AI2022-2

# AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

JAPAN AIR COMMUTER CO., LTD.
**J A 0 7 J C**

**March 24, 2022**

Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board (and with Annex 13 to the Convention on International Civil Aviation) is to prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

TAKEDA Nobuo
Chairperson
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

《Reference》

The terms used to describe the results of the analysis in "3. ANALYSIS" of this report are as follows.

i) In case of being able to determine, the term "certain" or "certainly" is used.
ii) In case of being unable to determine but being almost certain, the term "highly probable" or "most likely" is used.
iii) In case of higher possibility, the term "probable" or "more likely" is used.
iv) In a case that there is a possibility, the term "likely" or "possible" is used.

# AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

## RUNNING OFF THE SIDE OF RUNWAY
## JAPAN AIR COMMUTER CO., LTD.
## ATR 42-500, JA07JC
## AMAMI AIRPORT, KAGOSHIMA PREFECTURE
## ABOUT 10:01 JST, JANUARY 8, 2020

February 25, 2022
Adopted by the Japan Transport Safety Board

| | |
|---|---|
| Chairperson | TAKEDA Nobuo |
| Member | MIYASHITA Toru |
| Member | KAKISHIMA Yoshiko |
| Member | MARUI Yuichi |
| Member | NAKANISHI Miwa |
| Member | TSUDA Hiroka |

## 1. PROCESS AND PROGRESS OF THE INVESTIGATION

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| **1.1 Summary of the Serious Incident** | On Wednesday, January 8, 2020, an ATR42-500, registered JA07JC, operated by Japan Air Commuter, Co., Ltd., ran off the side of Runway 03 at landing and was disabled to perform taxiing. There were 21 persons on board consisting of the captain, two flight crew members and 18 passengers, and no one was injured. |
| **1.2 Outline of the Serious Incident Investigation** | The occurrence covered by this report falls under the category of "Running off the side of runway (limited to when an aircraft is disabled to perform taxiing)" as stipulated in Clause 3, Article 166-4 of the Ordinance for Enforcement of the Civil Aeronautics Act of Japan(Ordinance of the Ministry of Transport No.56 of 1952) before revision by the Ministerial Ordinance on Partial Revision of the Ordinance for Enforcement of Civil Aeronautics Act of Japan(Ordinance of Ministry of Land, Infrastructure, Transport and Tourism No.88 of 2020), and is classified as a serious incident.<br>On January 8, 2020, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this serious incident.<br>An accredited representative and an advisor of the French Republic as the State of the Design and Manufacture of the aircraft involved in this serious incident participated in the investigation.<br>Comments were invited from the parties relevant to the cause of the serious incident and from the relevant State. |

## 2. FACTUAL INFORMATION

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| **2.1 History of the Flight** | According to statements of the captain and the first officer (FO), records of flight data recorder (FDR) and cockpit voice recorder (CVR) and |

communication records with Amami Aerodrome Mobile Communication Station (hereinafter referred to as "the RADIO"), the history of the flight is summarized as follows:

On January 8, 2020, an ATR 42-500, registered JA07JC (hereinafter referred to as the Aircraft) and operated by Japan Air Commuter Co., Ltd., (hereinafter referred to as the Company) was planned to fly as its scheduled flight from Kagoshima Airport, Amami Airport, Kikai Airport, Amami Airport, Tokunosima Airport, Okinoerabu Airport, and Naha Airport.

Figure 1 Serious incident aircraft

When checking weather conditions before the first flight departing Kagoshima Airport, the flight crew predicted that a northwesterly wind would become strong after the front had passed.

The Aircraft took off from Kagoshima Airport at 07:29 JST (JST: UTC+9 hours; unless otherwise noted, all times are indicated in JST in this report on a 24-hour clock) and normally landed on Runway 21 at Amami Airport at 08:28 in northwesterly wind.

Then, after flying to Kikai Airport, the Aircraft took off from Runway 25 at Kikai Airport as its scheduled flight 3830 at 09:53 and flew at an altitude of 2,000 ft back to Amami Airport under visual flight rules. The captain sat in the left pilot seat as PF*1 and the FO sat in the right pilot seat as PM*1 in the cockpit. The captain planned to approach Runway 03 with flap 35° at an approach speed of 105 kt for landing at Amami Airport. The captain conducted an approach briefing that did not include information on a crosswind landing.

When the Aircraft established communications with the RADIO at 09:54:31, the wind received from the RADIO was such that wind direction was 320°, wind velocity was 28 kt, and maximum instantaneous wind velocity was 38 kt. The captain continued the approach judging that a landing was practicable since the crosswind component of the mean velocity of the wind received was within the limit stipulated in the Airplane Operating Manual (AOM) of the Company. When the Aircraft thereafter reported the right base leg of Runway 03 to the RADIO, the RADIO advised that there was no obstacle on the runway along with information of wind direction 320°, wind velocity 28 kt, and maximum instantaneous wind velocity 40 kt. The autopilot system of the Aircraft was disengaged by the captain at an altitude of about 1,400 ft and the flaps were set at 35°.The captain and the FO conducted the landing checklist and confirmed that a

*1 "PF" and "PM" are terms used to identify pilots by their different roles in aircraft operated by two persons. The PF abbreviates Pilot Flying and is mainly responsible for maneuvering the aircraft. The PM abbreviates Pilot Monitoring and mainly monitors the flight status of the aircraft, cross checks operations of the PF, and undertakes other non-operational duties.

stabilized approach was established at an altitude above the ground level (AGL) of 1,000 ft (see 2.6 (6)). Since the Aircraft speed fluctuated multiple times from the approach speed of 105 kt by exceeding minus 5 kt or plus 10 kt at 1,000 ft AGL or lower influenced by a varying wind, the FO called "Airspeed" whenever fluctuated, which is stipulated as deviation call in AOM (see 2.6 (7)).

