AA2014-6

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

PRIVATELY OWNED

J A 3 8 1 4

October 30, 2014

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 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.

Norihiro Goto
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

PRIVATELY OWNED CESSNA 172N RAM, JA3814
CONTACT WITH GROUND WORKER FOLLOWING DEVIATION FROM RUNWAY AT OTONE AIRFIELD, KAWACHI TOWN, INASHIKI-GUN, IBARAKI PREFECTURE, JAPAN AT ABOUT 15:55 JST, AUGUST 18, 2012

October 10, 2014
Adopted by the Japan Transport Safety Board
(Aircraft Sub-committee)

Chairman Norihiro Goto
Member Shinsuke Endoh
Member Toshiyuki Ishikawa
Member Sadao Tamura
Member Yuki Shuto
Member Keiji Tanaka

SYNOPSIS

<Summary of the Accident>

On Saturday, August 18, 2012, at around 15:35, a privately owned Cessna 172N Ram, registered JA3814, took off from the Otone Airfield for a familiarization flight. At around 15:55 during a touch and go attempt back at the airfield, the aircraft bounced on the first touchdown and after the ensuing landing the aircraft ran obliquely resulted in running off the runway.[*1] The aircraft became airborne again and struck one of the workers mowing grass on the south side of the runway. The worker suffered fatal injuries.

On board the aircraft were the Captain and three passengers, none of whom was injured.

The aircraft sustained substantial damage, but there was no outbreak of fire.

<Probable Causes>

It is highly probable that in this accident, the aircraft veered off the runway at the Otone Airfield during a touch and go attempt, striking a worker who was mowing grass.

With regard to deviation of the aircraft from the runway, it is highly probable that it was because the Captain moved the throttle lever to full open for takeoff concurrently with operating the left rudder to correct the direction of the landing roll, and that the Captain's maneuver was caused the aircraft to abruptly swerve to the left, which is the characteristic of the single-engine propeller airplane with a propeller rotating clockwise, and that the Captain could not take appropriate corrective actions.

With regarding to the Captain's failure to correct the deflection of the aircraft, it is somewhat likely that the Captain was upset by the bouncing and other factors after the ensuing landing. In addition, it is somewhat likely that the Captain did not have well-established capability to successfully handle in such the situations as something unexpected happened to him or something made the Captain temporally and psychologically pressed.

Moreover, it is somewhat likely that the weight and the location of the center of gravity, which were both beyond the operating limitations, had an adverse effect on the characteristic and maneuverability of the aircraft.

Unit conversions :

1 kt:	0.514 m/s (1.852 km/h)
1 ft:	0.305 m
1 lb:	0.454 kg
1 in:	2.54 cm
1 qt:	0.946 l
1 gal:	3.785 l
1 bar:	29.92 inHg (1013 hPa)

Table of Contents

1. PROCESS AND PROGRESS OF AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On Saturday, August 18, 2012, at around 15:35, a privately owned Cessna 172N Ram, registered JA3814, took off from the Otone Airfield for a familiarization flight. At around 15:55 during a touch and go attempt back at the airfield, the aircraft bounced on the first touchdown and after the ensuing landing, the aircraft ran obliquely resulted in running off the runway.*1 The aircraft became airborne and struck one of the workers mowing the grass on the south side of the runway. The worker suffered fatal injuries.

On board the aircraft were the Captain and three passengers, none of whom was injured.

The aircraft sustained substantial damage, but there was no outbreak of fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On August 18, 2012, the Japan Transport Safety Board designated an investigator-in-charge and another investigator to investigate this accident.

1.2.2 Representatives of the Relevant State

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.

1.2.3 Implementation of the Investigation

August 18, 2012	Interviews
August 19, 2012	On-site investigation and interviews
August 20, 2012	Aircraft examination and on-site investigation
August 28, 2012	Examination of flight data, etc., on-site investigation and aircraft examination
September 14, 2012	On-site investigation
March 26, 2013	Examination of documents

1.2.4 Comments from the Parties Relevant to the Cause of the Accident

Comments were invited from parties relevant to the cause of this accident.

1.2.5 Comments from the Relevant State

Comments on the draft report were invited from the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

On August 18 (Saturday), 2012 at around 15:35, a privately owned Cessna 172N Ram (hereafter referred to as "the Aircraft"), registered JA3814, took off from the Otone Airfield (hereafter referred to as "Otone Field") for a familiarization flight. At around 15:55 during a touch and go

*1: In this report, "runway" refers to the "landing field" in a permitted place for takeoff/landing. As for "landing field", see footnote*9 in 2.10.8.

attempt back at the airfield, the Aircraft bounced on the first touchdown, then after the ensuing landing, the Aircraft ran obliquely resulted in running off the runway. The Aircraft became airborne again and struck one of the workers (hereafter referred to as "Worker A") mowing the grass on the south side of the runway.

There were four persons on board the Aircraft: the Captain in the left front seat, Passenger A in the right front seat, Passenger B in the left rear seat and Passenger C in the right rear seat. The history of the flight from takeoff up to the time of the accident is summarized below, based on the statements of the Captain and the three passengers, the manager of Otone Field (hereafter referred to as "Manager A") who had been observing the Aircraft, a pilot who was at the clubhouse (hereafter referred to as "Club Member A"), an employee of an event planning company (hereafter referred to as "Operation Supervisor") who was discussing the preparation and arrangement of their work as a person in charge with Manager A, the site leader of the grass mowing operation (hereafter referred to as "Site Leader"), and a worker (hereafter referred to as "Worker B") who was collecting the mowed grass.

2.1.1 Statements of the Captain and Passengers

(1) Captain

The Captain had planned to execute a familiarization flight with Passenger A and Passenger B, each of them had more flight experience as a pilot than the Captain did, and Passenger C who was a pilot trainee. He started preparing for the flight without visiting Manager A. After checking the maintenance service records and the fuel and oil levels of the Aircraft, he carried out general inspections of the Aircraft in a usual manner. As the Aircraft would not be carrying a heavy load, he did not check the weight and the location of center of gravity of the Aircraft.

The Aircraft left the apron, rolled down the runway and took off from Runway 25 at around 15:35. After completing some turning exercises that lasted about 10 minutes, the Captain decided to return to Otone Field to practice a touch and go. The Aircraft entered the traffic pattern*2 for Runway 25 at around 15:55. The Aircraft itself exhibited no problem from takeoff through final approach, while Captain had competently controlled the Aircraft. The Captain maintained the speed of 60 kt on the final approach, though, the Captain's belated flare*3 led to a near three-point landing,*4 which caused the Aircraft bouncing up. Then after the ensuing landing, the Aircraft veered off the runway centerline toward the right. The Captain thought that he could still continue executing touch and go though the Aircraft did not align with the runway centerline and he moved the throttle lever to full open. The Aircraft then quickly swerved to the left and veered off the runway.

Once veered off the runway, the Captain did not have a clear recollection of how he operated the Aircraft or what movements and attitudes the Aircraft took before it came back onto the runway. He did remember, however, that he operated the right rudder

*2: A "traffic pattern" is a route, flown to achieve the standardized takeoff and landing from/to the runway.
*3: In a "flare," the aircraft pitches up to reduce the rate of descent for landing.
*4: In a "three-point landing," the front wheel and the main wheels touch down simultaneously for landing. Normally, the aircraft pitches up in a flare before landing so that the main wheels touch down before the front wheel does.

pedal in an attempt to bring the Aircraft back onto the runway. He did not notice that the Aircraft had struck Worker A.

