their equipment.

An agreement between the DAC and Météo-France must be drawn up for each aerodrome with respect to the equipment ensuring the required minimum level of meteorological services.

2.3.2 French Polynesia civil aviation state service (SEAC/PF)

The SEAC/PF is a service placed under both the higher authority of the High Commissioner representing the French State in French Polynesia, and the technical and financial authority of the civil aviation authority (DGAC).

2.4 Aerodrome information

Flights to Hiva-Oa-Atuona airport come from Tahiti Faa’a or via Nuku-Hiva. Since 2016, the average number of passengers carried per year, by Air Tahiti, to and from Hiva-Oa-Atuona is approximately 13,800.

Hiva-Oa-Atuona airport is a category C, restricted-use airport. It is located on a ridge at an altitude of around 1,500 ft. It is bordered to the east and west by terrain rising to 2,825 ft and 2,838 ft respectively. The summit of the island lies to the south-west of the airport, at an altitude of 4,151 ft. It has a paved runway 02-20 measuring 1,600 x 30 m with a mean downward slope of 1.3% facing south-west (1% recommended in section 3.1.13 of ICAO Annex 14). The maximum slope is 1.9% in the middle part and wheel touchdown on runway 20 (1.5% maximum recommended in section 3.1.14 of Annex 14). It is open to VFR or IFR operations in the presence of the AFIS officer.

AD 2 NTMN.13 **Distances déclarées *Declared distances***

RWY ID	TORA	TODA	ASDA	LDA	Observations *Remarks*
02	1510	2000	1510	1350	Fin des distances TORA, ASDA, LDA située 90m avant l'extrémité physique de la RWY02. End of declared distances TORA, ASDA, LDA located 90m before RWY02 physical end.
20	1440	1840	1440	1440	

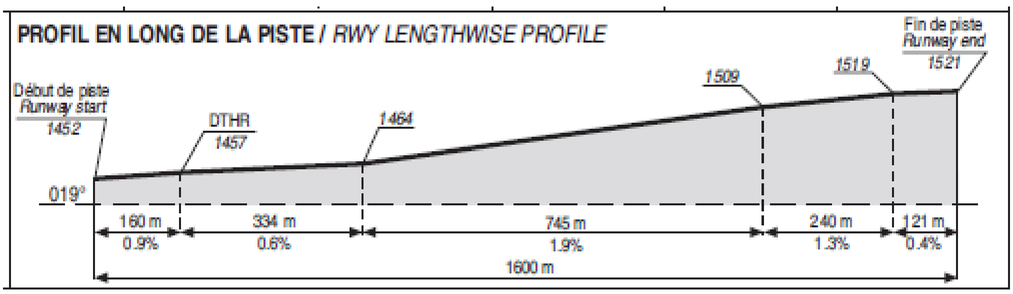


Figure 6: declared distances and runway lengthwise profile (source: SIA)

The AIP specifies in its “Air navigation hazards” section that the airport is located in a mountainous environment, that there is turbulence in the airport circuit and heavy turbulence and windshear on final due to wind coming from the relief.

Part C of the Air Tahiti OM (Routes and Aerodromes Manual) describes the particularities of Hiva-Oa-Atuona airport operations, including the visual approach procedures and RNP approaches to runways 02 and 20. Pilots are regularly trained in these particularities.

The PAPI for runway 20 is calibrated with a 4° slope (7%), and that for runway 02 with a 3° slope (5.2%). Flashing lights are present at thresholds 02 and 20. There is no centreline or edge lighting, regulations do not require it.

2.5 Information on instrument approach procedures

RNP procedures with LNAV minima are published for both runways.

The approach to runway 20 is described as an approach where turbulence is regularly present, as soon as the coastline is crossed and particularly during the descent between the high ground.

Air Tahiti privileges landing on runway 02, if the tailwind component allows it. The RNP 02 approach takes the aircraft over the island of Tahuata, and then alongside the highest ground of Hiva-Oa-Atuona where cloud cover can be thick depending on the time of day. During the investigation, interviews with pilots regularly operating at Hiva-Oa-Atuona airport revealed that for this reason, alternative visual flight paths were sometimes preferred to the published RNP 02 path.

