

AA2016-5

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**PRIVATELY OWNED
J A 0 2 1 R**

June 30, 2016

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 determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Kazuhiro Nakahashi
Chairman,
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.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

DAMAGE TO AIRCRAFT DUE TO OVERRUNNING PRIVATELY OWNED CESSNA 525A, JA021R KOHANAN AIRFIELD, OKAYAMA PREFECTURE, JAPAN AROUND 15:46 JST, JUNE 10, 2015

June 10, 2016

Adopted by the Japan Transport Safety Board

Chairman	Kazuhiro Nakahashi
Member	Toru Miyashita
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Keiji Tanaka
Member	Miwa Nakanishi

1 PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	On Wednesday, June 10, 2015, a privately owned Cessna 525A, registered JA021R with only the captain onboard, took off from Tokyo International Airport to ferry the aircraft. When landing at Kohnan Airfield, it overran the runway and fell into a pond; accordingly, damaged its airframe.
1.2 Outline of the Accident Investigation	On June 10, 2015, the Japan Transport Safety Board designated an investigator-in-charge and an investigator to investigate this accident. On June 15, 2015, JTSB designated one additional investigator for this accident. An accredited representative of the United States of America, as the State of Design and Manufacture of the aircraft involved in this accident, participated in the investigation. Comments were invited from a party relevant to the cause of the accident and the relevant State.

2 FACTUAL INFORMATION

2.1 History of the Flight	<p>Based on the records obtained from the Cockpit Voice Recorder (CVR), the Enhanced Ground Proximity Warning System (EGPWS), and the radar tracking, the statement of the captain, and images captured by cameras placed at the airfield, the flight up to the time of the accident is summarized below:</p> <p>On June 10, 2015, a privately owned Cessna 525A, registered JA021R with only the captain onboard, took off from Tokyo International Airport at 14:41 Japan Standard Time (JST, UTC+9 hrs) by Instrument Flight Rules</p>
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(IFR) to ferry it for Kohnan Airfield. The aircraft changed the flight rules from IFR to Visual Flight Rules (VFR) at about 15nm short of Kibi VOR.

The aircraft passed over the vicinity of Saidaiji (the published visual reporting point, 6.7 nm northeast from the airfield) at an altitude of about 3,000 ft and a speed of about 200 kt at 15:41, and acquired information on the active runway and wind condition from Kohnan Flight Service*1. At that time, the information was the using Runway 09, wind direction 090° and wind velocity was 5kt, and the aircraft was requested to report on the left downwind leg. The captain remembered wind condition during landing as 4 kt from the south, and assessed both runway directions to be available. He thus requested to land using Runway 27, which was a shorter flight path, and was requested to report at 2 nm short of Runway 27 or on the base leg. The captain read back the requests.

Before the turning base, the captain set the approach flaps (refer to 2.7 (4)), and checked the landing gears were down and locked. The captain remembered that he set the landing flaps (refer to 2.7 (4)) at 155 kt before the turning final, and performed pre-landing checks while on the final approach. He remembered that he had completed the checks before reaching 500 ft above ground level (AGL). At 15:44:59 when the automatic voice message “Five hundred (500ft)” was recorded in the CVR, EGPWS records showed the aircraft was almost on its final approach course at 458 ft AGL, with an airspeed of 162 kt and ground speed of 165 kt.

The captain remembered that he made straight-in approach at 117 kt added 10 kt as usual above the V_{REF} displayed on the speed indicator to avoid stalling. According to EGPWS records, there was a warning “Too Low, Flaps” (refer to 2.7 (4)) at 15:45:11 when the aircraft was at 205 ft AGL, with an airspeed 155 kt and ground speed 160 kt. The CVR also recorded automatic voice warnings of “Too Low, Flaps” at 15:45:11 and 15:45:16. EGPWS records showed the aircraft gradually reduced speed on the final approach, with the last record being at 87 ft AGL with an airspeed 142 kt and ground speed 147 kt.