When the Aircraft was back on the runway the Captain heard the words of "No more power needed," moved the throttle lever to idle and halted the Aircraft. He then moved the Aircraft to the apron and stopped the engine. As he got off the Aircraft, he was told by those involved in the grass mowing operation that the Aircraft had struck Worker A. He then ran to Worker A, who was lying down on the grass.

(2) Passenger A

Passenger A, who has a private pilot certificate, was at Otone Field on the day of the accident because Passenger A was offered to go there to fly together by Passenger B who is one of his friends.

Passenger A, who had never met the Captain before, was going to take a rear seat on the Aircraft for the Captain's flight. However, Passenger A was requested to take the right front seat and provide the Captain with advice on flying skill by Passenger B. Since the Captain was older and had more flight experience at Otone Field, Passenger A thought he would not say anything to the Captain during his flight as long as he was not asked something specific by the Captain. Since Passenger A was not supposed to instruct the operations to the Captain, there had been no preliminary arrangement such as takeover for controlling the aircraft.

Prior to departure, the Captain appeared highly concentrated, briskly going through procedures including the preflight checklist. As the Aircraft rolled down the runway after leaving the apron, Passenger A noticed workers mowing the grass on the side of the runway, but as there were enough distance from the runway, he did not feel dangerous. From takeoff through landing, Passenger A did not develop any feeling of discomfort in general. The Captain appeared confident of flying; therefore, Passenger A did not feel risky about the Captain's operation at all.

Passenger A thought that the Captain flew adequately in the traffic pattern and he was watching carefully the final approach speed so that the Aircraft might not lose its speed less than 60kt. The Captain was flying properly in that respect. Upon just before touchdown, Passenger A told the Captain that the Aircraft had not been well enough flared. The Aircraft then bounced up, and after the ensuing landing, began swerving to the right. As the Aircraft was going to run off the right edge of the runway, Passenger A told the Captain to bring the Aircraft into alignment with the runway centerline. Shortly afterwards the Aircraft suddenly began swerving to the left and crossed the runway centerline and veered off the runway onto the grass area.

Passenger A, whose front view was blocked because of high pitch angle of the Aircraft, thought that the Aircraft was rolling to the left when it entered the grass area and that it then rolled deeply to the right. From around that time on, Passenger A did not have a clear recollection of what attitudes the Aircraft might have taken, but felt that the Aircraft might turn upside down as it skidded sideways while its nose kept violently shaking up and down.

Upon returning on the runway, as the throttle was still in advanced position, Passenger A remembered saying to the Captain that they did not need power any more.

Since Passenger A noticed a big thump and blow while shaking, he thought that the Aircraft struck something but he did not realize the event of collision with Worker A working in the grass area.

Throughout the Captain's flight, Passenger A did not touch the rudder pedals or the control yoke at all.

(3) Passenger B

Passenger B is a member of the flight club (hereafter referred to as "the Club") to which the Captain also belongs, and had flown with the Captain a number of times. Knowing that the Captain had been seeking to improve his flying skill, Passenger B asked Passenger A, who was just boarding the Aircraft, to take the right front seat and offer advices from the another pilot's view. They let Passenger C, who is also a member of the Club and happened to be there near the Aircraft, take the right rear seat.

After takeoff, the Captain continued operating the Aircraft in a controlled manner. Upon touchdown, the Aircraft bounced up and veered off the runway centerline to the right. The Aircraft then swerved to the left and veered off the runway. Subsequently the Aircraft rolled to the left and shook violently which made the Passenger B whirl around. After the Aircraft returned onto the runway, Passenger B suggested that the Captain should let the Aircraft proceed to the apron since Passenger B thought that an aircraft had better not stay on the runway.

Passenger B did not notice that the Aircraft struck Worker A, who was in the grass area. Back on the apron, Passenger B heard people nearby talking about an injured worker and the need for an ambulance. Passenger B then called an ambulance.

(4) Passenger C

Passenger C, who sat in the right rear seat, did not feel that the Captain made a hard landing. The Aircraft bounced up and, on the next touchdown, veered to the right. Just when Passenger C was afraid that the course should be corrected to the left, the Aircraft swerved to the left and Passenger C was forced to be swung fiercely around.

Passenger C struggled to stay on both arms and legs extended, pressed hard against the seat and faced downwards. Therefore, Passenger C did not notice that the Aircraft veered off the runway into the grass area or that it struck Worker A.

2.1.2 Statements of Manager A, Club Member A and Grass Mowing Staff

(1) Manager A

Administrator of Otone Field is the Japan Flying Association, one of general incorporated associations. The Japan Motor Glider Club (hereafter referred to as "JMGC"), which is operating at Otone Field as their base field, has effectively managed on a daily basis at the request of the association. Manager A, an active pilot, has been the flight operations leader at JMGC at Otone Field for 12 years.

The grass mowing, had been underway at the time of the accident, was a preliminary work for the event at Otone Field exclusively reserved and organized by the event planning company. Manager A, who started arranging the grass mowing work with the Operation Supervisor several months earlier, had explained to the supervisor

that working near the runway would not be permitted while the aircraft conducting takeoff and landing.

The grass mowing work had been planned for three days as the preparation work for the event. Prior to the grass mowing work on the first day, Manager A had a meeting with Operation Supervisor and Site Leader at the site, and he explained about the establishment of the restricted area and operational precautions.*5

This accident happened on the third day, the last day of the event preparations.

Manager A normally stays at the clubhouse while conducting daily duties. At the time of the accident, however, Manager A was outside near the clubhouse, checking the finished tasks of the day with Japan Self-Defense Forces staff members. During the checking, Manager A heard a crashing sound. Manager A looked toward the sound and saw the Aircraft raising a plume of dust in the grass area and then skidding sideways. Then the Aircraft returned onto the runway and proceeded to the apron. A crowd had gathered in the grass area south of the runway where Worker A lay down on the grass. Manager A immediately asked Club Member A to call an ambulance.

Self-Defense Forces staff members gave Worker A the emergency medical treatment on the spot.

(2) Club Member A

Before the accident occurred, around 15:35 when Club Member A, a member of JMGC, had just finished his flight on other aircraft and landed on Runway 25, there was no turbulence on the final approach path and the wind direction was around 180° and its velocity was around 4 kt.

Club Member A was resting in the clubhouse in Otone Field when the accident occurred. When a club member together with Club Member A yelled out "Oh, no," Club Member A looked toward the runway and saw the Aircraft veering off the runway and coming toward the clubhouse. The Aircraft was flying about 4 ft high from the ground with extreme high pitch and rolled to the left. The power of the Aircraft sounded fine but the Aircraft appeared too slow and unstable to fly. Subsequently, the Aircraft pitched down and rolled to the deep right and then, when the Aircraft turned to fly parallel with Runway 25, the tip of the right wing appeared to contact the ground. The Aircraft momentarily hid behind the event stage that had been built on the side of the apron. When Club Member A caught the Aircraft in view again, the leading edge of the right wing had a dent. The Aircraft, heading north, skidded westward in parallel with Runway 25. Soon afterwards the left main gear touched down, and then the tire sidewall contacted and dragged the ground, rutting in the grass field. At the same time, the Aircraft kept bouncing with the nose moving up and down. The Aircraft then went back onto the runway and halted there when the power reduced. Afterwards, the Aircraft moved to the apron.

Upon dashing out the clubhouse, Club Member A was asked by Manager A to call an ambulance and immediately followed.

*5: The "operational precautions" include advising the workers to pay constant attention to aircraft activities and never face away from aircraft during grass mowing work, as described later in 2.10.10 (2).

(3) Operation Supervisor

Operation Manager had been in touch with Manager A for a couple of months to discuss the preparations for the event at Otone Field. Operation Supervisor was the coordinator for the event workers.