Although the captain thought to execute a go-around, he judged that the requirement of a stabilized approach could be satisfied by his corrective maneuvering, and continued approaching.

At 09:59:37 when the Aircraft was at an altitude of approximately 850 ft, the RADIO transmitted to the Aircraft that the wind direction was 310°, the wind velocity was 27 kt, and the maximum instantaneous wind velocity was 38 kt.

The FO performed a deviation call against the speed at an altitude of about 300 ft and recognized that the Aircraft was deviating to the left of the final approach course (see Figures 2 a, 3 a, and 4 a)

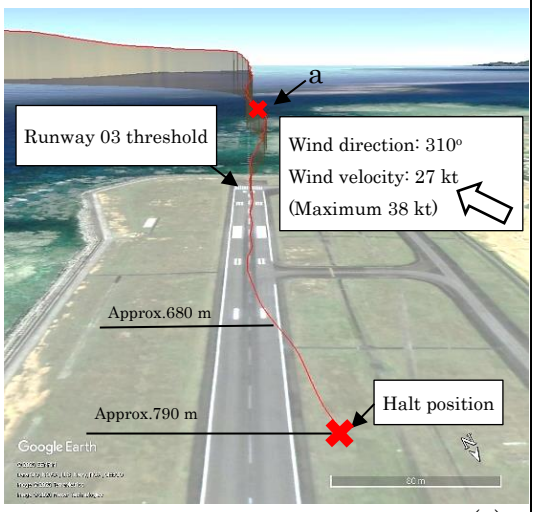


Figure 2 Estimated flight route (1)

(Note: Distance is expressed from the runway threshold)

The Aircraft flew returning its flight path to the right at an altitude around 250 ft and passed over the vicinity of the threshold while flying on almost the final approach course at approximately 50 ft AGL with bank angle at approximately 4° to the left and magnetic heading at approximately 023°.

The right rudder pedal of the Aircraft was applied at approximately 30 ft AGL (see Figure 4 b), and the elevators were moved in the nose-up direction at around 20 ft AGL (see Figure 4 c). When the Aircraft touched down from the left main wheel almost on the runway centerline at approximately 400 m from the threshold of Runway 03, the engines' power were in the flight idle position, the rudder pedals were in the nearly neutral position, the bank angle was approximately 2.6° to the left, and the magnetic heading was approximately 029°. Approximately one second later, the weight on wheels*2 (WOW) of all gears changed to the ground mode.

*2 "Weight on wheels" means the data that indicate the ground contact condition of main landing gear or all of landing gears recorded in FDR by signals from the sensor that is activated by the load applied on nose landing gear or both main landing gears. For the ground contact condition of main landing gear, "GND" is recorded when the load is applied to both main landing gears. For the ground contact condition of all landing gears, "GND" is recorded when the load is applied to all of landing gears.

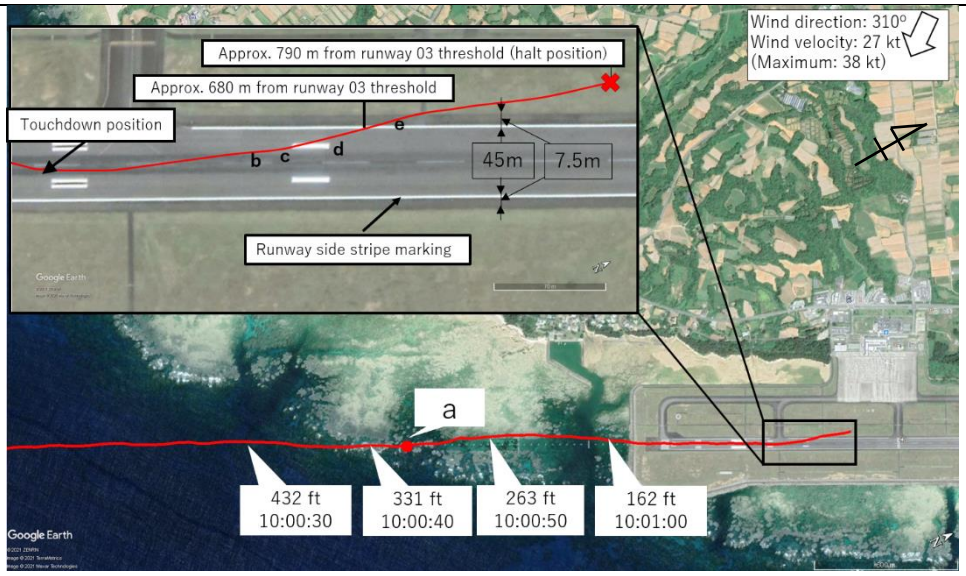


Figure 3　Estimated flight route (2)

Although the captain and the FO remembered that the captain had called " YOU HAVE CONTROL*3 ", this call and the call "I HAVE CONTROL" by the FO were not recorded in the CVR. The CVR recorded the captain's voice as saying "USE THE AILERON SUFFICIENTLY TO THE LEFT" at about the time of the touchdown. About one second after the touchdown, the captain initiated reverse operation after confirming the status of the propeller pitch by himself. Besides, the call of the FO, "TWO LOW PITCH" (see 2.6(8) was not recorded in the CVR when the captain moved the power levers in the reverse position.

