AI2023-1

AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

OKAYAMA AIR SERVICE CO., LTD.
J A 0 1 H J

January 19, 2023

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 THE RUNWAY

OKAYAMA AIR SERVICE CO., LTD.

HONDA AIRCRAFT MODEL HA-420, JA01HJ

KOHNAN AIRPORT, OKAYAMA PREFECTURE, JAPAN

AT ABOUT 17:26, MARCH 13, 2021

December 16, 2022
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member SHIMAMURA Atsushi
Member MARUI Yuichi
Member SODA Hisako
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE AIRCRAFT SERIOUS INCIDENT INVESTIGATION

1.1 Summary of the serious incident	On Saturday, March 13, 2021, a Honda Aircraft Model HA-420, JA01HJ, operated by Okayama Air Service Co., Ltd., ran off to the left side (south side) of Runway 27 at Kohnan Airport when landing, and was unable to perform taxiing after stopping in a grassy area. There were two persons on board in total, consisting of the captain and a trainee and they were not 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 the runway (limited to when an aircraft is unable to perform taxiing)" as stipulated in Article 166-4, item (4) of the Ordinance for Enforcement of the Civil Aeronautics Act of Japan (Ministry of Transport Ordinance No. 56, 1952), and is classified as a serious incident. On March 13, 2021, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this serious incident. An accredited representative and an adviser of the United States of America, as the State of Design and Manufacture of the aircraft involved in this serious incident, participated in the investigation. Comments on the draft Final Report were invited from parties relevant to the cause of the serious incident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

Figure 1: Serious Incident Aircraft

On March 13, 2021, a Honda Aircraft Model HA-420, JA01HJ, operated by Okayama Air Service Co., Ltd., performed training to acquire the captain qualification for each type of aircraft, as stipulated in the Company's Qualification Manual (QM: the Company regulations defining the standards relating to the training and examination), with the captain in the right pilot seat as an instructor and the trainee in the left pilot seat in the cockpit.

After taking off from Kohnan Airport at about 16:13 JST (JST: UTC+9 hours; unless otherwise noted, all times are indicated in JST in this report on a 24-hour clock) and performing flight training around the airport, including six touch and go training exercises at Takamatsu Airport, the aircraft headed for Kohnan Airport. At about 17:26, after landing on Runway 27 (Runway direction: 273°) at Kohnan Airport, the aircraft ran off to the left side (south side) of the runway, stopped in a grassy area, and was unable to perform taxiing. The captain and the trainee disembarked from the aircraft by themselves, and no one was injured.

The aircraft's Central Maintenance Function (CMF: a function to record maintenance data) recorded that at 17:25:30, the WOW[*1] of the left main landing gear changed to the Ground Mode (Touchdown) following the right main landing gear. The history of the flight up until the aircraft stopped after its touchdown is summarized as follows:

(1) Records of flight data and voice in the cockpit of the Flight Recorder

Time (JST)	Flight Record	Voice Record
17:25:30 (See (a) in Figure 2)	・Heading: 274° ・Roll angle: Right 0.4° ・Ground speed: 101 kt	・Following the sound of touchdown, the captain's voice saying "Slowly" "Brake", "Brake" was recorded.
17:25:33	・Heading: 277° ・Roll angle: Left 3.5° ・Ground speed: 96 kt ・Lateral acceleration: Right 0.1 G	
17:25:35 (See (b) in Figure 2)	・Heading: 272° ・Roll angle: Right 1.4° ・Ground speed: 90 kt	

[*1] "WOW" stands for Weight On Wheel, which refers to the data indicating whether the aircraft is on the ground or in the air by signals from a sensor that works if loads are put on the nose landing gear and the main landing gear. For the aircraft, the WOW of the main landing gear is recorded in the CMF, but the WOW of the nose landing gear is not recorded.