The main landing gears of the aircraft touched down forward of the aiming point marking, and as its nose fell, the captain found a bird (kite) on the halfway marking. After the nose wheel touched down short of the forward touchdown zone marking, the captain remembered that while he was not sure whether he was going to execute a

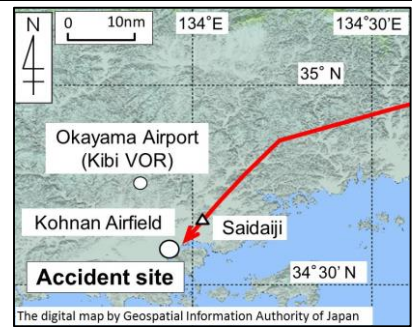


Figure 1: Estimated flight route



Photo 1: A bird on the halfway marking (Photographed on June 11, 2015)

*1 “Flight Service” refers to a radio station that is set up at places such as airfields, heliports and glider fields for communication with aircraft to provide flight advisory.

go-around, he might have advanced the throttle lever a little after setting the ground flaps (refer to 2.7 (4)). The bird flew away immediately to the left after the aircraft turned a little bit to the right to avoid the bird. The captain confirmed the throttle lever in the idle position, and then strongly applied the brakes, but he did not feel the usual deceleration. The sound of the engine rotating speed decreasing was recorded in the CVR about three seconds after the main landing gears touched down.

Continuing to apply the brakes, the aircraft avoided the stopway edge lights to the right and entered a grass area; accordingly, it went into a pond used as a regulating reservoir located west of the runway at about 20 to 30 kt. The aircraft came to a stop, and the alarms for the red warning lights lighting up started to sound.

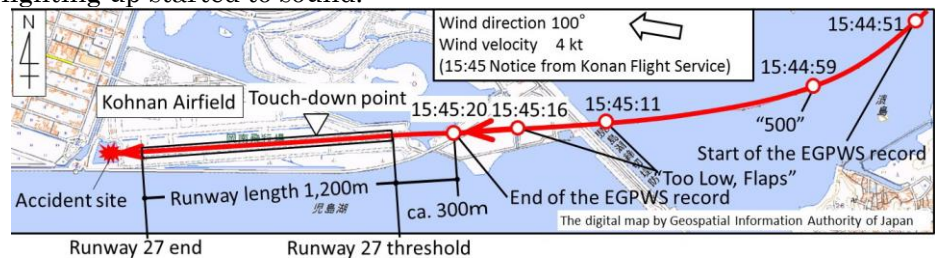


Figure 2: Estimated flight route (Detail)

The captain returned the flaps from the ground flaps to the takeoff flaps (refer to 2.7 (4)), reported the occurrence of the accident to Kohnan Flight Service, shut down the engines, cut off the power supply, detached the battery from the aircraft and left the aircraft.



Photo 2: The aircraft after the accident

The captain confirmed that no abnormalities were found in the aircraft systems including the brakes during the pre-flight check and no abnormalities were found in the aircraft systems while flying.

This accident occurred in the pond used as a regulating reservoir located west of the runway of the airfield (34°35'25"N, 133°55'31"E) at around 15:46 on June 10, 2015.