Around this time, the attitude of the Aircraft began to bank to the right, and the control wheel input of the Aircraft to the left increased (see Figure 4d), however, the right roll angle of the Aircraft increased to about 5° (see Figure 4e). ), and the magnetic heading changed to about 019°. In addition, the WOW of either of the main landing gears temporarily changed to the air mode (see Figure 4 f).

Approximately three seconds after the touchdown, the captain fully pushed the right rudder pedal kept using reverse (see Figure 4 g). The magnetic heading of the Aircraft began to change toward the runway centerline after it had changed to 011° approximately four seconds after the touchdown (see Figure 4 h). The captain continued pushing the right rudder pedal and simultaneously used the nosewheel steering and the right brake only (see Figure 4i). The status of the nosewheel steering was not recorded in the FDR.

The FO managed the control wheel to maintain the captain's input and simultaneously pushed the control column in the nose-down direction. The bank in the Aircraft attitude was getting small, however, the banked attitude to the right continued until approximately six seconds after the

*3 At the Company, by calling, "YOU HAVE CONTROL." and "I HAVE CONTROL." after touchdown, the pilot sitting in the left seat commences to control the course with nosewheel steering wheel and simultaneously maneuvers deceleration, and the pilot sitting in the right seat maneuvers control wheel to keep main wings levelled and control column to increase effect of brakes and nosewheel steering.

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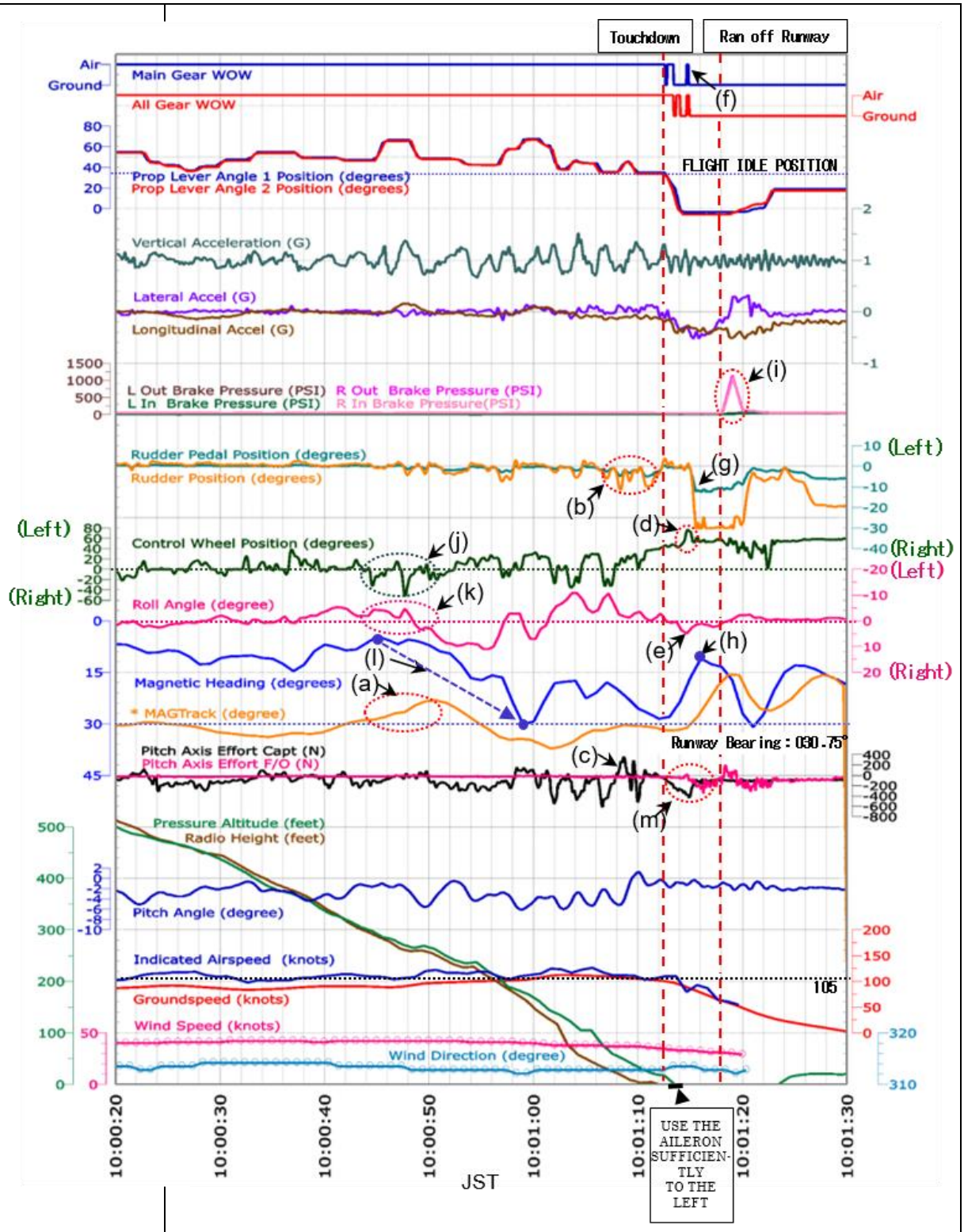
| | touchdown. After the handling on the control wheel and the control column had been transferred from the captain, although the FO noticed that the Aircraft was proceeding to the left, he thought that correction of the course by the captain was practicable enough.<br>The Aircraft, however, entered a grassy area on the left side of the runway beyond the runway side stripe marking*4, came to a stop, and was disabled to perform taxiing.<br>Amami Airport was closed until 23:24 with 37 scheduled flights canceled.<br><br>This serious incident occurred at Amami Airport (28°25'45" N, 129°42'40" E) and the time of occurrence was January 8, 2020, about 10:01. |