	・Lateral acceleration: Left 0.2 G	
17:25:38 (See (c) in Figure 2)	・Heading: 283° ・Roll angle: Left 1.8° ・Ground speed: 76 kt ・Lateral acceleration: Right 0.3 G	
17:25:39 (See (d) in Figure 2)	・Heading: 282° ・Roll angle: Left 0.4° ・Ground speed: 72 kt ・Lateral acceleration: Right 0.1 G	
17:25:41 (See (e) in Figure 2)	・Heading: 258° ・Roll angle: Left 3.5° ・Ground speed: 60 kt ・Lateral acceleration: Left 0.6 G	・The voice of the captain, who sensed danger, was recorded.
17:25:44 (See (f) in Figure 2)	・Heading: 254° ・Roll angle: Left 3.5° ・Ground speed: 48 kt ・Lateral acceleration: Right 0.1 G	
17:25:52 (See (g) in Figure 2)	・Heading: 243° ・Roll angle: Left 2.1° ・Ground speed: 0 kt	・It was recorded that the captain confirmed with the trainee that the left and right brake pedals were not symmetrically applied between the time the brakes were applied and the time the aircraft ran off the side of the runway.

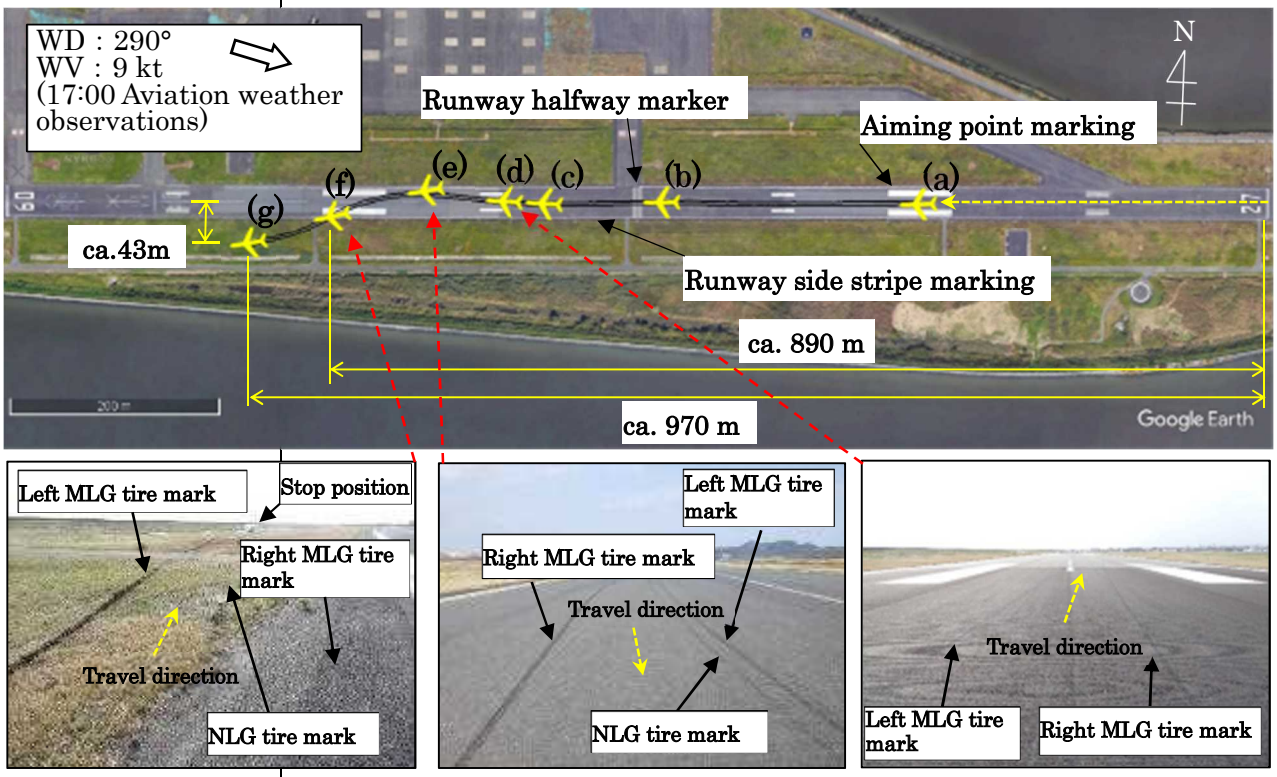

Figure 2: Estimated runway path and tire marks

(2) Statements of Captain and Trainee

The captain and the trainee felt the training conducted at Takamatsu Airport was generally well and the aircraft's approach and touchdown at Kohnan Airport were also stable.