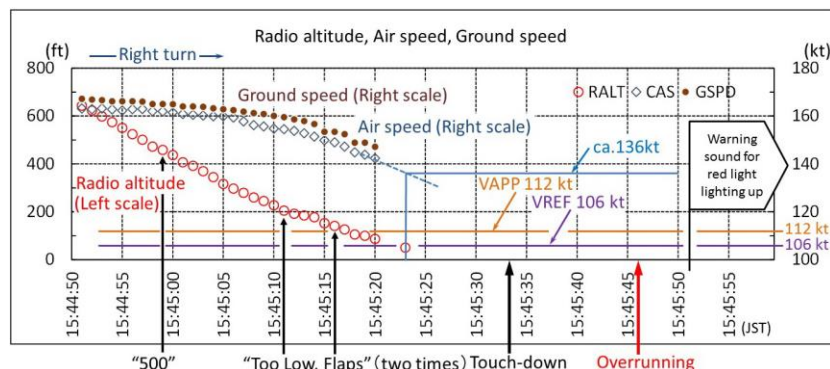


Figure 3: Records of EGPWS and CVR

2.2 Injuries to Persons	None
2.3 Damage to the Aircraft	<p>Extent of damage: Substantially damaged</p> <p>No fire outbreak</p> <ul style="list-style-type: none"> - Fuselage Forward section damaged - Left wing Leading edge damaged, Flap damaged - Right wing Flap damaged - Nose landing gear Wheel detached
2.4 Personnel Information	<p>Captain Male, Age 54</p> <p>Commercial pilot certificate (Airplane) October 31, 2006</p> <p>Type rating for Cessna 500 November 12, 2007</p> <p>Instrument Flight Certificate (Airplane) June 24, 1993</p> <p>Class 1 Aviation Medical Certificate</p> <p>Validity: August 20, 2015</p> <p>Specific pilot competence</p> <p>Expiry of practicable period for flight: March 28, 2016</p> <p>Total flight time 7,211 hr 11 min</p> <p>Total flight time on the type of aircraft 1,261 hr 21 min</p>
2.5 Aircraft Information	<p>(1) Type of aircraft: Cessna 525A</p> <p>Serial number 525A-0380</p> <p>Date of manufacture December 14, 2007</p> <p>Category of airworthiness Airplane Normal N</p> <p>Total flight time 756 hr 20 min</p> <p>(2) Weight and balance</p> <p>When the accident occurred, the weight of the aircraft was estimated to have been 10,390 lb and the center of gravity (CG) was estimated to have been 282.97 in, it is highly probable that both of which were estimated to have been within the allowable range (maximum landing weight of 11,525 lb and CG range of 276.40 to 283.73 in corresponding to the weight at the time of the accident).</p>
2.6 Meteorological Information	<p>The wind conditions noticed from Kohnan Flight Service at 15:45 was 100° and 4 kt.</p> <p>Special aeronautical weather observations recorded at the Kohnan Airfield Administration Office around the time of the accident were as follows.</p> <p>15:53 Wind direction 110°; Wind velocity 5 kt; Prevailing visibility 30 km; Cloud: Amount 1/8 to 2/8; Type: Cumulus; Cloud base: 3,000 ft Amount 5/8 to 7/8; Type: Unknown; Cloud base: Unknown Temperature: 26°C; Dew point: 19°C; Altimeter setting (QNH) 29.77 inHg</p>
2.7 Additional Information	<p>(1) Scene of the accident</p> <p>This airfield is the field elevation of 0 feet, and its Runway 09/27 is 20m in width at 1,200m in length, with almost no inclination forward of the aiming point marking on Runway 27. A grooving (ditch for drainage purposes) is given to the entire surface of the runway. There is a stopway</p>

of 60 m, and another 60 m of grass area followed by the end of Runway 27. Moreover, there is a pond used as a regulating reservoir, running 90 m to 130 m from east to west, and about 110 m from north to south. The depth of the pond is adjustable, and the depth at the time of the accident was about 0.8 m.

According to the statement of the captain, the main landing gear of the aircraft touched down at about 30 m forward of the aiming point marking (about – 810 m from the end of the runway), and the nose wheel touched down at about 10 m short of the forward touchdown zone marking (about – 760 m from the end of the runway). He turned right to avoid a bird at about 80 m before the halfway marking (about – 680 m from the end of the runway).

Brake marks of both main landing gears were found on the runway at about – 480 m from the end of the runway. The brake marks started as short dashed lines, indicating the antiskid system was in operation. The brake marks turned slightly to the right at – 210 m from the end of the runway, and passed into the end of the stopway.