On the first day of the grass mowing operation, Operation Supervisor, Site Leader and Manager A had a meeting at the site, at which time the manager explained about the establishment of the restricted area, operational precautions and other relevant matters.

Because the workers were scheduled to show up to the site at various times, Operation Supervisor did not organize a general briefing gathering all workers. But the supervisor conveyed the message, such as the establishment of the restricted area, operational precautions from Manager A, to the workers whenever possible.

Since Operation Supervisor was afraid that they were short of hands to complete their preparations only with workers from their own event planning company, Operation Supervisor decided to ask the local construction company introduced by Manager A to provide two workers to help them with the preparations. As a result, a total of seven workers, five from the event company and two from the construction company, were working in the grass area on the day of the accident.

Operation Supervisor, who was not always at the site, was not there when the accident occurred, having left to buy drinks for the workers. Soon after receiving a call that one of the workers had got injured, Operation Supervisor returned to the site and saw that Worker A was given the emergency medical treatment on the spot by the Self-Defense Forces staff members. Then Operation Supervisor was asked by Manager A to run to get an AED*6 at a nearby golf course, and brought it back to the site. While the emergency medical treatment with the AED continued, an air ambulance arrived. Worker A was taken to a hospital by the air ambulance.

(4) Site Leader

Site Leader was collecting the mowed grass with a tractor. At the accident, Worker A, who had more experience than Site Leader, was skillfully mowing the grass to bring the contrast with its various shades using a mower.

When Manager A explained about the restricted area and operational precautions, Site Leader thought that it would not be possible to work with continuous watching of the operation of the aircraft, and that it would be sufficient to work just with facing their front toward aircraft, while workers need to watch aircraft as much as possible, not turning their back against aircraft. Site Leader explained about the restricted area and operational precautions to the workers prior to the grass mowing work, and kept reminding them about the restricted area whenever appropriate.

On the day that the accident occurred, Site Leader had the workers rest from around 15:00 to around 15:30. Site Leader discussed the progress of their operation with

*6: The AED is an automated external defibrillator, a medical device designed to automatically analyze the ongoing ventricular fibrillation and, if necessary, provide electrical shock (defibrillation) to restore the heart to normal operation. The AED is one of the many types of defibrillators. Since the AED is an automated device, the operator does not need to be a doctor.

Worker A, who was at the position of around 385 m from the runway 25 threshold and around 15 m from the southern long side edge of the runway. Subsequently, Site Leader started the tractor and drove off to resume grass collection while Worker A restarted grass mowing work with the mower. While Site Leader was driving the tractor eastward, the Aircraft, which had veered off the runway, flew by. Seeing the Aircraft flying in an extremely unstable manner, Site Leader thought: "Why is it off the runway and flying so low unsteadily? That's dangerous." After quickly looking back and seeing a plume of dust rising, Site Leader felt that something serious had occurred and ran to Worker A.

(5) Worker B

While not responsible for operation in the grass area, Worker B had been manually collecting the mowed grass as had been requested to help the operation, when the accident occurred. Site Leader had provided instructions not to enter the restricted area and to stay aware of and not turn their back against aircraft while working. Worker B had not been instructed to wear a safety helmet.

While working toward Runway 25 threshold, some distance to the south from Worker A, Worker B noticed that the Aircraft had deviated from the runway and was flying to his direction. No sooner had the sense of danger arisen than the Aircraft changed its course, which was a relief for Worker B. However, looking toward the direction the Aircraft flying for, Worker A was operating a mower, bending down his head toward the Runway 25 threshold without noticing the approach of the Aircraft. At the moment when Worker B felt that Worker A is in peril, Worker A was raising his head but Worker A failed to break away and the Aircraft struck Worker A by the wing.

The accident occurred at the position of around 385 m from the runway 25 threshold and around 15 m from the southern long side edge of the runway in Otone Field at around 15:55.

(See Figure 1: Marks left at the Accident Site)

2.2 Injuries to Persons

Worker A who had been mowing grass suffered fatal injuries after being struck by the Aircraft.

2.3 Damages to the Aircraft

2.3.1 Extent of Damages

The Aircraft sustained substantial damages.

2.3.2 Damages to the Aircraft Components

(1) Propeller — The two propeller blades had scratch marks at the tips and the paint there had been peeled off.

(2) Wings — The left wing had no noticeable damage.

The right wing tip had scratch marks caused by contact with the ground. The leading edge of the right wing had a large dent at around the middle of the wing, with the outer skin of the dented area cracked and the inside structural members there deformed. The trailing edge

of the right wing was deformed by compression near the root of the wing, with the outer skin there having been raised.

(3) Landing gears The tires of the nose and the left main gears had soil adhering only to the left sidewalls.

(4) Aft fuselage The bottom outer skin on the tail had been scraped and the tip of the right elevator had scratch marks.

(See Photo 1 – Accident Aircraft, Photo 2 – Scratch Marks on the Propeller Blades, Photo 3 – Damage to the Right Wing)

2.4 Personnel Information

Captain: Male, Age 52

Private Pilot Certificate (Airplane)	November 16,2004
Type of rating for single engine (Land)	November 16,2004
Class 2 Aviation Medical Certificate	
Validity	Until June 28, 2013
Total flight time	109 hrs. 07 min.
Flight time in the last 90 days	15 hrs. 13 min.
Flight time in the last 30 days	4 hrs. 05 min.
Flight time on the type of aircraft	103 hrs. 17 min.
Flight time in the last 90 days	13 hrs. 18 min.
Flight time in the last 30 days	2 hrs. 10 min.
Solo flight time	11 hrs. 06 min.
Number of landings	329 times
Number of landings on solo flights	43 times

2.5 Aircraft Information

2.5.1 Aircraft

Type	Cessna 172N Ram
Serial number	17271076
Date of manufacture	July 28, 1978
Certificate of airworthiness	No.TO-24-037
Validity	April 27, 2013
Category of airworthiness	Airplane, Normal (N) or Utility (U)
Total flight time	7,621 hrs. 36 min.
Flight time since last periodical check (200-hour check on April 14, 2012)	24 hrs. 47 min.

(See Figure 5 – Three Angle View of Cessna 172N Ram)

2.5.2 Weight and Balance

When the accident occurred, four people were on board the Aircraft: the Captain, Passenger A, Passenger B and Passenger C. There were 173.2 liters (45.7 gallons) of fuel remaining in the fuel tank after the accident. Based on this, it is estimated that when the accident occurred, the weight of the Aircraft was 2,375 lbs and its location of center of gravity was 44.9 inches aft of the reference point. It is therefore estimated that the weight of the Aircraft went beyond the maximum

takeoff/landing weight of 2,300 lbs prescribed in the flight manual of the Aircraft and was also deviated from the weight and balance envelope shown in Figure A.

On the day of the accident, the Aircraft flew about 20 minutes before the accident, which corresponded to a fuel consumption of 4.3 gallons based on the flight manual. It is estimated that when the Aircraft took off the fuel tank was filled with fuel of 50 gallons and the weight of the Aircraft was 2,401 lbs with the location of center of gravity located 45.0 inches aft of the reference point.

For comparison, had there been two people on board consisting of the Captain and Passenger B and the same amount of fuel in the tank, the weight would have been 2,090 lbs and the location of center of gravity 41.0 inches aft of the reference point.