AIP
PAC-P

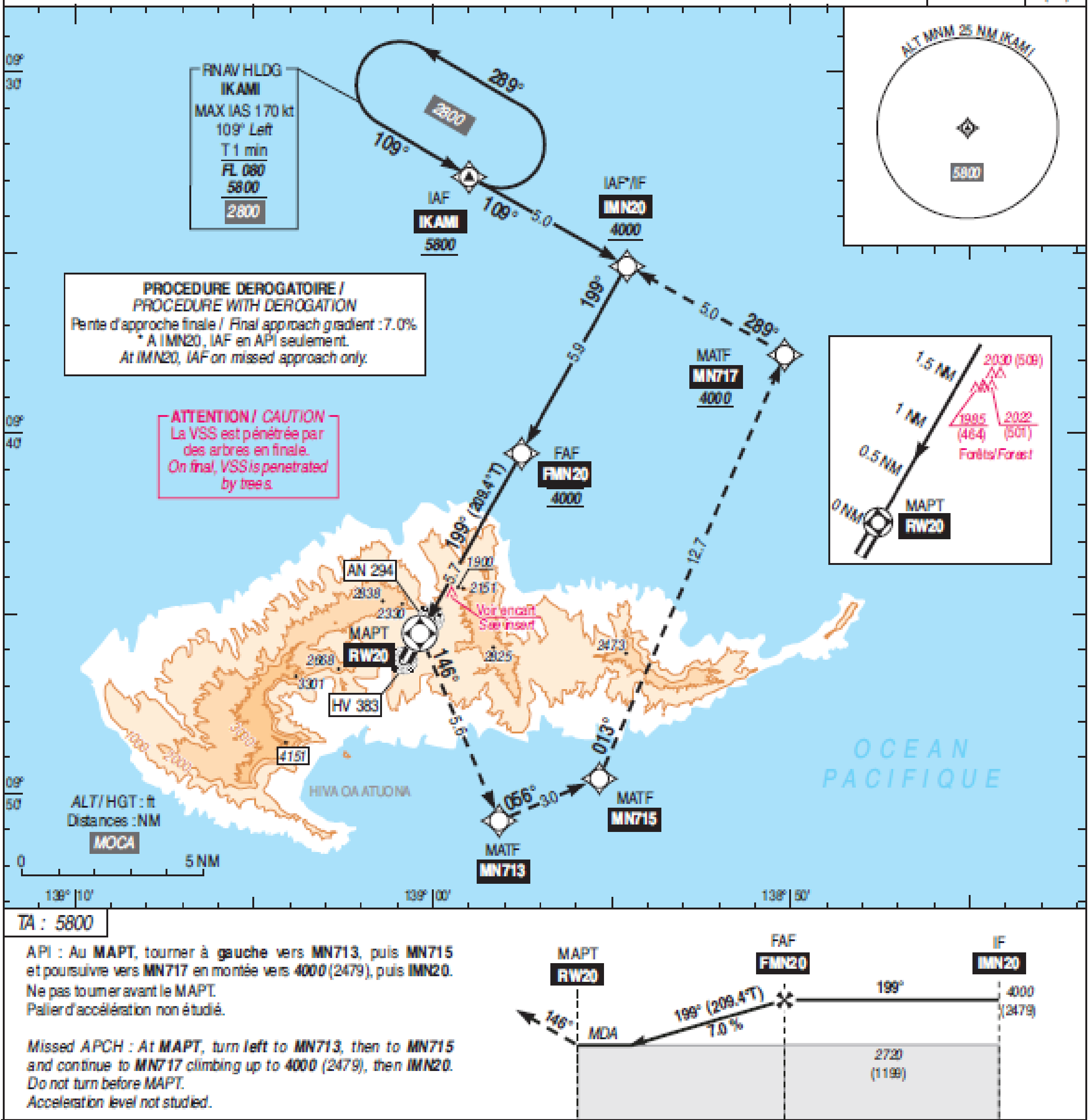
AD 2 NTMN IAC RWY20 RNP
29 DEC 22

APPROCHE AUX INSTRUMENTS
Instrument approach
CAT A.B
***ALT AD : 1521 (55 hPa)**, THR : 1521*

HIVA OA ATUONA

RNP RWY 20

APP : TAHITI CTL 133.500 au-dessus de / *above FL 045* TWR : NIL **AFIS :** HIVA OA Information 119.700 (FR)	**RNP APCH**	VAR 11° E (20)



API : Au **MAPT**, tourner à **gauche** vers **MN713**, puis **MN715** et poursuivre vers **MN717** en montée vers **4000** (2479), puis **IMN20**.
Ne pas tourner avant le MAPT.
Palier d'accélération non étudié.

*Missed APCH : At **MAPT**, turn **left** to **MN713**, then to **MN715** and continue to **MN717** climbing up to **4000** (2479), then **IMN20**.*
Do not turn before MAPT.
Acceleration level not studied.

MNM AD : distances verticales en pieds, RVR et VIS en mètres / *vertical distances in feet, RVR and VIS in metres.* REF HGT : *ALT AD*

CAT	LNAV		
	***MDA** (H)*	RVR	OCH
A B	***2510** (990)*	1500	987

DIST RW20			
NM	**5**	**4**	**3**
ALT	***3705***	***3280***	***2855***
(HGT)	(2184)	(1759)	(1334)

Observations / *Remarks* : Panne de guidage GNSS lors de l'approche / *Loss of GNSS guidance during approach* : voir / *see* AIP ENR 1.5.

		70 kt	80 kt	90 kt	100 kt	110 kt	120 kt	130 kt
FAF - RW20	5.7 NM	4 min 53	4 min 17	3 min 48	3 min 25	3 min 07	2 min 51	2 min 38
VSP (ft/min)		495	565	635	710	780	850	920

Figure 7: RNP 20 approach chart (source: SIA AIP)