*4 "runway side stripe marking" means the marking that is continuously placed on each side of the runway and delineates the edge of the runway served for precision approaches or another runway with an obscure boundary.




*MAG TRACK has modified a track (TRUE TRACK) in the true bearing recorded in the FDR with the magnetic variation.

Figure 4 FDR record

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| 2.2 Damage to the Aircraft | None |
| 2.3 Personnel Information | (1) Captain: Age 49<br>Airline transport pilot certificate (Airplane) August 13, 2010<br>Type rating for ATR 42/72 December 9, 2015<br>Class 1 aviation medical certificate |

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| | Validity: August 4, 2020<br>Total flight time: 12,373 hours 45 minutes<br>Flight time in the last 30 days: 62 hours 44 minutes<br>Flight time on the type of aircraft: 1,450 hours 36 minutes<br>Flight time in the last 30 days: 62 hours 44 minutes<br>(2) First Officer: Age 44<br>Commercial pilot certificate (Airplane): May 10, 2007<br>Type rating for ATR 42/72: November 16, 2018<br>Instrument flight certificate: December 5, 2007<br>Class 1 aviation medical certificate<br>Validity: May 31, 2020<br>Total flight time: 7,125 hours 36 minutes<br>Flight time in the last 30 days: 50 hours 2 minutes<br>Flight time on the type of aircraft: 738 hours 13 minutes<br>Flight time in the last 30 days: 50 hours 2 minutes |
| 2.4 Aircraft Information | (1) Aircraft type: ATR 42-500<br>Serial number: 1408<br>Date of manufacture: January 14, 2019<br>Certificate of airworthiness: No. 2019-003<br>Validity: During the period in which the aircraft is maintained in accordance with the maintenance manual (Japan Air Commuter Co., Ltd.)<br>Category of airworthiness: Airplane Transport<br>Total flight time: 1,463 hours 9 minutes<br>(2) When the serious incident occurred, the weight of the Aircraft is estimated to have been 32,198 lb and the position of the center of gravity is estimated to have been 24.9% MAC*5, both of which are estimated to have been within the allowable range. |
| 2.5 Meteorological Information | (1) According to Aviation Routine Weather Reports (M report*6) for Amami Airport during the period of occurrence of the serious incident, the airport was under visual flight rules with wind direction and wind velocity described below:<br>09:00 wind direction 310° (wind direction variable between 270° and 010°)<br>wind velocity 13 kt,<br>maximum instantaneous wind velocity 25 kt,<br>minimum instantaneous wind velocity 03 kt<br>10:00 wind direction 310°, wind velocity 27 kt,<br>maximum instantaneous wind velocity 39 kt, |

*5 "MAC" means the mean aerodynamic chord, which is the wing chord representing aerodynamic characteristics of the wings and indicates the representative wing chord when the wing chord is not constant such as a sweptback wing, etc. 24.9% MAC indicates the position of 24.9% from the forward edge of the MAC.

*6 "M report" means Aviation Routine Weather Report and is announced only inside the airport and wind direction is reported by a magnetic bearing. Wind direction and wind velocity are mean values in the past 10 minutes. The maximum instantaneous wind velocity is indicated when instantaneous wind velocity exceeds the mean wind velocity in 10 minutes before observation by 10 kt or more and is followed by an indication of the minimum instantaneous wind velocity.

minimum instantaneous wind velocity 14 kt

(2) Wind direction and wind velocity measured every 6 seconds during the period of occurrence of the serious incident with anemoscope and anemometer installed in the vicinity of Runway 03 touchdown area (approximately 330 m inside from the threshold and approximately 105 m west-northwest of the runway centerline) are as shown in Table 1:

Table 1 Wind direction and wind velocity before and after touchdown (wind direction was true heading)

| Time | Instantaneous wind direction (°) | Instantaneous wind velocity (kt) | Crosswind component (kt) |
|---|---|---|---|
| 10:01:00 | 314 | 26 | 25 |
| 10:01:06 | 310 | 23 | 22 |
| 10:01:12 (touchdown) | 326 | 21 | 18 |
| 10:01:18 | 313 | 26 | 25 |
| 10:01:24 | 313 | 24 | 23 |

2.6 Additional Information

(1) Situation of the Serious Incident Site

Amami Airport is located along the coast of the northeastern part of Amami Oshima Island and the west to northwest of the airport is hilly land. The airport has only one runway with magnetic bearing 030.75°/210.75°, 2,000 m long and 45 m wide, and is paved with asphalt concrete up to 7.5 m outside the runway side stripe marking.

From the tire marks left on the runway during the on-site investigation, the Aircraft entered the grassy area running off the runway side stripe marking at approximately 680 m from Runway 03 threshold and halted approximately at 790 m from Runway 03 threshold.