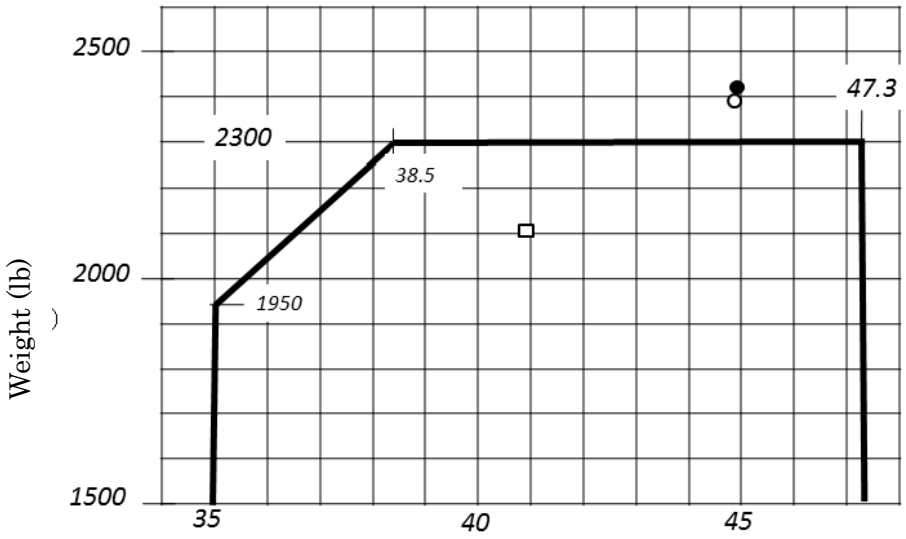
The weight and location of center of gravity of the Aircraft in both of these cases are indicated below in Figure A Weight and Balance Envelope.

(See Figure 3 – Weight and Balance Calculations)

4 Passengers (Captain and Passenger A in the front seats, Passengers B and C in the rear seats) at landing ○ : *2,375* (lb) *44.9* (in)

4 Passengers (Captain and Passenger A in the front seats, Passengers B and C in the rear seats) at takeoff ● : *2,401* (lb) *45.0* (in)

2 Passengers (Captain and Passenger B in the front seats) at landing □ : *2,090* (lb) *41.0* (in)



Reference point: bottom front of firewall

Figure A Weight and Balance Envelope

2.6 Meteorological Information

According to a few members who were at the clubhouse of Otone Field, it was cloudy around the time of the accident, with a high cloud base, good visibility and almost no winds. The aerodrome routine meteorological report (METAR) for Narita International Airport, about 17 km southeast of Otone Field, around the time of the accident was as follows:

15:30 Wind direction ... 150°, Wind velocity ... 8 kt, Visibility ... 10 km or more
Cloud: Amount ... FEW, Type ...Cumulus, Cloud base ... 2,000 ft
Amount ... FEW, Type ...Cumulonimbus, Cloud base ... 2,000 ft

	Temperature ... 30 °C,	Dew point ... 23 °C	
	Altimeter setting (QNH) ... 29.95 inHg		
16:00	Wind direction ... 160°,	Wind velocity ... 10 kt,	Visibility ... 10 km or more
	Cloud: Amount ... FEW,	Type ... Cumulus,	Cloud base ... 2,000 ft
	Amount ... FEW,	Type ... Cumulonimbus,	Cloud base ... 2,000 ft
	Temperature ... 29 °C,	Dew point ... 23 °C	
	Altimeter setting (QNH) ... 29.95 inHg		

2.7 Site of the Accident

The Otone Airfield is located on a riverbed of the Tone River about 17 km northwest of Narita International Airport. On weekends, the airfield is used by many recreational pilots. The landing field, or the runway, is 600 m long and 20 m wide, and is paved with asphalt, having runway designation marking of 07/25 representing the runway direction, touchdown zone marking, runway centerline marking and halfway marking.

There were tire marks on the runway, starting along the right edge of the runway at around 215 m from the approach end of Runway 25. The tire marks continued until around the halfway marking along with the travel of the Aircraft on ground.

On the grass area, there were grooved skid marks by the tires and slash marks of the propeller blades, starting from around the location where Worker A was mowing grass (about 385 m from the approach end of the runway) and returning back onto the runway in a clockwise direction.

(See Figure 1 – Marks Left at the Accident Site, Photo 4 – Tire Marks on the Runway, Photo 5 – Slash Marks of the Propeller Blades on the Grass Area, Photo 6 – Grooved Skid Marks Left by the Tires on the Grass Area)

2.8 Medical Information

According to the information provided by the police, Worker A, who had been struck by the Aircraft, was found with contusions and fractures of the head and neck and also fractures and abrasions to the chest and abdomen. Worker A died from multiple traumas.

2.9 Lifesaving Operations

Based on the information provided by the police and eyewitnesses, lifesaving operation for Worker A following the accident is outlined below.

At around 15:57, Passenger B called for an ambulance while Self-Defense Forces staff members who happened to be at Otone Field given the emergency medical treatment to Worker A including heart massage and artificial respiration.

At around 16:13, an air ambulance with a doctor on board arrived near the site of the accident. Worker A was then taken to a hospital by it, where Worker A was identified as dead at 16:36.

2.10 Additional Information

2.10.1 Captain's Flight Experience

The Captain began his flight training in March 2004 and had received flight training of about 26 hours in Japan and about 24 hours in a foreign country. The Captain obtained a private pilot certificate from a foreign authority in June 2004, and had converted it to the corresponding Japanese certificate on November 16, 2004. At that time, the total flight time of Captain was about 50 hours, which was more than the minimum flight time of 40 hours required to qualify as a

candidate to apply for the Japanese private pilot certification.

According to Captain's flight records, the Captain flew about 50 hours in the year of 2004 when he obtained the certificate, and about 16 hours in 2005. Then his yearly flight time gradually decreased. In 2009 and 2010, he did not fly at all. In 2011, he resumed flying but only made two one-hour flights with just single landing each. In 2012, he had flown about 22 hours up to the day of the accident, making 43 landings during 21 flights, of which 39 times of landings were made at Otone Field. The Captain said that he flew most with single person in the cockpit and that he had less experience flying with three other persons in the cockpit.

In 2012, the Captain flew regularly, and continued to practice landings at Otone Field.

The runway at Otone Field is 20 m wide (600 m long) as described in 2.7. The runway at Oshima Airport where the Captain flew three times in 2012 is 45 m wide (1,800 m long). The runway at Fukushima Airport where he flew once in 2012 is 60 m wide (2,500 m long).

(See Figure 4 – Captain's Flight Records for 2012)

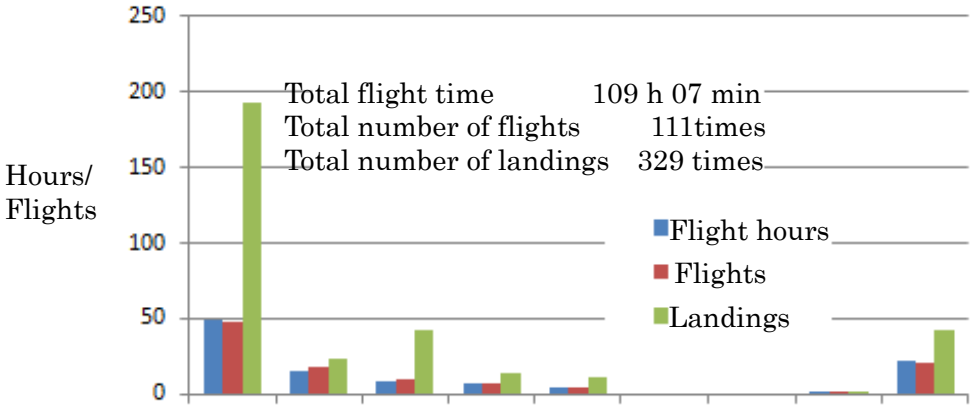


Figure B Captain's Flight Experience

2.10.2 Confirmation before Departure

Article 73-2 (Confirmation before Departure) of the Civil Aeronautics Act stipulates that the pilot in command shall not start an aircraft, unless he/she has confirmed that the aircraft has no problems for flight and the necessary preparation for air navigation has been completed. Article 164-14 of the Ordinance for Enforcement of the Civil Aeronautics Act prescribes the specific matters that must be confirmed by the pilot in command pursuant to Article 73-2 of the Civil Aeronautics Act.