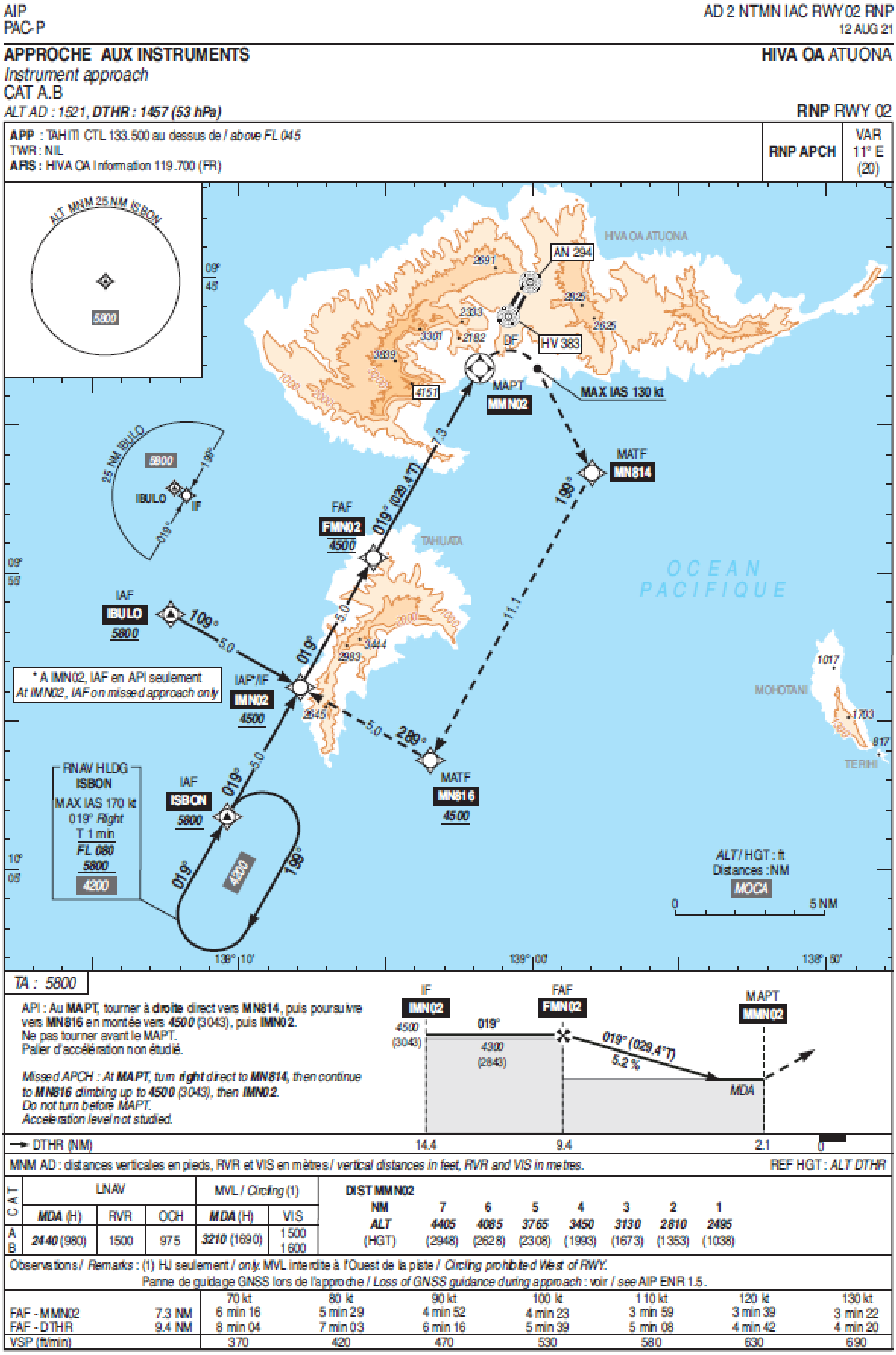


Figure 8: RNP 02 approach chart (source: SIA AIP)

2.6 Stabilisation of an approach

2.6.1 ATR's approach stabilisation criteria

In its FCTM, ATR defines the stabilisation criteria corresponding to an approach in standard conditions as well as decision criteria in the event of a deviation. At the time of the occurrence, the manufacturer's FCTM notably specified the following conditions:

- minimum stabilisation height: 1,000 ft in IMC and 500 ft in VMC;
- speed deviation: 0/+10kt;
- maximum vertical speed 1,000 ft/min with authorised adjustments of +/-300 ft/min with respect to the target value.

In September 2022, ATR updated the criteria in the "Deviations" section:

- the maximum vertical speed criteria no longer exists;
- the speed deviations are reduced to +/- 5 kt (and -5 + 10 kt for N-1).

ATR indicated that the torque (TQ) targets could also be used to qualify the pilot's activity on the power levers (PL). Without this constituting a stabilisation criteria, this activity can show the pilot's difficulty in holding a specified flight path.

2.6.2 Air Tahiti's approach stabilisation criteria

At the time of the occurrence, the stabilisation criteria for an approach in the Air Tahiti OM (part A08), notably specified that the IAS must be between VAPP and VAPP +15 kt and heading for the VREF at 50 ft. The descent rate must not exceed 1,000 ft/min with deviations not exceeding 300 ft/min tolerated. The OM specified that if one of the conditions was not met, then the crew had to go around.

Revision 12 of the OM of January 2024 differs from the ATR FCTM updated in 2022 with respect to the conditions, and keeps the Vz limitation at 1,000 ft/min +/- 300 ft/min without taking into account the approach slope followed. The speed criteria is also VAPP+10 kt which is different from the FCTM updated in 2022.

Note: The vertical speed is proportional to the slope, for a constant ground speed.

Vz (ft/min) = 10/6 x GS(kt) x P(°) or Vz (ft/min) = GS(kt) x P(%)

For example, for an average ground speed of 140 kt on a 3° slope, the Vz would be 700 ft/min and on a 4° slope, 930 ft/min on average. This calculation does not take into account the influence of the vertical wind component.

The Air Tahiti head of flight operations indicated that certain identified destinations (which include Hiva-Oa-Atuona) call on the pilots' judgement and experience to determine at what point the deviations require the pilot to envisage carrying out a missed approach. These particularities are not specifically covered in part C of the OM for example.

2.6.3 Stabilisation of approach during occurrence

The analysis of the flight parameters found a destabilisation of the approach below 500 ft. It was notably characterised by:

- an IAS exceeding the VAPP + 10 kt threshold several times;
- a descent rate which reached values greater than 1,000 ft/min;
- and engine torques[6] regularly varying between 0 and 52%.

Between 200 ft and 0, the PF tried to reabsorb the excessive speed by reducing the power. From 100 ft to 0, the wind rotated (the headwind became a tailwind). The IAS rapidly decreased while the GS remained constant. The vertical speed increased from -750 ft/min to around 1,250 ft/min. This situation may have been perceived by the crew as the aeroplane being pushed down. It is most probably the captain's callout that made the co-pilot act on the power levers. The crew continued the approach by trying to converge towards the speed target value despite the extremely disturbed aerological conditions. The stabilisation criteria which are known and taught did not make the pilots reject the approach sufficiently early.