(2) Operational Examination on the Aircraft

No abnormalities were found in the operational examination of the braking system, rudders, and nosewheel steering system on the Aircraft during the on-site investigation.

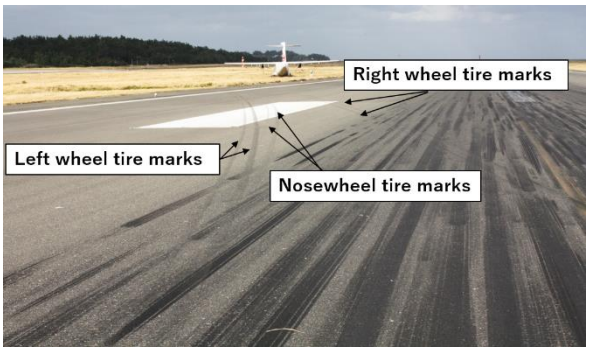
(3) Meteorological Characteristics of Amami Airport

According to Amami Aviation Weather Station of Fukuoka Local Aviation Weather Service Center, Fukuoka District Meteorological Observatory, north-northwesterly wind becomes remarkable at the time of a winter pressure pattern (high pressure in the west and low pressure in the east) in winter (December through February). In addition, when the wind from the west to the north-northwest reaches a wind velocity of 15 kt or more, a gust is prone to occur.

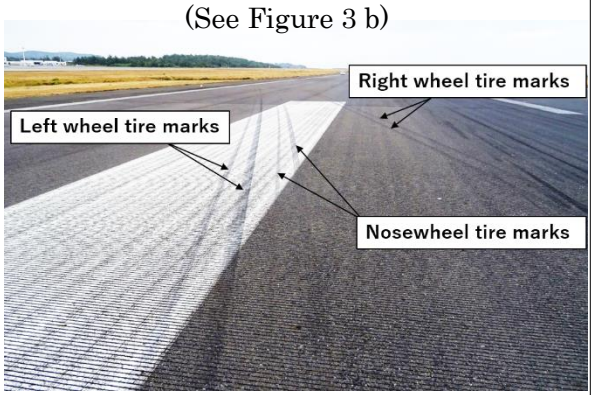
(4) Maximum Cross Wind for the Aircraft in Takeoff and Landing

AOM of the Company stipulates that the maximum crosswind in takeoff and landing on a dry runway is 30 kt, however, a temporary excess after a landing decision is allowable.

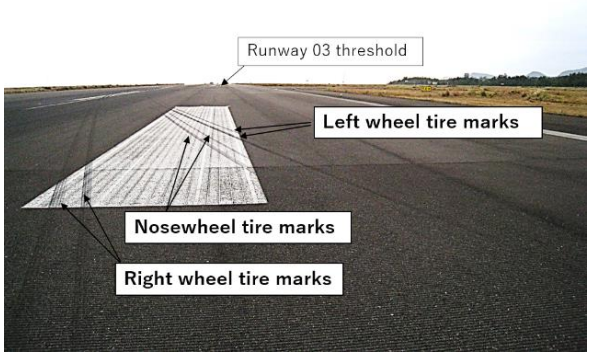
In addition, the Company uses a reported mean wind velocity when deciding whether a crosswind velocity is at or below the maximum crosswind velocity.



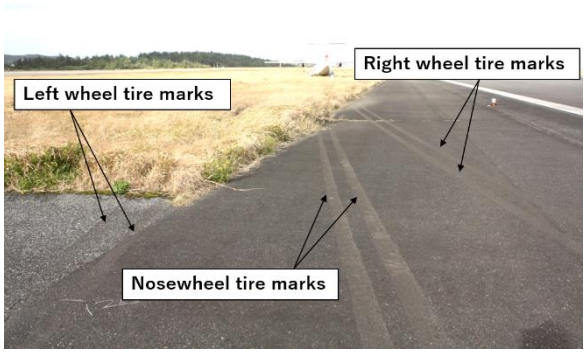

(See Figure 3 b)




(See Figure 3 c)




(See Figure 3 d)




(See Figure 3 e)

Figure 5 Tire Marks

(5) Applied Wind in Approach and Landing

The summary of the stipulation in "Chapter 2 Operation Policy, 2-3 Implementation of Operations" in Operations Manual (OM) Supplement of the Company relating to how a wind should be applied in landing approach is as follows.