In the grass area, the trace of nose landing gear was almost wheel width detruing, blowing down the grass, ran down straight towards the pond from the stopway. There were traces of the both main landing gears which cut the ground to the width of the wheel and ran down straight towards the pond.



Photo 3: Trace of the nose landing gear



Photo 4: Trace of the right main landing gear

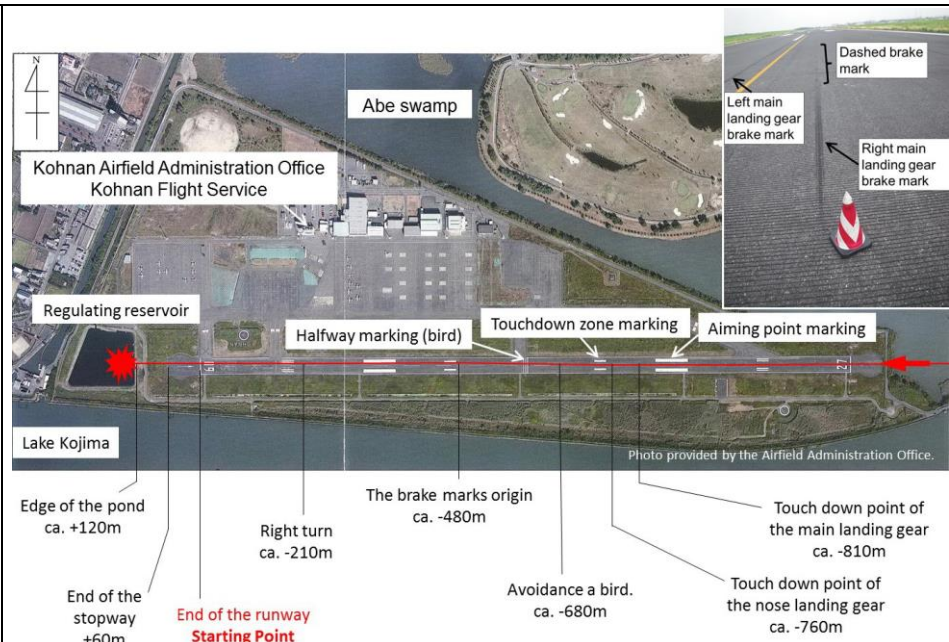


Figure 4: Estimated landing path and brake marks

(2) Detailed Damage Description

Regarding the nose landing gear, the fork was broken and the wheel was detached from it.

The airframe was flooded up to the floor level in the cockpit. Regarding the damage to the forward section of the airframe, the bottoms of the radome and nose compartment had collapsed, and electronic equipment were submerged. There was a dent with a vertical length of 2.3 cm and a width of 3.9 cm on the leading edge of the left wing.

The left wing flap was in the ground flaps position and the right wing flap was in the takeoff and approach flaps position, while speed brakes were retracted. Both flaps had wrinkles on their surfaces and its inboard two hinges out of three of each flap were broken and the circumferences of the bracket on the inside of flaps were fractured. There were up thrust dent by the connector on the oil hydraulic system and fracture at the connector part of an extension side on its system.

(3) Estimated aircraft speed based on surveillance cameras at the airfield

Figure 5 shows the ground speed of the aircraft, estimated based on images captured by four surveillance cameras at the airfield during its landing.