The a eroplane had a substantial amount of energy on the final approach. To reabsorb it, the co-pilot reduced the engine power before the flare. This is why he no longer had sufficient, rapidly available reserve power to counter the windshear effects when they were detected.

[6] This does not constitute a stabilisation criteria in the Air Tahiti OM.

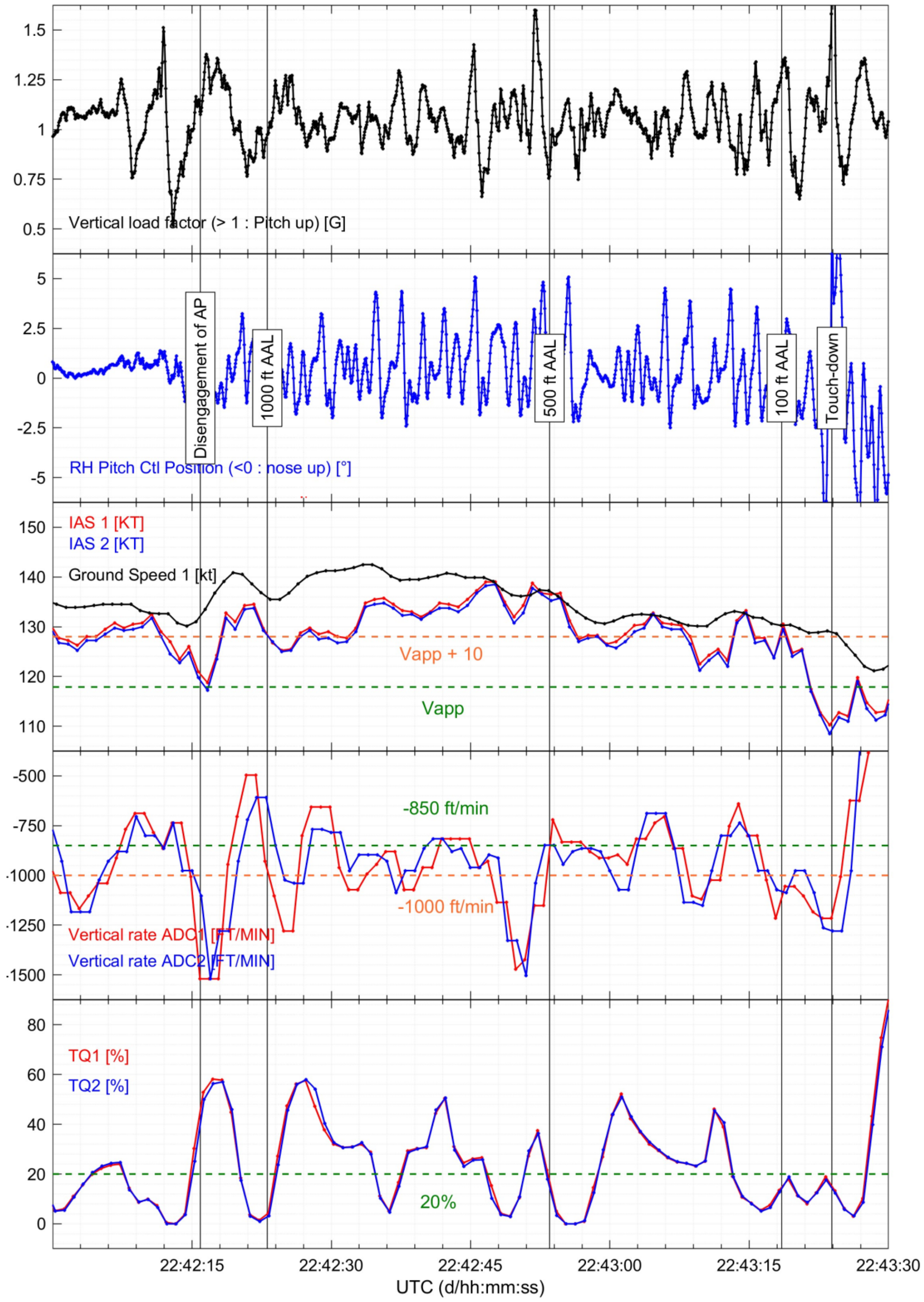


Figure 9: destabilisation of approach (source: BEA)

2.6.4 Comparison of flight data of other approaches to runway 20

The management of energy during the approach to runway 20 during the occurrence flight was compared to that observed during the sixty-six other approaches carried out on the same runway and for which the BEA obtained the flight data. To do this, the average ground speed, IAS and vertical speed between 1,000 ft agl and wheel touchdown were calculated.

The values obtained for the occurrence flight were:

- average ground speed = 135 kt;
- average IAS = 130 kt (the approach speed VAPP was 118 kt, including an increase of 10 kt which respect to the reference speed VREF to take into account the wind);
- average vertical speed = 950 ft/ min.

These three values were greater than all those calculated for the other approaches.

The energy during the approach (vertical speed-ground speed pair) of the occurrence flight (blue circle) was significantly higher than for all the other approaches analysed (red cross).