Article 164-14 (1) of the Ordinance for Enforcement of the Civil Aeronautics Act

Matters that must be confirmed by the pilot in command pursuant to Article 73-2 of the Act are as listed below.

(i) Maintenance status of a subject aircraft and its equipment

(ii) Take-off weight, landing weight, location of the center of gravity, and weight distribution

(iii) Information offered by the Minister of Land, Infrastructure, Transport and Tourism pursuant to the provision of Article 99 of the Act (skipped)

(iv) Weather information required for such navigation

(v) Loading quantity of fuel and lubricant, and their quality

(vi) Safety of payloads

2.10.3 Aircraft Operating Limitations

The Civil Aeronautics Act and the Ordinance for Enforcement of the Civil Aeronautics Act describe aircraft operating limitations as follows.

The Civil Aeronautics Act (excerpts)

Article 10

(3) Airworthiness certification shall describe the categories of aircraft use and aircraft operating limitations as prescribed by Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism.

Article 11

(2) No person may operate an aircraft beyond the categories of its use or operating limitations as designated in the airworthiness certificate.

The Ordinance for Enforcement of the Civil Aeronautics Act (excerpts)

Article 5-4

Flight Manual shall mean the documents that state the following items:

(ii) Matters relating to Aircraft Operating Limitations

Article 12-3

(2) Aircraft operating limitations as specified by Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism set forth in paragraph (3) of Article 10 of the Act shall be matters of limitations of the aircraft under item (ii) of Article 5-4.

As specified by these laws and regulations, the matters of limitations described in the flight manual of the Aircraft must be used as operating limitations for the Aircraft.

2.10.4 Impact of Weight and Location of Center of Gravity on Aircraft Control

The second edition of "Aerodynamics I: Propeller Aircraft" issued on September 15, 2006 by the Japan Aeronautical Engineers' Association, a public interest incorporated association, includes the following descriptions (excerpts).

Chapter 14 Weight and Location of the Center of Gravity

14.4 Loading limitations

The limit can be exceeded depending on how the aircraft is loaded. In this case, reduce the weight below the limitations to keep the center of gravity within the permissible range or relocate the load.

a. Weight limitations

A small aircraft fully occupied with passengers and with a fully loaded fuel tank can often exceed the maximum takeoff weight limitations.

(Skipped)

c. Location of Center of gravity at the rear limit of the permissible range

An aircraft fully occupied with passengers can easily exceed not just the weight limitations but the aft limit of the permissible center of gravity range. Therefore, measures must be taken to keep the center of gravity within the permissible range such as by leaving one of the rear seats

vacant or measuring the weight of all people who are boarding and assigning lighter passengers to the rear seats.

If the center of gravity of an aircraft is close to the rear limit of the permissible range, stability and controllability of the aircraft can still be maintained through careful piloting. However, the fore portion of the aircraft becomes lighter than desired, highly caused the following tendencies such as unstable ground roll, excessive rotation rate during takeoff, reduced stability at low airspeeds, risk of stall and spin, and greater difficulty recovering from spin.

(Skipped)

Important precautions regarding loading of a small aircraft are summarized below.

(a) An aircraft with fully loaded fuel shall not fly with the seats fully occupied or the cargo weight limit reached.

(b) An aircraft with the seats fully occupied shall have restriction of fuel on board, resulting in shortening flight time and distance.

(c) The location of center of gravity shall be within the permissible range throughout the flight including the fuel consumption during the flight.

(d) Throughout the flight, the pilot shall stay aware of the location of center of gravity. If the location of center of gravity is closer to the fore or aft limit of the permissible range, the pilot must adapt his/her control maneuver accordingly.

The "PILOT SAFETY AND WARNING SUPPLEMENTS" produced by the manufacturer of the Aircraft include the following descriptions (excerpts).

AIRPLANE LOADING

＜Airplane center of gravity range＞

Pilots should never become complacent about the weight and balance limitations of an airplane, and the reasons for these limitations. Since weight and balance are vital to safe airplane operation, every pilot should have a thorough understanding of airplane loading, with its limitations, and the principles of airplane balance. Airplane balance is maintained by controlling the position of center-of-gravity. Overloading, or misloading, may not result in obvious structural damage, but could do harm to hidden structure or produce a dangerous situation in the event of an emergency under those conditions. Overloading, or misloading, may also produce hazardous airplane handling characteristics.

＜Effects of loading on the flight＞

Weight and balance limits are placed on airplanes for three principal reasons: first, the effect of the weight on the primary and secondary structures; second, the effect on airplane performance; and third, the effect on the flight controllability, particularly in stall and spin recovery.

A knowledge of load factors in flight maneuvers and gusts is important for understanding how an increase in maximum weight affects the characteristics of an airplane. The structure of an airplane subjected to a load factor of 3Gs must be capable of withstanding an added load of three hundred pounds for each hundred pound increase in weight. All Cessna airplanes are analyzed and tested for flight at the maximum authorized weight, and within the speeds posted for the type of flight to be performed. Flight at weights in excess of this amount may be possible, but loads for which the airplane was not designed may be imposed on all or some parts of the structure.

An airplane loaded to the rear limit of its permissible center-of-gravity range will respond differently than when it is loaded near the forward limit. The stall characteristics of an airplane change as the airplane load changes, and stall characteristics become progressively better as the center-of-gravity moves forward. Distribution of weight can also have a significant effect on spin characteristics. Conversely, extremely aft C.G. locations will tend to promote lengthened recoveries since a more complete stall can be achieved. Changes in airplane weight as well as its distribution can have an effect on spin characteristics since increases in weight will increase inertia. Higher weights may delay recoveries.

An airplane loaded beyond the forward C.G. limit will be nose heavy, and can be difficult to rotate for takeoff or flare for landing. Airplanes with tail wheels can be nosed over more easily.

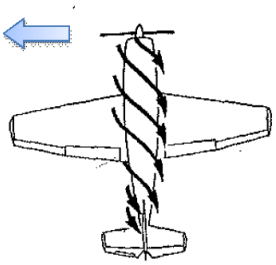
2.10.5 Characteristics of Single-Engine Propeller Aircraft during Takeoff Roll

The propeller is designed to produce thrust, but it also has a secondary effect to aircraft maneuverability. As a fast rotating propeller generates thrust, a spiraling slipstream (hereafter referred to as "Propeller Slipstream") is also created behind the propeller, which then flows rearward along the fuselage. Spiraling slipstream generated by a propeller rotating clockwise viewed from the pilot's seat eventually hits the left face of the vertical tail, forcing the nose of the aircraft to the left. The force becomes stronger as the speed of aircraft is slower and the propeller speed is higher, as in a takeoff.

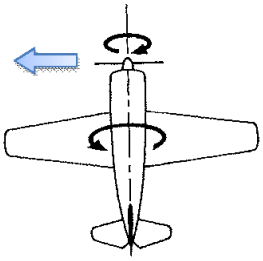
The propeller is turned by the engine in the same direction of rotation as the engine. In reaction to this rotation force, the counter torque that is generated tries to rotate the aircraft around the longitudinal axis in the direction opposite to the engine rotation. On an aircraft with a clockwise rotating propeller, this counter torque (hereafter referred to as "Torque Reaction") pushes the left landing gear down, increasing the friction between the left wheel and the ground and thereby forcing the nose of the aircraft to the left. Torque Reaction becomes greatest when engine power is set to maximum, as in a takeoff.