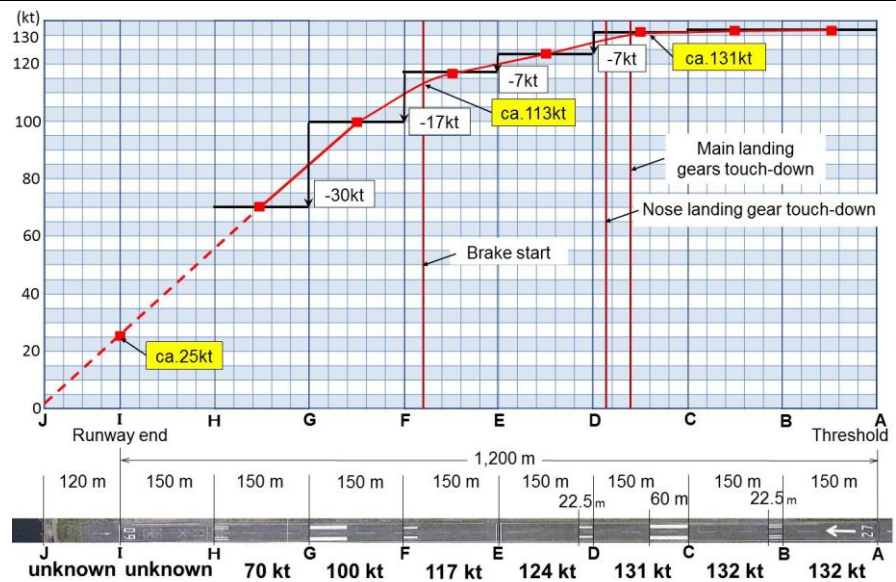


Figure 5: The ground speed of the aircraft

(4) Descriptions in the Flight Manual

The flight manual of the aircraft provides the following (excerpts).

① **SECTION III – OPERATING PROCEDURES - NORMAL PROCEDURES**

BEFORE LANDING

1. Landing Gear ----- DOWN and LOCKED
2. Flaps ----- LAND
3. Pressurization ----- CHECK ZERO DIFFERENTIAL
4. Autopilot and Yaw Damper ----- OFF
5. Airspeed ----- V_{REF}
6. Speed brakes ----- RETRACTED PRIOR TO 50 FEET AGL

LANDING

1. Throttles ----- IDLE
2. Brakes (after nose wheel touchdown) ----- APPLY (omit)

< NOTE >

- To obtain maximum braking performance from the antiskid system, the pilot must apply continuous maximum effort (no modulation) to the brake pedals.

(omit)

3. Flaps ----- GROUND FLAPS

FLAP / GROUND FLAPS 60° / SPEED BRAKES

The flaps can be selected to the UP (0°), TAKEOFF AND APPROACH (15°), LAND (35°) and GROUND FLAPS (60°) positions using the flap select handle. A slight downward pressure is required to move the handle beyond the TAKEOFF AND APPROACH gate to the landing position. The handle must be lifted at the landing gate before it can be moved aft to the GROUND FLAPS (60°) position.

The GROUND FLAPS (60°) flap position provides increased

aerodynamic drag for landing rollout. After touchdown, with both throttles at idle, the flaps may be selected to *GROUND FLAPS* (60°). The flap handle must be moved to the full aft stop. As the flaps pass 38° , the speed brakes will automatically extend.

(omitted below)

② *SECTION IV - PERFORMANCE - GENERAL*

LANDING

a. Landing preceded by a steady three degree angle approach down to the 50-foot height point with airspeed at V_{REF} in the landing configuration.

b. Two engine thrust setting during approach was selected to maintain the three degree approach angle at V_{REF} .

c. Idle thrust was established at the 50-foot height point and throttles remained in that setting until the airplane had stopped.

d. Rotation to a landing attitude was accomplished at a normal rate.

e. Maximum wheel braking was initiated immediately on nose wheel contact and continued throughout the landing roll. Ground flaps were selected immediately after brake application.

(omitted below)

DEFINITIONS

Indicated Airspeed (KIAS): Airspeed indicator readings (knots). Zero instrument error is assumed.

V_{REF} : The airspeed equal to the landing 50-foot point speed ($1.3 V_{SO}$) with the landing flap position and landing gear extended.

V_{SO} : The stalling speed, or the minimum steady flight speed in the landing configuration.

③ *EGPWS warning*

As the procedure for the sound alert message, “TOO LOW, FLAPS”, it is described below.