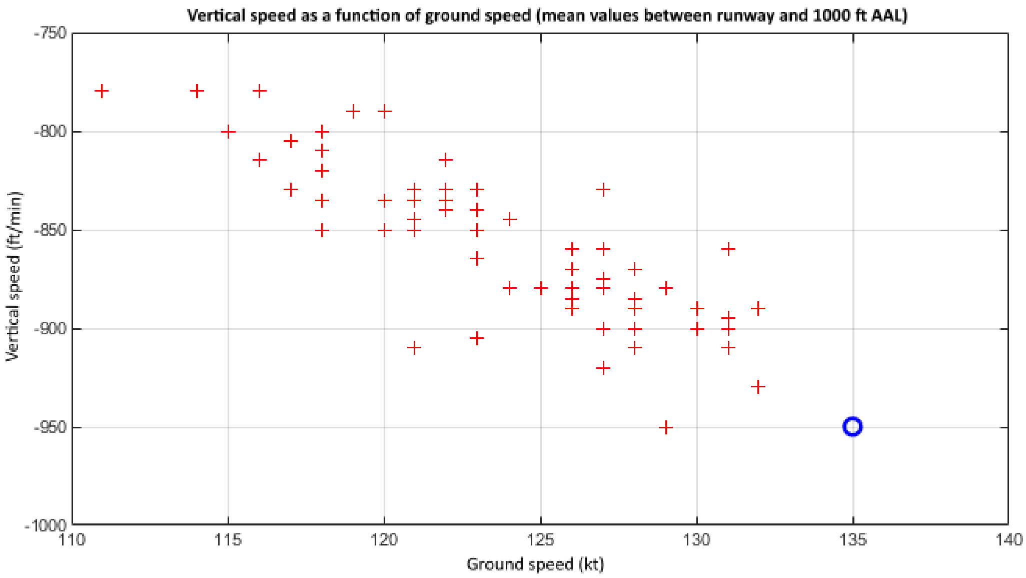


Figure 10: analysis of average energy on approach (source: BEA)

2.7 Aircraft and systems information

2.7.1 Pitch uncoupling mechanism

ATR aeroplanes are equipped with mechanical flight controls made up of cables, rods and bellcranks. The two elevators are positioned at the top of the T-tail unit, one on the RH side and the other on the LH side.

The LH and RH elevators are mechanically connected respectively, to the LH and RH control columns situated in the cockpit. The two elevators are mechanically connected together by a Pitch Uncoupling Mechanism (PUM).

The PUM transmits all the loads and movements from one elevator to the other. For example, a nose-up input on the LH control column will be transmitted to the LH elevator. The latter will deflect upwards and will move the RH elevator via the PUM. The cables, rods and bellcranks connecting the RH elevator to the RH control column in the cockpit will transmit the movement to the RH control column which will move in the same direction as the LH control column.

The role of the PUM is to uncouple the two elevators and make them independent if one of them should be jammed by an outside phenomenon. This architecture was designed to minimise the crew reaction time and automatically uncouple the two elevators in certain critical flight phases, and allow the pitch axis to be controlled by the other elevator. The PUM acts when the differential load on the two elevators exceeds a fixed value. The uncoupling also occurs when opposite dual inputs are made on the control columns (between 50 and 55 daN applied to each control column on ground).

The uncoupling by the PUM is irreversible in flight. A maintenance action carried out on the ground by qualified personnel is required to recouple the system.

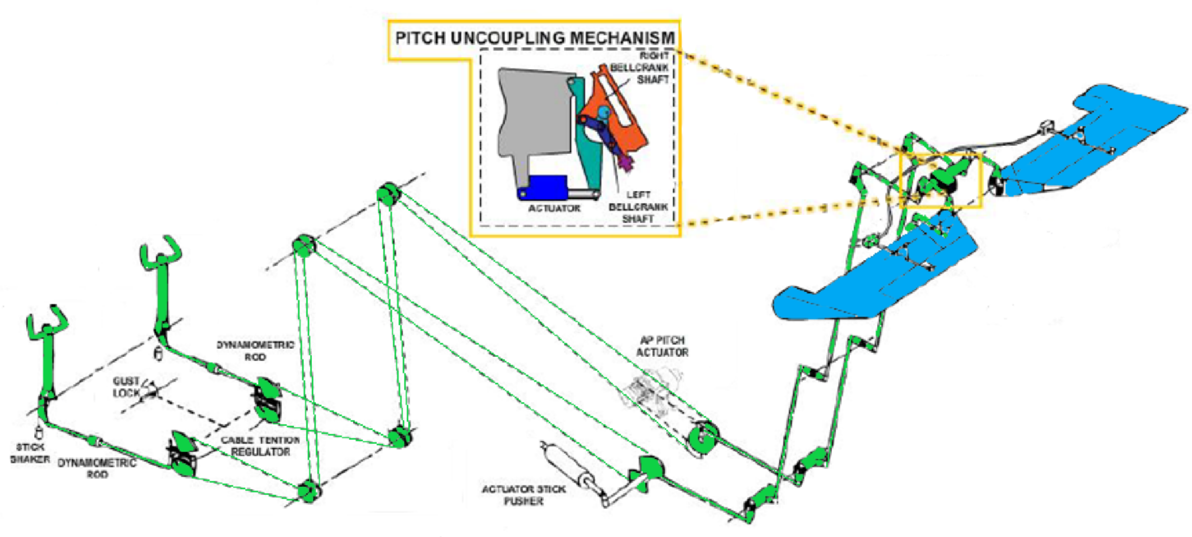


Figure 11: diagram of elevator control (source: ATR, modified by BEA)

2.7.2 Information and procedure

In the event of uncoupling, an aural and visual "**MASTER WARN**" warning is activated. A visual "**PITCH DISC**" warning appears in the ALERT window of the EWD (Engine and Warning Display). The crew must then carry out the "**PITCH DISCONNECT**" procedure detailed in the EWD procedure window.

Only the PF shall control the aeroplane's flight path as, when the elevators are uncoupled, each control column independently controls each elevator. Opposite control column movements would lead to inaccurate control of the flight path. Furthermore, at high speed, the structural loads become considerable.

2.7.3 Uncoupling during occurrence flight

The analysis of the parameters concerning both the elevator positions and the loads applied to the control columns precisely identified the point at which the LH and RH elevators were uncoupled. It occurred less than one second before wheel touchdown when the PM was applying a nose-up load of 65 daN and the PF a nose-down load of 30 daN.