As the travel direction of the aircraft slightly veered to the left after touchdown (see (a) in Figure 2), the trainee tried to maintain the aircraft's direction along the runway centerline while operating the rudder pedals.

The trainee started to depress the brake pedals in order to decelerate near the runway halfway marker as usual (see (b) in Figure 2) and corrected the aircraft's deviation to the left from the runway centerline by using the steering or braking, and then the aircraft's nose greatly veered to the right (see (c) in Figure 2). Therefore, the trainee depressed the left rudder pedal to correct the travel direction to the left (See (d) in Figure 2).

As the aircraft veered to the left abruptly, the captain felt the aircraft would run off to the left side (south side) of the runway and depressed the right rudder pedal (see (e) in Figure 2). The captain felt that there was a possibility that the load might not be fully placed on the nose landing gear and the main landing gear.

The captain and the trainee tried to correct the travel direction to the right by depressing the right pedal, but the aircraft entered the grassy area after passing the runway side stripe marking (see (f) and (g) in Figure 2).

The trainee tried to keep applying the left and right brake pedals symmetrically from the time when he started using the brakes until the aircraft stopped.

	The captain and the trainee did not notice anything abnormal about the behavior of the aircraft from the time when the brakes were applied near the runway halfway marker until the aircraft veered to the right. Furthermore, the captain and the trainee did not recognize any warnings notifying malfunctions in the aircraft's systems and others from the time when the aircraft touched down to the time when it stopped in the grassy area on the left side (south side) of the runway.