As described above, on aircraft with a single, clockwise rotating propeller, the nose tends to be pushed to the left. This is particularly significant during a takeoff roll.

The Aircraft is equipped with a clockwise rotating propeller.



Propeller Slipstream



Torque Reaction

Source: "Aerodynamics I: Propeller Aircraft" by the Japan Aeronautical Engineers' Association

2.10.6 Touch and Go Landing Procedure

Touch and go is one of the training exercises that combines takeoff and landing maneuvers. The objective is to learn not just the takeoff and landing procedures but also the setting of parameters for the takeoff, climb, approach and landing along the traffic pattern. The procedure is therefore effective to master basic flight techniques. This training also provides the opportunity to perform go-around or aborted takeoff along with own proactive decision.

In the standard touch and go procedure, it is important to first establish the direction of the ground roll after landing before moving on to takeoff.

The flight manual of the Aircraft includes the following descriptions regarding normal takeoff.

(1)	Wing Flaps	UP
(2)	Carburetor heat	COLD (CLOSED)
(3)	Throttle Control	FULL OPEN
(4)	Elevator control	LIFT NOSE (at 55 KIAS*7)
(5)	Climb Airspeed	70 to 80 KIAS

2.10.7 Places for Landing and Takeoff

Article 79 of the Civil Aeronautics Act stipulates: "No aircraft (skipped) shall take off or land, on land, at places other than aerodromes (skipped); provided; however, that the same shall not apply when permitted by the Minister of Land, Infrastructure, Transport and Tourism."

Otone Field is designated as a permitted place for takeoff and landing other than aerodromes (hereafter referred to as "Permitted Place for Takeoff/Landing") as specified in Article 79 of the Act.

Those who wish to receive this approval must apply to the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism with documents showing the items listed in Article 172-2 of the Ordinance for Enforcement of the Civil Aeronautics Act.

Article 172-2 of the Ordinance for Enforcement of the Civil Aeronautics Act:

A person intending to apply for the permission prescribed in the proviso of Article 79 of the Act shall submit a written application describing the matters listed below to the Minister of Land, Infrastructure, Transport and Tourism.

(i) Name and address
(ii) Type of aircraft and Nationality and registration mark of aircraft
(iii) Date, time and place of take-off or landing (sketches of said place shall be attached.)
(iv) Reasons for take-off or landing
(v) Measures to prevent accidents
(vi) Outline of flight plan (Purpose, date and time, and paths shall be clearly stated.)
(vii) Name and qualification of pilot
(viii) Other matters for reference

2.10.8 Aeronautical Information Procedures Manual

The specific criteria for the approval of Permitted Place for Takeoff/Landing are stipulated in the Aeronautical Information Procedures Manual*8 issued by the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism. The following are excerpts of the criteria.

II Aeronautical support information operation
(VI) Permission of operation and so on
9 Permission Specified in the proviso of Article 79 of the Act
(1) Purpose of permission

In order to ensure the safety of the properties or persons on the water or the ground and the safety of aircraft, the permission specified in the proviso of Article 79 of the Act is intended to prohibit takeoff and landing at a place other than those airfields that have been established and managed in accordance with the applicable standards and to lift the

*7: KIAS" stands for Knots-IAS, or indicated airspeed in knots.
*8: "The Aeronautical Information Procedures Manual" is part of the Aeronautical Navigation Procedures Manual (Ku-So Notification No. 130 dated March 13, 1967, by the Director-General of the Civil Aviation Bureau) and lists specific procedures for implementing aeronautical information duties.

prohibition on an exception basis that the Minister of Land, Infrastructure, Transport and Tourism determines that the takeoff and landing will be executed for a compelling reason and that no safety issues will be raised from the takeoff or landing.

(Skipped)

(3) Criteria for granting permission

Permission shall be issued only if the aircraft for compelling reasons must use the place to effectively fulfill the purpose of the flight and the place meets the standards a. and b. described below.

(Skipped)

a. Requirements for landing field[*9] *etc.*

A landing field and its related facilities shall meet the standards of establishment specified in the Ordinance for Enforcement of the Civil Aeronautics Act and other applicable laws or the following standards.

(a) Servicing for aircraft takeoff and landing

Landing field	*Location and direction*	*A landing field shall be located and directed such that, in the event of engine failure, takeoff and landing paths can be secured to make an emergency landing without causing injury or damage to people or properties on the ground or water.*
	Length and width	*A landing field shall be at least long enough for takeoff and landing in varying atmospheric pressure and temperature at the field. Its width shall be at least 15 m or the width of the aircraft added 5 m, whichever is greater.*
	Surface	*The landing field shall be sufficiently flat and its maximum longitudinal gradient shall be 2% or less while its maximum lateral gradient shall be 3% or less.* *The surface shall be strong enough to withstand aircraft operation.*
Approach area and surface	*An approach area and surface shall be those as shown in Figure 2. An approach surface shall have a gradient of 1/20 or less and have no structures protruding above the surface.*	
Horizontal surface	*Horizontal surface shall be a plane that runs across a point 45 m high above the middle point of the landing field. No structures shall protrude above the plane within the area for traffic pattern flights.*	
Transitional surface[*10]	*Transitional surface shall be a plane with a gradient of 1/5 or less as shown in Figure 2. No structures shall protrude above the transitional surface or the extended surface of the landing field within 10 m from its long sides.*	

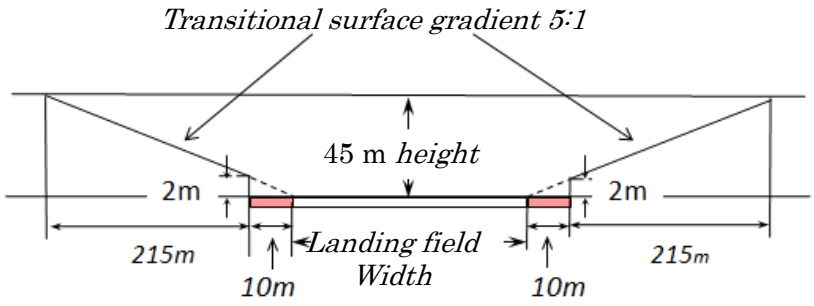
Figure 2 – Schematics of Approach Area and Surface and Transitional Surface for Airplane

*9: A "landing field" is a rectangular area in a permitted place for takeoff/landing used for the purpose of aircraft takeoff and landing in specific directions, and corresponds to "landing strip" in aerodromes.

*10: "Transitional surface" is a plane restricting the structures from protruding above it to secure a safe way out for an aircraft which incorrectly approaching to the runway.

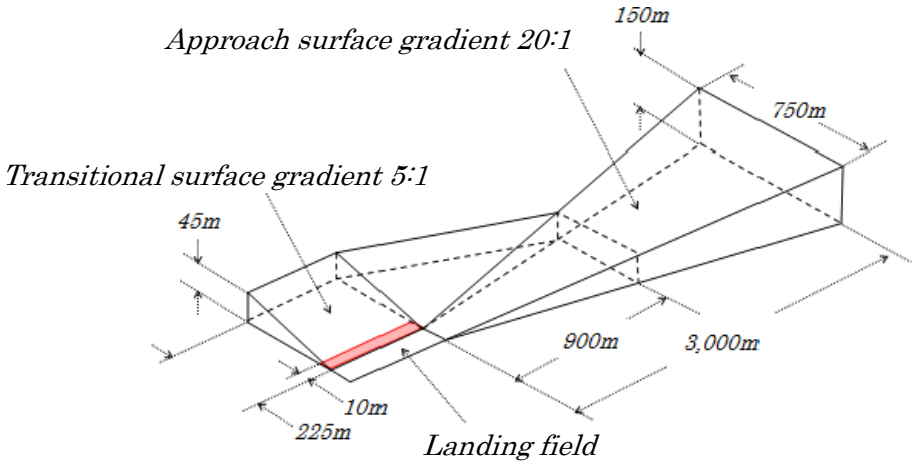
(Skipped)

③ Cross section of transitional surface (partly supplemented)



No structures shall protrude above the extended surface of the landing field within 10 m from its long sides.