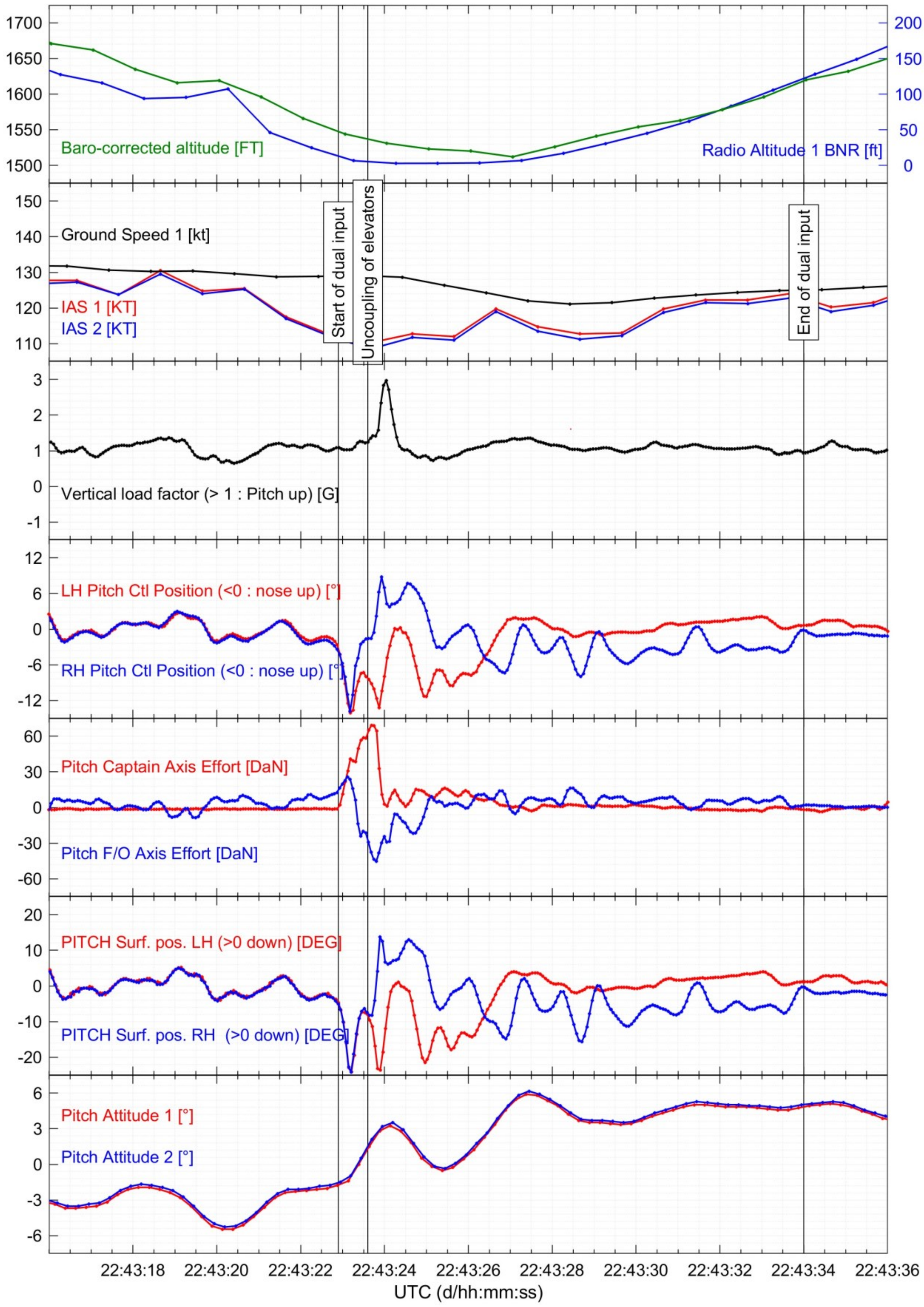


Figure 12: uncoupling of elevators (source: BEA)

The PM had called for power and then acted on the control column in a reflex manner in reaction to a sudden loss of height due to windshear. Being a reflex action, he did not call out his input. The co-pilot who, until that time, had been correcting flight path deviations caused by severe aerological disturbances was surprised by this load and countered it. The captain called out, "*Go-around*" at 22:43:24, then indicated the Pitch disconnect warning and added that he had the controls in the following second.

From 22:43:23 to 22:43:34 (11 s), loads were recorded on both control columns until the moment when the co-pilot asked the captain to confirm that he did in fact have the controls.

During the climb following the go-around, the IAS was temporarily recorded at values in excess of 180 kt which corresponds to the manoeuvre limit with the PUM disconnected (Memo item PITCH DISCONNECT in procedure QRH A27-07).

2.8 Dual inputs

2.8.1 General

In all multi-pilot aeroplanes, the division of tasks between the PF and the PM is based on the principle that there must be only one pilot, the PF, who makes inputs on the main flight controls. The Standard Operating Procedures (SOPs) and training reflect this principle. Only certain abnormal situations such as the proven jamming of controls may require simultaneous inputs to be made on them.

Manufacturers of aeroplanes with linked controls and the certification authorities consider that the flight control system provides each pilot with hand-feel and visual information concerning the controls of the other pilot. It remains possible that an opposite input made by the other pilot may be perceived as a jam. However, the call out when the controls are taken is a rampart against the possibility of the two pilots having different action plans. In practice, the investigations carried out by the BEA[7] or in which it has participated[8] show that, in very dynamic situations, this principle has proven to be ineffective.

Opposite dual inputs on the controls are not mentioned in the Air Tahiti documentation and are not covered in training.