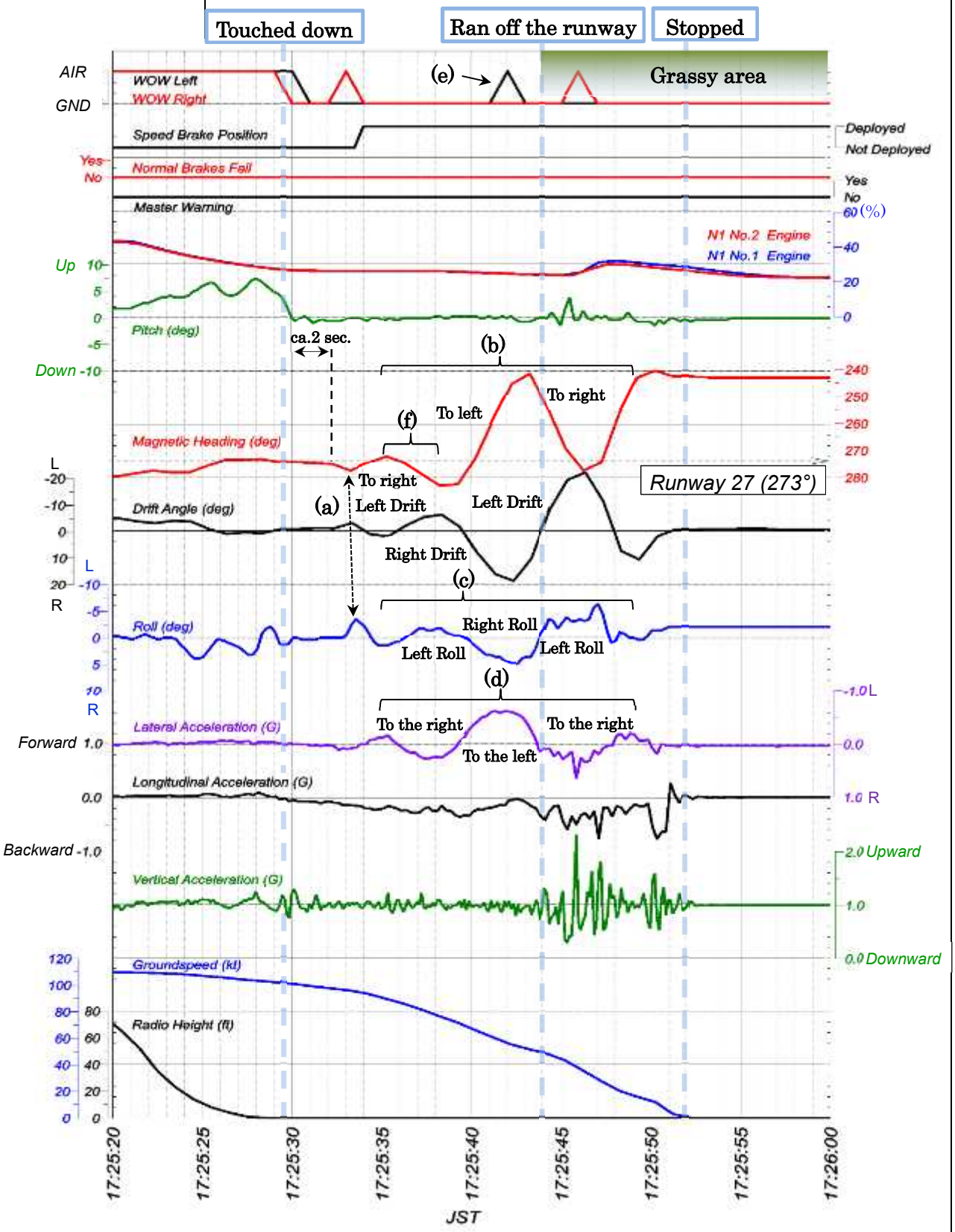

Figure 3: Records from flight recorder and CMF

This serious incident occurred at Kohnan Airport in Okayama Prefecture (aircraft stop position: 34'35"25 N, 133'55"46 E) at about 17:26 on March 13, 2021.

2.2 Injuries to Persons	None
2.3 Damage to the Aircraft	Minor damage (1) Scratch marks and paint peeling on the lower surface of the fuselage and impact marks on the nose landing gear and main landing gear wheels and others (2) Impact marks on the air intake of the engine, and the engine fan blades were partially damaged
2.4 Personnel Information	(1) Captain: Age 51 Commercial Pilot Certificate (Airplane) March 9, 2015 Type rating for HA-420 April 24, 2019 Specific Pilot Competence Expiry of practicable period for flight January 18, 2023 Class 1 Aviation Medical Certificate Validity: September 14, 2021 Total flight time 5,950 hours 31 minutes Flight time in the last 30 days 39 hours 46 minutes Flight time on the type of aircraft 70 hours 15 minutes Flight time in the last 30 days 3 hours 48 minutes (2) Trainee: Age 49 Commercial Pilot Certificate (Airplane) August 17, 1998 Type rating for HA-420 April 24, 2019 Specific Pilot Competence Expiry of practicable period for flight January 29, 2023 Class 1 Aviation Medical Certificate Validity: December 30, 2021 Total flight time 5,150 hours 3 minutes Flight time in the last 30 days 28 hours 48 minutes Flight time on the type of aircraft 78 hours 52 minutes Flight time in the last 30 days 11 hours 23 minutes
2.5 Aircraft Information	(1) Aircraft type: Honda Aircraft Model HA-420 Serial number: 42000133 Date of manufacture: November 20, 2018 Certificate of airworthiness: No. 2020-119 Validity: June 16, 2021 Category of airworthiness: Aircraft Normal N Total flight time: 248 hours 18 minutes (2) When the serious incident occurred, the aircraft's weight was estimated to have been 8,880.3 pounds and the center of gravity was estimated to have been 25.79% MAC[*2], both of which were estimated to have been within the allowable range.
2.6 Meteorological Information	Aeronautical weather observations for the airport around the time of the serious incident were as follows: 17:00 Wind direction 290°, Wind velocity 9 kt, Prevailing visibility 25 km

[*2] "MAC" is a chord representing the aerodynamic characteristics of a wing and given by a mean value if the chord is not constant as in the case of a sweptback wing. 25.79% MAC indicates a position located at 25.79% distance from the leading edge of the mean aerodynamic chord.