“Immediately level off, initiate a climb or extend flaps, as required. (This is message indicates the airplane has descended below approximately 245 feet AGL, airspeed is below 160 KIAS and flaps are not in the 35° position.)”

Besides, there is a description with ““TOO LOW, FLAPS” repeated twice” in the voice warning, caution and advisory.

(5) Landing performance

V_{APP} , V_{REF} , and the landing distance, when the accident occurred, derived from the performance table of the flight manual based on weight of the aircraft, weather (tail wind or head wind 5 kt) and altitude (0ft) were as below.

V_{APP} : 112 kt, V_{REF} : 106 kt

Landing distance: 945 m (tail wind), 837 m (head wind)

A description of “ACTUAL DISTANCE” is in the performance

	<p>table, and the precondition is as below.</p> <p><i>LANDING GEAR</i> ----- <i>DOWN</i></p> <p><i>THRUST</i> ----- <i>IDLE AT 50 FEET</i></p> <p><i>AIRSPEED</i> ----- <i>V_{REF} AT 50 FEET</i></p> <p><i>ANTI-ICE</i> ----- <i>ON OR OFF</i></p> <p><i>GROUND FLAPS</i> ----- <i>AFTER TOUCHDOWN</i></p> <p><i>BRAKES:</i> As described above ((4)②) “<i>Maximum wheel braking was initiated immediately on nose wheel contact and continued throughout the landing roll.</i>”</p> <p>(6) Information on measures against bird strikes</p> <p>The airfield is located between Abe Swamp and Lake Kojima where many wild birds live. Kohnan Airfield Administration Office has set up a device which generates annoying sounds at constant intervals, as well as a device for chasing away birds by generating explosive sounds remotely controlled from the Kohnan Flight Service communication desk. If the birds are not fled by these devices, staff will be dispatched to chase away them. In addition, at the communication desk, a staff confirm no birds on the runway and the path of departure or approach with binoculars prior to aircraft takeoff and landing.</p> <p>At the time of the accident, three staff members were confirming the birds with binoculars due to the landing of a high speed business jet; however, they could not find any birds on the runway prior to the its landing.</p>
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3 ANALYSIS

3.1 Involvement of Weather	No
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	No
3.4 Analysis of Findings	<p>(1) Brake system</p> <p>Based on the brake marks and other signs left on the runway and the grass area, it is highly probable that the brakes of the aircraft was operating normally.</p> <p>After the accident occurred, the left wing flap was in the ground flaps position, while the right wing flap was in the takeoff and approach flaps position. Both flaps had sustained damage, and connector part of an extension side on the oil hydraulic system was fractured. Additionally, the captain stated he had set the flaps into the ground flaps position after the nose wheel touched down, and he returned them into the takeoff flaps position after the accident. Judging from these findings, it is probable that both flaps were in the ground flaps position after the aircraft touched down, and were damaged by the impact from falling into the pond, and when the captain attempted to return the flaps into the takeoff flaps</p>

position, the right wing flap responded, but the left wing flap did not return due to more severe damage.

Although the captain stated he might have advanced the throttle lever a little after landing, according to the CVR records, it is probable that the engines of the aircraft rotating speed decreased to ground idling speed right after landing.

(2) Approach of the aircraft

The captain remembered that he selected land flaps at 155 kt before entering final approach course, performed pre-landing checks while on the final approach, and completed the checks by 500 feet AGL. However, according to the CVR and EGPWS records, when an automatic voice message "Five Hundred" was recorded, the aircraft was almost on its final approach course at 458 feet AGL, with an airspeed 162 kt and a ground speed 165 kt. In addition, the first warning of "Too Low, Flaps" issued at 205 feet AGL, when airspeed was 155 kt and ground speed was 160 kt. From this finding, it is highly probable that the captain did not complete the pre-landing checks until 205 ft AGL, and selected the land flaps after that.