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| | (a) The latest surface wind reported by ATC and others until passing 500 ft AGL shall be within the limit of wind velocity stipulated in AOM.<br>(b) After passing 500 ft AGL, the aircraft shall be under the condition where flight crew members can judge to achieve a safe landing with normal maneuvering irrespective of the notified value.<br>(6) Stabilized Approach<br>According to OM Supplement and AOM of the Company stipulate, that Stabilized Approach means an aircraft is in the position where it can land safely while conducting an approach normally until starting a flare maneuver since passing 1,000 ft AGL to eliminate any unsafe factors in an approach and a landing and to ensure a safe and stable landing.<br>Besides, OM Supplement stipulates that a PF performs appropriate planning and maneuvering and a PM performs correct and positive monitoring and challenging (such as evoking caution to PF, and others), and if Stabilized Approach is judged not to be established or requirements for Stabilized Approach are continuously not satisfied, a go-around shall be executed.<br>On the other hand, AOM stipulates that flight crew members complete the Landing Checklist before 1,000 ft AGL (500 ft AGL in case of a circling approach) and confirm Stabilized Approach at 1,000 ft AGL and its continuance at 500 ft AGL.<br>(7) Deviation call<br>AOM of the Company stipulates deviation calls for each type of approach that is carried out as standard callout*7 at 1,000 ft AGL or lower. When an approach and a landing are conducted sighting the runway as this serious incident occurrence, a PM performs deviation call if airspeed changes from the approach speed exceeding by minus 5 kt or plus 10 kt or becomes less than VREF*8, the descent rate exceeds 1,000 fpm, the bank angle exceeds 30º, or the pitch angle exceeds plus 6º at less than 100 ft AGL. Besides, AOM stipulates that descent rate and airspeed shall not continuously exceed the criteria for deviation call.<br>(8) Operations after Touchdown<br>The summary of the stipulation in "Chapter 3 Normal Operations, 3-15 LANDING" of AOM and "2-2 NORMAL PROCEDURE, 2-2-19 LANDING" of Flight Technical Guide*9 (FTG) of the Company relating to |

*7 According to AOM of the Company, "standard callout" means the callout that is necessary for every flight crew member to have correct recognition of the flight situation in Critical Phase, judge whether takeoff or landing is practicable to continue, and correctly perform maneuvering associated with the takeoff or landing.

*8 According to AOM of the Company, "VREF" means Final Approach Speed, and VmHB35 (Minimum High Bank Speed: the speed which limits the bank angle to 27° when flap 35° is in use) or VMCL (Minimum maneuvering speed in an approach and a landing, and the minimum speed at which maneuvering of the aircraft can be maintained with a critical engine inoperative and level flight can be retained with the bank angle of 5° or less when the critical engine suddenly becomes inoperative in an approach and a landing with all engines operative at that minimum speed), whichever is greater.

*9 "Flight Technical Guide" is to supplement for the AOM regarding basic procedures that the Company aims to standardize actual operations, education, and training.

the operations after touching down is as follows. (Descriptions contained only in FTG are underlined)

| PF | PM |
|---|---|
| ▶ Set power levers in ground idle position.<br><br>▶ Use reverse as required.<br>Use brakes together at 70 kt or lower and set power levers back in ground idle position before 40 kt.<br>Call, "YOU HAVE CONTROL." | ▶ Confirm that power levers can be set in ground idle.<br><br>▶ Confirm propeller pitch condition and call how such condition is.<br>("TWO LOW PITCH" for example)<br><br>Call, "I HAVE CONTROL." |

Note: CM2*10 is required to retain the control wheel promptly after touchdown to maintain the wings in a horizontal position and control direction.

| CM1*10 | CM2 |
|---|---|
| ▶ Control the direction using nosewheel steering*11.<br>▶ Apply brakes as required.<br><br>"CHECK" | ▶ Keep control wheel leaning upwind.<br><br>▶ Announce 70 kt<br>"SEVENTY". |

Besides, the normal operating procedure of Flight Crew Operating Manual (FCOM) developed by the Design and Manufacturer describes that the transfer of handling of the control wheel and control column should be done after a first officer calls "70 kt". However, in consideration that the type of aircraft is operating at airports with 1,200 m long and 30 m wide runway, the Company stipulates in AOM that the procedures developed by the Design and Manufacturer, which purpose takeoff and landing at the runway with less than 30 m in width, apply mutatis mutandis to every airport where the same type of the aircraft is operating, and CM1 can maneuver nosewheel steering simultaneously as soon as a touchdown of nosewheel after landing.

(9) Landing Distance

The distance after the Aircraft had passed through at 50 ft height above runway surface until it came to a complete stop using a normal braking system with both power levers in ground idle position was computed to be approximately 590 m based on the estimated landing weight of the

*10 "CM1" and "CM2" are the terms to identify pilots by the seats they are seated. The pilot seated in the left pilot seat is CM1 and the pilot seated in the right pilot seat is CM2.

*11 The type of the aircraft did not have function to perform nosewheel steering maneuvering on the ground by rudder pedals. CM1 performs nosewheel steering maneuvering using the nosewheel steering handle installed in the left of the left pilot seat.

Aircraft, flap position, using a normal braking system, runway conditions, and weather conditions.

(10) Crosswind Landing

a. AOM of the Company does not contain any stipulation regarding a takeoff and a landing in a crosswind, and FTG has the descriptions that are summarized as follows.

a) Because of not so large inertia, the type of aircraft is easy to react to external turbulence.

b) In crosswind landing, it is important to touch an aircraft down without a side-slip in De-Crab*12 or Wing Low*13.

c) After touchdown, CM2 needs to promptly take and maintain the control wheel into upwind to maintain the main wings level and in the direction.

d) Maintain the elevator in a nose-down direction to keep the effect of nosewheel steering during the landing roll.

b. FCOM developed by the Design and Manufacturer contains descriptions regarding a crosswind landing that are summarized as follows:

a) During the approach briefing, PF shall evaluate his/her own ability to land in reported crosswind conditions and prepare for a go-around and/or diversion.

b) The flight crew shall strictly adhere to the stabilized approach criteria.