	Cloud: Amount 1/8 to 2/8; Type Cumulus; Cloud base 3,500 ft Amount 3/8 to 4/8; Type Cumulus; Cloud base 4,500 ft Amount 5/8 to 7/8; Type Altocumulus; Cloud base 12,000 ft Temperature 12℃, Dew point 5℃ Altimeter setting (QNH) 29.98 inHg
2.7 Additional Information	(1) Conditions at the Serious Incident Site Kohnan Airport in Okayama Prefecture has a runway with magnetic bearing 093°/273°, 1,200 m long and 30 m wide. Judging from the aircraft's tire marks, it was found that the aircraft entered the grassy area after passing the runway side stripe marking at approximately 890 m from Runway 27 threshold. Furthermore, the aircraft stopped with its heading 243° at approximately 970 m. In addition, the tire marks of the left main landing gear were left close to those of the nose landing gear from around where the aircraft veered to the right after passing near the runway halfway marker. Furthermore, close to the tire marks of the nose landing gear, there were the tire marks of the right main landing gear, which were left by the aircraft just before it ran off the side of the runway after passing the left runway side stripe marking (see Figure 2). (2) Operation Checks of the Relevant Systems The operation checks of the aircraft's brakes, rudders, nose landing gear steering and speed brakes found no faults. In addition, the data recorded by the steering computer installed in the aircraft were checked, but any system failures were not recorded. (3) Nose Landing Gear Steering The nose landing gear steering of the aircraft is hydraulically operated by the rudder pedals mounted on the floor in front of both pilots' seats. The nose landing gear steering will not respond to the rudder pedal operation for about two seconds after the WOW of the nose landing gear changes to the Ground Mode. In addition, as for the operation angle for the nose landing gear steering, the maximum operation angle is changed in correspondence with the ground speed of the aircraft. (4) Operation after Touchdown With regard to the operation after touchdown, the following description is included in Section 4: Normal Procedure Landing of the aircraft's Airplane Flight Manual. (Excerpt) *Establish directional control using rudder and then apply brakes symmetrically during the initial part of the landing rollout.* (5) Training The training conducted at the time of this serious incident was for the purpose of acquiring the captain qualification for each type of aircraft, as stipulated in the Company's QM. The trainee had already completed six hours out of the 7.5-hour flight training with actual aircraft, as stipulated in the Company's QM, before the serious incident flight. The instructor

	(hereinafter referred to as "Instructor A") in charge of this six-hour flight training was different from the captain who was on board the aircraft when the serious incident occurred. Instructor A pointed out that the trainee's directional control during the landing roll tended to be unstable. Instead of Instructor A, the captain was in charge of the training on the day of the serious incident, and would decide whether to continue the training after confirming the trainee's skills. (6) Flight Recorder In the aft section, the aircraft was equipped with a Combined Voice and Flight Data Recorder (CVFDR) that functions both as a digital flight data recorder and a cockpit voice recorder, manufactured by Universal Avionics Systems Corporation of the United States of America. This flight recorder is capable of recording flight data for about 25 hours and voice data for about two hours, both of which retained the records at the time of the serious incident. It is not required to install a digital flight data recorder and a cockpit voice recorder specified by the Civil Aeronautics Act in the aircraft, therefore, the flight recorder in the aircraft recorded only the items specified by the manufacturer.