2.8.2 Minimum training programme

ATR's "Operational Suitability Data" (OSD), approved by EASA, sets out the minimum training programme which must be implemented by the ATOs and operators in order to establish initial and recurrent training programmes for the given type. Part "Flight Crew Data", chapter 7, "Training Areas of Special Emphasis (TASE)" draws attention to specific subjects.

Flight control desynchronisation on the ATR is covered during the theoretical training for the type rating, when the flight controls are described. This system is not specifically reviewed during recurrent training nor covered in other supplementary training. The subject of opposite dual inputs is not covered in the OSD.

[7] Serious incident to the Boeing 777 registered F-GSQJ operated by Air France on 5 April 2022 at Paris - Charles de Gaulle.

[8] Accident to the ATR 72 registered VH-FVR operated by Virgin Australia Regional Airlines (VARA) on 20 February 2014 in descent towards Sydney (Australia).

Furthermore, the manufacturer specifies that it is counter-productive to carry out practical training associating opposite dual inputs and the decorrelation of the elevators (negative training).

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

At the request of the crew of the ATR72 operated by Air Tahiti which were ready to take off for Hiva-Oa-Atuona airport, the AFIS officer at Nuku-Hiva airport where the crew were on a stop, indicated that the upper wind at the destination airport was from the east with a surface wind showing significant variations in direction and strength. The crew planned to carry out an RNP approach to runway 20 due to the reported tailwind component on preferred runway 02.

En route, the crew contacted the Hiva-Oa-Atuona AFIS officer several times to obtain up to date wind information. The AFIS officer specified that the direction was still variable and the tailwind component on runway 02 still present. The crew confirmed their choice of landing on runway 20. On the RNP20 approach, the crew chose to increase the approach speed given the turbulent air after passing the coastline and on the lee side of the terrain. The co-pilot, PF at this point, managed to hold the flight path by means of many large-amplitude inputs on the power levers. However, despite these inputs, there were significant Vz and IAS deviations with respect to the stabilisation criteria. The crew perceived this situation as usual in these wind conditions for this approach.

At 200 ft agl, to reduce the speed, the co-pilot reduced the engine power to flight idle. On flying through 90 ft agl, the aeroplane's IAS suddenly decreased due to windshear and the rate of descent increased. This variation led to the captain asking the co-pilot to increase power as the aeroplane was flying over the threshold of runway 20. More time was required to counter the windshear effects starting from flight idle than that needed with steady-state speed. When he perceived that the aeroplane was sinking, the captain (PM) made a nose-up input on the control column, at the same time as the co-pilot. This reflex action, which was not called out, surprised the co-pilot who probably thought that his nose-up input had been inappropriate. This led him to make an opposite input. The captain increased the nose-up load applied to his control column which led to the elevators uncoupling.

Less than one second later, the wheels of the main landing gear touched down hard on the runway. The aeroplane bounced and the captain called out a go-around. He then informed the co-pilot that he was taking the controls. At the same time, the "Pitch disconnect" Master Warning was activated. The co-pilot and the captain continued to make opposite dual inputs for 11 s.

After an analysis of the situation and coordination, the crew decided to carry out a visual approach to runway 02. The landing proceeded normally.

Contributing factors

The following factor may have contributed to the crew choosing the RNP 20 approach which seems to have increased their exposure to risks of turbulence and windshear:

- an inadequate meteorological service at Hiva-Oa-Atuona which cannot guarantee accurate information to enable pilots to choose the most suitable runway for the approach and landing.

The following factors may have contributed to the approach being continued although the stabilisation criteria were no longer met, and then to the hard touchdown:

- the acceptance of the destabilisation of the approach, without rejecting it, due to recurrent turbulent conditions on runway 20;
- the operator's definition of stabilisation criteria insufficiently adapted to an approach on a steep slope;
- the difficulty of reacting effectively to low-height windshear due to the absence of detection means, either on the ground or on board the aeroplane.

Opposite dual inputs following the captain's reflex action led to the unwanted activation of the PUM.

4 MEASURES TAKEN AND DISCUSSIONS SINCE OCCURRENCE

Safety measures taken by ATR

The ATR ATO (ATC) has modified its program to introduce the notion of "dual input" in the following training courses:

- type rating: in the Elevator Jam procedure of session FFS9;
- type rating: dual input will be covered in the CRM section;
- captain module: dual input will be covered in the CRM section;
- type rating instructor module: dual input will be covered in the theory section.

No regulatory requirement obliges another ATO approved to provide type rating training to increase its training hours in order to reflect such modifications.

ATR therefore plans to modify the content of the OSD in order to make the relevant measures applicable to all the ATOs. At the end of 2025, it intends to include in section 7 listing the TASEs, in the part concerning flight controls, content regarding undesired control uncoupling and prevention means (Revision 14).

➢*Flight Controls*

▪ *Knowledge of elevators coupling system, **sources of undesired pitch uncoupling and prevention means**, pitch uncoupling techniques and associated normal/abnormal/emergency operations.*

Contacted during the investigation, EASA, as the primary certification authority, informed the BEA that a proposal of this type made by the manufacturer would be acceptable.

Each ATO, overseen by the competent civil aviation authorities, is responsible for taking into account the modifications to the OSD.

Safety measures taken by Air Tahiti

Air Tahiti plans to revise Part C of its OM to reflect the adaptation of standard stabilisation criteria to particular approaches, especially steep-slope approaches.

Air Tahiti has revised its training program to take into account the stabilisation of steep-slope approaches, and to cover the theoretical aspects of opposite dual inputs.

Safety measures taken by the French Polynesia civil aviation directorate (DAC)

In December 2023, the DAC signed a service agreement with Météo-France to provide Nuku-Hiva airport with a level N3 meteorological service.