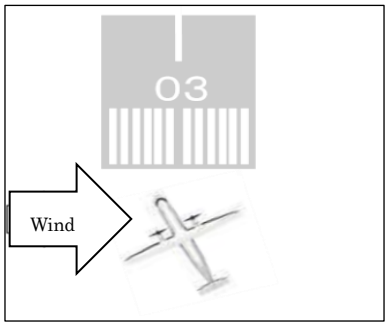

Figure 6 Crabbed Approach (Conceptual image)

c) During the final approach, the flight crew shall pay particular attention to changes in wind direction and strength and maintain a high level of cooperation.

d) It is recommended to perform a crabbed approach with the nose of the aircraft directed upwind and with wings leveled by correcting crosswind component, and thereby the aircraft flies over the final approach route (see Figure 6).

e) PF should initiate flare and de-crab maneuvering at the latest at 20 ft height.

f) During the landing roll, PF uses rudder pedals to keep the airplane on the runway axis.

g) PF holds the control column in a nose-down position to increase directional control efficiency.

h) PF maintains aileron upwind and increases aileron input proportionally to speed decrease to keep main wings leveled. In case of insufficient aileron input, crosswind gusts could lift the upwind wing,

*12 "De-Crab" means to dissolve the crabbed condition in landing following the crabbed approaching in crosswind (see 2.6 (10) b.d)).

*13 "Wing Low" means a way of approaching with the upwind wing lowered so that the aircraft cannot drift from the extended runway centerline by crosswind.

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| | reduce the aircraft ground contact force, and could make the aircraft turn into the wind (weathercock effect).<br>i) PF applies braking to minimize time exposure to the crosswind effect. Asymmetrical braking can also be used to assist lateral control as rudder efficiency decreases with airspeed.<br>j) Below 70 kt, the CM1 controls airplane alignment with nose wheel steering and CM2 maintains aileron upwind and in nose-down direction until the aircraft comes to a complete stop.<br>Besides, Flight Crew Training Manual (FCTM) developed by the Design and Manufacturer contains an article titled "BE PREPARED FOR CROSSWIND LANDING" and the Company reprints it in their FTG.<br>(11) Training<br>The captain had received landing training in 30 kt crosswind with simulators during the instructor regular training and the FO had received landing training in 35 kt crosswind as PM with simulators during the recurrent training. |

## 3. ANALYSIS

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|---|---|
| 3.1 Involvement of Weather | Yes |
| 3.2 Involvement of Pilot | Yes |
| 3.3 Involvement of Aircraft | None |
| 3.4 Analysis of Findings | (1) Weather Conditions<br>The JTSB concludes that it is certain that the weather conditions at the time of occurrence of this serious incident at Amami Airport, although it was under visual meteorological conditions, was such that a northwesterly wind accompanied by a gust was blowing.<br>(2) Decision on Approach<br>The JTSB concludes that it is highly probable that the Aircraft conducted the approach and the landing because all crosswind components of reported mean wind velocity by the RADIO from the establishment of the communication until the Aircraft was passing an altitude of 850 ft were 30 kt or less, which was the maximum crosswind limit stipulated in AOM applied in takeoff and landing.<br>(3) Flying on the Final Approach Course<br>The JTSB concludes that the approach of the Aircraft is highly probable to have been performed in turbulent air because the northwesterly wind accompanied by the gust was observed at the airport at the time of occurrence of this serious incident, and frequent changes in pitch angle, roll angle and vertical acceleration were recorded in FDR.<br>Deviation call was performed by the FO because aircraft speed changed from the target approach speed exceeding the criteria stipulated in |

AOM due to the turbulence at 1,000 ft AGL or lower. However, it is probable that the captain and the FO continued approaching because they judged that the requirements for Stabilized Approach were satisfied by the corrective maneuver by the captain.

From the FO' statement and FDR record, during the first approximately five seconds after the Aircraft had deviated from the final approach course to the left at an altitude around 300 ft until reaching an altitude around 250 ft, maneuvering of the control wheel to the right was recorded in FDR (see Figure 4 j), and roll angle to the left was continuously recorded in FDR (see Figure 4 k). It is probable that the Aircraft could not establish a stabilized approach because the flight situation during this period was continuously deviating from the final approach course. Besides, it is probable that changing the magnetic heading of approximately 25°to leeward side at an altitude around 250 ft that the Aircraft performed to correct the deviation described above has been large as correcting amount in the final approach (see Figure 4 l). In addition, since the approach was performed in turbulence at the time of this serious incident, it is probable that PF was required to conduct the approach by more appropriate planning and maneuvering not to make the extent of correction large for safe landing as described in Stabilized Approach of OM Supplement of the Company.

On the other hand, it is probable that PM was required to advise PF while the extent of deviation from the final approach course remained small and to perform accurate and positive monitor and challenge in order to ensure Stabilized Approach.

Besides, when approach and landing are performed in the situation that is close to the limits stipulated in AOM as this serious incident occurred, it is probable that such is of importance that PF conducts briefing after mature consideration of predictable situations, establishes common recognition with PM and urges PM to perform correct and positive monitor and challenge.

(4) Running Off the Side of the Runway

The JTSB concludes that the Aircraft most likely started the De-Crab maneuver at around 30 ft AGL and initiated the flare maneuver at around 20 ft AGL. It is probable that the Aircraft touched down as the captain wished since it touched down almost on the runway centerline at approximately 400 m from Runway 03 threshold at the predetermined speed although the Aircraft heading was directed slightly to the left to the runway heading.