3. ANALYSIS

3.1 Involvement of Weather	None
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	None
3.4 Analysis of Findings	(1) Systems of the Aircraft The JTSB concludes that as the captain and the trainee did not recognize any warnings notifying malfunctions in the aircraft's systems and others, and the flight recorder did not record any alarm on the system, each system of the aircraft most likely operated normally. (2) Approach and Touchdown of the Aircraft The JTSB concludes that it is highly probable that judging from the flight record on the flight recorder and the tire marks left at the time of touchdown, the aircraft was flying in stable condition until it touched down around the middle of the aiming point marking of Runway 27 and its travel direction was deflected. (3) Running off the Side of Runway Judging from the flight record on the flight recorder, approximately two seconds after the WOW of both main landing gears of the aircraft changed to the Ground Mode, the aircraft's heading changed to the right by 3° and its roll angle was at 3.5° to the left (see (a) Figure 3). At this time, the pitch angle became less than 0° and about two seconds had passed,

	therefore, the JTSB concludes that the nose landing gear steering was likely operable, and that from the above, when the nose landing gear steering was able to respond to the rudder pedal operations, the rudder pedal had been likely biased more to the right than neutral as a result of the rudder operations or one-side brake operation to correct the travel direction after landing. From approximately five seconds after the aircraft touched down, the change in heading became apparent (See (b) in Figure 3). This change was most likely caused by the operations of the trainee who corrected the aircraft's leftward deviation from the runway centerline, and subsequently corrected the travel direction, while starting to depress the brake pedals in order to decelerate near the runway halfway marker. The fact that the heading started to change to the left was likely caused by the operations of the trainee, who might abruptly switch his depressing rudder pedal from the right to the left, or might not apply the left and right brake pedals symmetrically. Furthermore, the change in heading more likely became greater than 15° per second due to repeated corrections made every time the heading changed. Furthermore, it was recorded that as the heading direction greatly changed, the aircraft was tilted (See (c) Figure 3), lateral acceleration was generated (see (d) in Figure 3), and the WOW of the left main landing gear changed to the Air Mode at about 17:25:42 (see (e) in Figure 3). In addition, judging from the tire marks of the left or right main landing gear, which were left close to those of the nose landing gear, it is probable that the aircraft's tires skidded and the steering control capability and the braking capability of the main landing gear had decreased. From the above, as the tires skidded during the landing roll and the aircraft was unable to control its travel direction, the aircraft more likely ran off the side of the runway, stopped in a grassy area, and was unable to perform taxiing. It is probable that as the aircraft was tilted and large lateral acceleration was generated due to the excessive corrections on the travel direction, the tires skidded and the travel direction could not be controlled, resulting in the reduced capability of steering control and the main landing gear braking control, and leading to the lost control of the travel direction. However, as the data regarding the input amount of brake pedals and rudder pedals were not recorded by the flight recorder, it could not be determined which operation was responsible for the direct cause. (4) Response of the Instructor The JTSB concludes that the captain was likely concentrating on assessing the trainee's operation skills as an instructor because the trainee's operations at Takamatsu Airport were stable and the training was supposed to end with the landing at Kohnan Airport. After the aircraft's heading changed to the right, about three seconds passed before it turned to the left (see (f) in Figure 3), therefore the captain should have more likely given the trainee necessary advice, or taken over the control at an early stage.

	(5) Damage to the Aircraft The JTSB concludes that the damage to the aircraft, including numerous scratch marks, was most likely caused by the impact of pebbles and other objects in the grassy area after the aircraft ran off the side of the runway.

4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this serious incident was that as the tires skidded during the landing roll and the aircraft was unable to control its travel direction, the aircraft more likely ran off the side of the runway, stopped in a grassy area, and was unable to perform taxiing.

It is probable that the tires skidded and the travel direction could not be controlled because the aircraft was tilted and large lateral acceleration was generated due to the excessive corrections on the travel direction, resulting in the reduced capability of steering control and the main landing gear braking control, and leading to the lost control of the travel direction.

5. SAFETY ACTIONS

After the occurrence of this serious incident, the Company has taken the following safety actions.

(1) They held a meeting to review this serious incident with qualified personnel (crewmembers).
(2) They provided safety training to all the crewmembers.
(3) They provided the captain with lectures and special training by pilots in charge of the training as stipulated in the QM.
(4) They newly issued the "OAS Instructors Guide" for instructors.
(5) They issued a notice from the flight operation manager to remind all the crewmembers of what to keep in mind when operating with two pilots on board.