The DAC has also indicated its intention to:

- deploy level N3 (note: level which includes weather reports but not forecasts) for Hiva-Oa-Atuona airport (at the time of writing this report, no service agreement had been signed with Météo-France);
- reinforce the AFIS service by increasing the amplitude of the service;
- install daytime lighting at Hiva-Oa-Atuona.

Safety measures taken by the French Polynesia civil aviation state service (SEAC/PF)

The SEAC/PF included the problems linked to the provision of weather information services for aircraft pilots in the "local subjects" of the State Safety Plan.

Chronology of exchanges regarding minimum meteorological service levels, between the services, after the serious incident on 4 April 2022

- 4 April 2022: date of occurrence.
- On 8 April 2022, the SEAC/PF informed the DAC of the minimum meteorological service levels required for the airports operated by the DAC, and in particular level N1 for AFIS airports such as Hiva-Oa-Atuona.
- On 11 July 2022, the technical protocol established under the framework agreement between the DGAC and Météo-France was updated. This revision did not include the same provisions as those mentioned in paragraph 2.2.1.3. It did not define **any minimum meteorological service level**, for airports where the DSNA is not competent in French Polynesia (this is the case for the AFIS airports apart from Huanine), except for Hao, Nuku-Hiva, Totegegie and Tubuai Mataura airports where level N3 is required.
- On 20 July 2023, the DAC informed the SEAC/PF that its recommendations had been taken into account, specifying in particular that level N1 initially envisaged for Hiva-Oa-Atuona would not be implemented, due to an unfavourable response from Météo-France. The contracting of new services between the DAC and Météo-France had had to be suspended.
- On 3 August 2023, the SEAC/PF informed the DAC of the need to provide Hiva-Oa-Atuona airport with a level 3 and noted the difficulties encountered with Météo-France.
- On 20 September 2023, the DAC asked Météo-France about the progress of the projects and the provision of the necessary equipment, and proposed a timetable for 2024-2027. In order to continue the work bringing certain airports into regulatory compliance, the DAC proposed a provisional contractual schedule for these airports.
- On 3 October 2023, the DAC clarified its letter of September and confirmed the request for a level N3 service for Hiva-Oa, for 2024.

- On 24 May 2024, the DAC modified the list of airports and replaced Totegegie airport by Mataiva airport (initially requested in letter of 3 October 2023).

5 SAFETY RECOMMENDATIONS

Note: in accordance with the provisions of Article 17.3 of Regulation No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations shall report to the safety investigation authority which issued them, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.

Airport meteorological service levels

Commercial air transport to and from Hiva-Oa-Atuona helps to open up the region. The airport's specific features, particularly in terms of aerology, are recognized: access for pilots is subject to authorization and requires specific training.

On the date of the occurrence, Hiva-Oa-Atuona airport should have had at least meteorological service level N4, according to the DGAC/DTA – Météo-France technical protocol of 2019. To meet a minimum meteorological service level, sensors must be certified, installed and maintained by Météo - France. However, the sensors at Hiva-Oa-Atuona were installed and maintained by the DAC who is the operator for most of the Polynesian airports. Thus, according to the regulations, Hiva-Oa-Atuona airport did not comply with any meteorological service level. The meteorological facilities at Hiva-Oa-Atuona airport do not have the expected guarantees on which accuracy and reliability may depend.

Furthermore, the airport has no weather report or weather forecast service.

As a result, during flight preparation or on initial contact with the AFIS officer, pilots do not have the information they need to choose the most suitable runway, particularly in view of operational limitations such as the maximum tailwind component.

In the case of the serious incident, the information provided to the crew prompted them to carry out an approach for runway 20. The investigation showed that this choice increased the crew’s exposure to the risks of turbulence and windshear.

Since the serious incident, the various exchanges between the DAC, Météo-France and the SEAC/PF have not led to a notable improvement. The July 2022 revision of the protocol even degraded the expected meteorological service level.

The provision of meteorological information by zone (APZ) does not make up for the absence of an airport weather report (METAR) and weather forecast (TAF) service. The APZ is not precise enough to strictly comply with the regulatory requirements for commercial air transport to use Hiva-Oa-Atuona airport safely, and does not allow pilots to build an effective strategy during the flight preparation phase.

In many of these aspects, Hiva-Oa-Atuona does not appear to be an isolated case among French Polynesia airports.

Lastly, although this was not a contributing factor to the serious incident, the BEA noted during the investigation that the operator’s pilots regularly privileged visual approaches rather than PBN approaches to runway 02, the procedure exposing them to the risk of not having the minimum visibility due to the cloud cover clinging to the high ground close to the flight path.

Therefore, the BEA recommends that:

- *whereas the limited reliable and accurate meteorological information available when preparing flights, and subsequently in flight;*
- *whereas uncertified, more or less reliable or inaccurate meteorological information represents a risk for the approach;*
- *whereas the increased risks when flying in and out of certain airports, notably due to their specific aerological characteristics;*
- *whereas the applicable regulatory provisions with respect to the transmission of meteorological information to aircraft pilots by the ATS services;*
- *whereas the regulatory provisions applicable to aircraft operators concerning flight preparation, in particular the access to destination and alternate airports;*
- *whereas better-quality meteorological information could be used to design IFR approach paths better suited to local conditions;*

the DGAC, in coordination with Météo-France, ensure that on the various airports in French Polynesia, an adequate meteorological service level is provided, in order that inter-island commercial flights are carried out safely and in accordance with requirements [Recommendation FRAN-2025-005];

pending the upgrading of the meteorological service on French Polynesia airports, the DAC ensure that crews who receive meteorological parameters from facilities not certified by Météo-France are fully informed that the values of these parameters have not been validated [Recommendation FRAN-2025-006].

The BEA investigations are conducted with the sole objective of improving aviation safety and are not intended to apportion blame or liabilities.