It is probable, however, that because the right rudder pedal input was reduced for de-crab and the rudder pedals were in an almost neutral position when touching down from the left main wheel, the Aircraft changed its heading to the left because of weathercock effect. Besides, although the control wheel was deflected into the wind (left) after the touchdown, the bank to the right became a maximum of about 5° about 2 seconds after the touchdown, and the attitude continued banking to the right until 6 seconds

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| | after the touchdown, therefore, it is probable that the control wheel input against crosswinds was not sufficient, and the yawing to the left added to weathercock effect, the heading changed about 18° into the wind in about 4 seconds after the touchdown and became 011°.<br>Both the captain and FO remembered that the captain called, "YOU HAVE CONTROL," which, however, was not recorded in CVR. On the other hand, the captain's voice of, "USE THE AILERON SUFFICIENTLY TO THE LEFT," was recorded in CVR almost simultaneously with the touchdown, which the captain is likely to have called, instead of, "YOU HAVE CONTROL," intending to transfer handling of control wheel and control column to the FO. It is, however, likely that the captain's intention was not immediately and clearly understood by the FO since the FO's response to the captain's call was not recorded in CVR. Besides, it is probable that the captain, even after having called, "USE THE AILERON SUFFICIENTLY TO THE LEFT," continued nose-down input for approximately three seconds after the touchdown, and the FO added nose-down input into the control column when the captain's input into control column began to cease (see Figure 4 m).<br>From these findings, it is probable that handling the control wheel and control column was not transferred explicitly, and it created a situation where occurred that task sharing between the captain and the FO was ambiguous.<br>The captain is more likely to have attempted to control the direction with nose wheel steering after having ceased nose-down input into the control column. However, from the Aircraft's attitude that banked to the right and the tire marks shown in Figure 5, it is likely that the contact area of the nosewheel narrowed, sufficient load needed to obtain the effect of the steering was not applied to the nosewheel, and nosewheel steering did not produce sufficient effect as the captain wished.<br>Besides, although the captain attempted to change the course of the aircraft using the right brake only, it is probable that the situation was such that the Aircraft already came too close to runway side stripe marking to avoid runway excursion.<br>From what is described above, the JTSB concludes that the Aircraft most likely ran off the side of the runway, halted in the grassy area, and was disabled to move on its own because the correction for the deviation to the left immediately after the touchdown was delayed.<br>In addition, although the captain confirmed the status of the propeller pitch by himself to commence reverse operation, AOM of the Company stipulates that reverse operation commences after PM has called out the status of the propellers. The landing distance, which was calculated approximately 590 m at the time of the serious incident, had enough room against the runway length and the Aircraft deviated to the left immediately after touchdown, it is probable that the captain was required to pay much attention to the behavior of the Aircraft after the touchdown and prioritize |

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| | maneuvering to control the direction by timely rudder control and others rather than reverse operation.<br>(5) Education and Training<br>The Company did not describe points to be noted in crosswind landing in AOM but in FTG and reprinted what is described in FCTM developed by the Design and Manufacturer in the FTG. On the other hand, since the information on crosswind landing was deemed to be described as necessary information for safe flight operation of the type of the aircraft in FCOM and FCTM developed by the Design and Manufacturer, the JTSB concludes that it is probable that the Company was required to be more deliberate in verifying handling of the information provided by the Design and Manufacturer.<br>Besides, landing training in the maximum crosswind value is handled as an optional subject in the recurrent training using simulators and is not conducted every year. Because CM2 of the type of aircraft is stipulated to maneuver a control wheel into the wind and a control column in nose-down direction during a landing roll, and coordination with CM1 is of importance, it is probable that the establishment of more training opportunities for crosswind landing including training in the maximum crosswind (including the coordination between CM1 and CM2) is required after assessing the representativity of an actual aircraft of the Company's simulator. |

## 4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this serious incident was the delay in correcting the deviation to the left immediately after the touchdown at landing in a crosswind from the left, which resulted in the Aircraft running off the side of the runway, halting in the grass area and being disabled to move on its own.

## 5. SAFETY ACTIONS

The Company and the Design and Manufacturer have taken the following measures to avoid recurrence of the serious incident:

(1) The Company

(a) Revised Manuals

a. Regarding landing performed when a gust is reported, it is stipulated in OM Supplement that judgment, whether to continue approach or halt for a go-around, is made based on the guide that crosswind component of the gust is 1.5 times the maximum crosswind in addition to that the crosswind component of the mean wind velocity satisfies the maximum crosswind stipulated in AOM.

b. AOM is revised to incorporate the revisions of FCOM by the Design and Manufacturer in terms of normal procedures in landing roll.

c. "OPERATIONS IN WIND CONDITIONS" is newly incorporated in AOM that reflects what is described in FCOM.

d. Descriptions in FTG regarding takeoff and landing in crosswind are revised.

(b) Relevant Flight Crew

a. Captain

Ground school training, simulator training, and check and line flight training and check.

b. FO

Ground school training, simulator training, and line flight training and check.

(c) Other Flight Crew Member Holding Type Rating for ATR Aircraft

a. Conducting ground school training and simulator training to establish knowledge and technique of crosswind landing maneuver recommended by the Design and Manufacturer.

b. Conducting ground school training for appropriate operations of Stabilized Approach.

(2) The Design and Manufacturer

Reviewed the procedures for normal operation in landing roll to revise FCOM.

(a) Clarified that braking was a primary role in deceleration after touchdown.

(b) Clarified to set power levers to ground idle at the time of touchdown of a nosewheel and use the reverse as required.