If the deceleration rate of airspeed is extrapolated as shown in Figure 3, it is highly probable that the airspeed of the aircraft at 50 feet AGL was about 136 kt. Therefore, it is highly probable that the aircraft exceeded about 30 kt from the V_{REF} derived from the performance table of the flight manual described in 2.7(5), and actual landing distance exceeded the landing distance obtained in it by a substantial distance.

It is necessary to recognize that actual landing distance is longer than that derived from the performance table when actual speed exceeds V_{REF} ; in case of the landing on a short runway, it is necessary to maintain the required approach speed, and make a judgment a go-around when speed maintaining is difficult.

(3) After the aircraft landing

It is probable that the aircraft touched down at about 131 kt as shown in Figure 5. The NORMAL PROCEDURES in the flight manual provides to first apply the brakes after the nose wheel touches down, and then set the ground flaps. It is highly probable that although the captain set the ground flaps after the nose wheel touched down, he noticed a bird and was forced to its correspondence; accordingly, he started to apply the brakes after about 280 m landing roll after the nose wheel touched down. At that time, it is probable that the distance to the runway end was about 480 m and the speed was about 113 kt. It is probable that the deceleration rate were to be about 7 kt per 150 m after touching down to starting the brakes and about 30 kt after applying the brakes. It is somewhat likely that the speed of the aircraft is to be about 25kt when it passed the end of the runway. As described in (2), the aircraft had substantially exceeded V_{REF} at 50 feet AGL, it is somewhat likely that the aircraft would overrun at this point; besides, it is highly probable that the delay in applying the

brakes made the situation even more serious.

Regarding the delay of applying the brakes of the aircraft, it is somewhat likely that it contribute that he noticed a bird and was forced to its correspondence.

(4) Overrunning

As described in 2.7(5), the aircraft had 945 m landing distance in 5 kt tail wind on the landing performance and was able to land in this airfield which has a runway length of 1,200m, with the allowance of 255m. It is highly probable that the aircraft overran and fell into the pond because it had deviated from the pre-requisites for the performance table in the following points.

- ① The approach speed exceeded V_{REF} by about 30 kt.
- ② The start of the applying of the brakes delayed about 280m.

(5) Choice of the landing runway

When landing at the airfield, the aircraft passed over the vicinity of Saidaiji of the published visual reporting point 6.7 nm northeast of it at altitude about 3,000 ft with speed about 200 kt. It is highly probable that the captain decided to land on the Runway 27 which flight path came to have a short after obtained information on the active runway and the wind. The captain remembered that wind was 4 kt from south; on the contrary, obtained wind information was 5 kt tail wind from 090°. Therefore, it is somewhat likely that he misunderstood the situation as a crosswind.

It is highly probable that if the aircraft had used Runway 09, the approach route would be longer and the captain could have margin of time to descend, decelerate and conduct the pre-landing checks. In addition, it is highly probable that the landing distance was 837m shorter by 108m compared with using Runway 27. Moreover, it is highly probable that the speed after touchdown would also be slower, giving the captain a wider margin to deal with any contingencies.

Regarding excessive speed of the aircraft at the landing, it is somewhat likely that the captain misunderstood of the wind information, landed on the runway in tail wind conditions with priority to early landing and lost time margin for the proper management of altitude and speed. Compared with an aircraft operated by a pair of pilots, it is preferable for single-pilot aircraft that pilot should give priority to having sufficient margin for safety landing, as a single person is controlling the aircraft, monitoring the instruments, and performing lookout. In this case, it is highly probable that the captain should have understood the wind conditions correctly, and deliberately decided reasonable plan and runway choice by considering flight path to landing.

4 PROBABLE CAUSES

In this accident, it is highly probable that the aircraft overran the runway, fell into the pond and sustained damage due to the excessive speed during landing and the delay in applying the brakes.

Regarding the excessive speed of the aircraft at the landing and the delay of applying its brakes, it is somewhat likely that it contribute that the captain misunderstood the wind information, chose to land on the runway in tail wind condition and lost time margin; besides, he noticed a bird and was forced to its correspondence.