④ Three-dimensional schematic (partly supplemented)



b. Requirements for safety measures and others

The following safety measures shall be taken.

(Skipped)

(a) Markings

(i) Servicing for aircraft	*A landing field shall have a wind direction indicator near the field, as well as runway centerline marking, runway threshold marking and runway side edge marking that are clearly visible from the approaching and departing aircraft (except where installation of these facilities is extremely difficult).*
(ii) Servicing for rotorcraft	*(Skipped)*

(b) Safety measures for landing field and other facilities

(i) Measures shall be in place to ensure that no one is allowed to enter into the landing field or any of the nearby areas where entry can hamper operation. Where crowds can be expected, necessary crowd control measures shall be taken such as arrangement of security guards.

(Skipped)

2.10.9 Application for Permission of proviso of Article 79 by the Captain

At the time of accident, JMGC, representing 444 member pilots of Otone Field and their 77 aircraft applied for and was granted the permission prescribed in the proviso of Article 79 of the Civil Aeronautics Act.

The Aircraft was included in the "type of aircraft, nationality and registration mark" list of the application. However, the Captain was not included in the "name and qualification of pilot" list of the application, which means that he had been conducting takeoffs and landings at Otone Field without obtaining permission.

Regarding the fact that the Captain did not obtain the proviso of Article 79 permission, the Captain said that he had not fully understood the contents and procedures for the application for permission or its criteria, and that he had been under the impression that everything would be taken care of by the Club. The owner of the Aircraft, who is also the leader of the Club, said that the Club did not know that the application should include the names of the pilots who were to use Otone Field as a Permitted Place for Takeoff/Landing. Therefore, the owner of the Aircraft had not given the name of the Captain to JMGC, which made application on behalf of the club, when applying for the permission.

2.10.10 Management of Otone Field

(1) Rules for management

At the time of accident, the Japan Flying Association put in place the rules of flight operation at Otone Field as well as the rules for management such as the rights of manager, limitations of entry and prohibited acts.

In its application for permission as prescribed in the proviso of Article 79 of the Civil Aeronautics Act, JMGC, which has effectively managed Otone Field on a daily basis, stated as "(v) Measures to prevent accidents" described in 2.10.7 that "the Otone Field managing rules shall be strictly observed." The following are excerpts from the rules for management that were in effect at the time of the accident.

Article 3 (Permission for use)

1. *Those wishing to use facilities at Otone Field for aircraft takeoff, landing or stopover shall in advance submit an "application for the use of Otone Field" to and be so permitted by the Japan Flying Association.*
2. *Those wishing to use the facilities shall in advance submit an application for the use of a Permitted Place for Takeoff/Landing to and be so permitted by the director of Hyakuri Airport administrative office as prescribed in the proviso in Article 79 of the Civil Aeronautics Act and the provision of Article 172-2 of the Ordinance for Enforcement of the Civil Aeronautics Act.*

(Skipped)

Article 5 (Management)

The manager shall keep the facilities and equipment of the landing field usable for aircraft operation and have the right to provide guidance on maintaining security of the field.

(Skipped)

Article 13 (Restrictions of entry)

The manager may, when considers necessary for management purposes, restrict entry to the landing field or restrict acts of those who are allowed entry.

Article 14 (Restricted area)

No one shall enter any of the restricted area that the manager may set up in the field.

(Skipped)

Article 17 (Prohibited Acts)

In addition to the provisions of the preceding Article (Ban on the transport of explosives.), the following provisions from Article 53 of the Civil Aeronautics Act-shall apply mutatis mutandis.

1. *No person shall damage runways, taxiways, aprons, markings or fueling facilities, nor commit such acts that are likely to impede the function thereof.*
2. *No person shall throw any objects at a aircraft within the precincts of an aerodrome*[*11]*, nor use fire or naked flame without any specific aim on runway strips*[*12]*, taxiways, aprons or in places other than those designated by the management.*
3. *No person shall be permitted to enter landing strips, taxiways or aprons with no specific aim.*

(Skipped)

The Captain was not permitted to use Otone Field as he did not meet the conditions stipulated in Article 3 (Permission for use) of the rules for management.

(2) Management in place at Otone Field at the time of the accident

Manager A normally stays at the clubhouse and remains aware of the aircraft using Otone Field. On the other hand, there were pilots who did not come to the clubhouse to meet or exchange information with Manager A when using Otone Field before flying. Therefore, a system was not in place that would have screened out those who did not have the permission granted under the proviso in Article 79 of the Civil Aeronautics Act described in 2.10.7 from the pilots who did not come to the clubhouse.

On the first day of the grass mowing work, Manager A had a meeting at the site with Operation Supervisor and Site Leader. During the meeting, Manager A gave instructions and told them to share these instructions with other workers; the instructions included the establishment of the restricted area along the long sides of the

*11: The "aerodrome" in this and other cases used in the managing rules refers to "landing field." (Source: The Japan Flying Association)

*12: The "landing strip" in this and other cases used in the managing rules refers to the "landing field" specified in the Aeronautical Information Procedures Manual. (Source: The Japan Flying Association)

runway stretching 13 m*13 away from the runway and place safety cones to mark the areas, and to watch operation of the aircraft while working and never turn their back against aircraft.

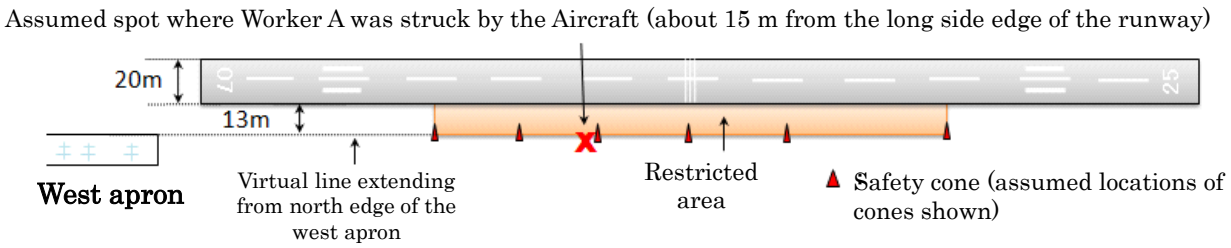


Figure C Restricted Area Set Up for Grass Mowting Operation

2.10.11 Personal Protective Gear Used by the Grass Mowing Workers

A total of seven workers were mowing grass at the times of the accident. Two of the workers were from a local construction company and had previous experience mowing grass at Otone Field. They were wearing personal protective gear including work clothes, work shoes, protective helmets, protective glasses and whistles.

On the other hand, the remaining five workers, namely Operation Supervisor, Worker A, Worker B and two other workers all from the event planning company, were casually dressed in T-shirts and below-knee trousers with no protective gear such as a protective helmet.

2.10.12 Specified Pilot Competency Assessment System

As of the May 25, 2011 partial amendment to the Civil Aeronautics Act, the Specified Pilot Competency Assessment*14 System was introduced with the aim of obliging pilots to maintain the required competency. Under the system, persons holding a Pilot Competency Certificate are not allowed to operate aircraft or engage in other related activities unless they have passed the Specified Pilot Competency Assessment conducted by an Authorized Pilot Competency Assessor for the required knowledge and skills within two years prior to their flight.

This system is set to come into effect on April 1, 2014. As a transitional measure, assessment equivalent to the assessment stipulated by the amended Act (hereafter referred to as "Equivalent Assessment") had been introduced since April 1, 2012. From April 1, 2014, persons holding a Pilot Competency Certificate are not allowed to operate aircraft unless they have passed the Equivalent Assessment.

The Captain had not received an Equivalent Assessment at the time of the accident. However, he said that he had attended the guidance session conducted by the Civil Aviation Bureau on the amendments (Specified Pilot Competency Assessment System and Aviation Medical Certification System) to the Civil Aeronautics Act.

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*13: The "13 m" depth of the no-go area corresponds to the distance between the long side edge of the runway and the virtual line extending from the west apron's north edge as shown in Figure C. This is an own way of Manager A , who adopted this virtual extending line to decide the border of the no-go area.

*14: The "Specified Pilot Competency Assessment" is a form of competency assessment conducted within two years preceding a flight on those holding a Pilot Competency Certificate issued by the Minister of Land, Infrastructure, Transport and Tourism. The oral test covers the subjects of recent changes and the knowledge and learning to be regularly reviewed . The practical test covers pre-flight procedures and basic competency such as traffic pattern flight and takeoff/landing, as well as knowledge on non-normal and emergency procedures.

2.10.13 Guidance on Private Pilot Competency Retention

The notification (Koku-Ku-Jou No.2077 dated March 28, 2003) from the Civil Aviation Bureau titled "Guidance on Private Pilot Competency Retention" states as follows,

It is highly recommended that Private pilots should actively make efforts to retain their competency, using this guideline as a basic reference.

1. Training workshop for aviation safety.[15]

(1) Private pilots should receive workshop for aviation safety within two years prior to its flight to try to acquire knowledge on safety and enhance safety awareness.

(2) Those private pilots who had their overseas certificates converted to corresponding Japanese versions should receive workshop for aviation safety promptly following the conversion to try to acquire knowledge on safety and enhance safety awareness.

(Skipped)

The Captain attended the workshop sponsored by the Civil Aviation Bureau in 2005, 2007 and 2011.

3. ANALYSIS

3.1 Airman Competence Certificate

The Captain held both a valid airman competence certificate and a valid aviation medical certificate.

3.2 Airworthiness Certificate

The Aircraft had a valid airworthiness certificate and had been maintained and inspected as prescribed. It is highly probable that all damages to the various parts of the Aircraft as described in 2.3.2 were caused in the accident.

3.3 Meteorological Conditions

As described in 2.6, the weather at Otone Field around the time of the accident was by good visibility and almost no winds. It is therefore highly probable that the weather had no relation with the occurrence of the accident.

3.4 Weight and Location of Center of Gravity in Excess of Operating Limitations

Regarding small aircraft, as described in 2.10.4, "An aircraft with fully loaded fuel shall not fly with the seats fully occupied or the cargo weight limit reached." However, as described in 2.5.2, four people were on board the Aircraft and the fuel tank was almost full at takeoff.

As a result, the takeoff and landing weight of the Aircraft went beyond the maximum takeoff/landing weight of 2,300 lbs prescribed in the flight manual of the Aircraft, and was also deviated from the weight and balance envelope.

Based on the above, it is highly probable that the Captain started the Aircraft without confirming its weight and the location of the center of gravity among the matters of confirmation

*15: "Training workshop for aviation safety" should ideally cover such subjects as ① compliance with aviation laws and regulations ② specific examples of accidents, serious incidents and near-miss incident and ③ importance of information gathering.

before departure prescribed in the Civil Aeronautics Act as described in 2.10.2, and flew the Aircraft on the condition in excess of the operating limitations prescribed in the Civil Aeronautics Act as described in 2.10.3.

As described in 2.10.4, the manufacturer of the Aircraft does not guarantee structural integrity, performance or flight maneuverability of the Aircraft if the weight and the location of the center of gravity exceed the operating limitations. It is therefore somewhat likely that the excess of operating limitations concerning the weight and the location of the center of gravity had an adverse effect on the characteristic and maneuverability of the Aircraft.

3.5 Bouncing and Veering to the Right following Landing

According to the statements of the Captain and the passengers described in 2.1.1 (1) through (4), it is highly probable that the Aircraft bounced on the the first touchdown. It is considered probable that these events happened as below.

It is probable that, as described in 2.10.1, the Captain flew most with single person on board, might be accustomed to landing with a relatively lightweight aircraft which would put the location of center of gravity around the middle of the permissible range, but the Captain flew less with three other persons on board, landing with a quite heavyweight aircraft, which would put the center of gravity way backward in the range; moreover, he had no experience of landing with an excess weight aircraft: beyond the operating limit weight of 2,300 lbs.

Generally, in proportion to the weight of an aircraft, its speed and rate of descent during landing and inertia of the aircraft increases. As described in 2.10.4, while a pilot flying an aircraft, he/she shall stay aware of the location of the center of gravity in his/her aircraft and realize it's the flying characteristics of the aircraft depending on its current location of the center of gravity, and then adapt the control maneuvers to it. As described in 3.4, however, it is probable that the Captain did not perform the confirmation of the weight and location of the center of gravity of the Aircraft, and did not notice that the weight of the Aircraft went beyond the operational limitation, and continued flying in the same manner as usual. It is probable that due to these Captain's unawareness toward the Aircraft, the flare was delayed as stated by the Captain described in 2.1.1 (1), or the amount of flare was not sufficient, leading to a bounce following the first touchdown as a result.

Regarding the movement of the Aircraft following the bounce, considering the statements described in 2.1.1 (2), (4) and the tire marks on the runway starting along the right edge of the runway as described in 2.7, it is probable that the Aircraft veered to right of the runway centerline after the ensuing landing.

3.6 Veering Off the Runway

According to the statements of the Captain and the passengers described in 2.1.1 (1) through (4) and the tire marks left on the runway as described in 2.7, it is highly probable that a strong force was applied on the Aircraft after it veered off the runway centerline toward the right after the ensuing landing, which made the Aircraft quickly swerve to the left. It is probable that the Captain could not control this strong force and the Aircraft continued on an unstable ground roll and veered off the runway.

It is probable that the strong force, caused the Aircraft which veered off the runway centerline to the right after the ensuing landing to quickly swerve to the left, was derived from following process.

First, it is probable that the Captain tried to make the Aircraft which veered off to the right

return back to the runway centerline with the left rudder. Second, it is probable that the Captain thought that the Aircraft, deviating to the right of the runway centerline, can be corrected within the runway and take off in a safe manner as described in 2.1.1 (1); and that the Captain tried to move the throttle lever to full open while correcting the direction of the ground roll of the Aircraft with the left rudder, which did not follow the standard touch and go procedure: priority is given to the establishment of the direction for the ground roll as described in 2.10.6. It is probable that, as a result, all the force composed of correcting force to the left by the Captain's rudder operation, Propeller Slipstream and Torque Reaction as described in 2.10.5, interacted on the Aircraft, driving the Aircraft to abruptly swerve to the left with strength.

Considering that the Captain had flown regularly and performed 43 landings in 2012 as described in 2.10.1, it is probable that he should have been able to perform a touch-and-go procedure under a normal condition. In this accident, however, the Aircraft bounced on the touchdown. It is therefore somewhat likely that the Captain was upset by this unusual bouncing. After the ensuing landing, the Aircraft veered off the runway centerline to the right. This made the Captain correct the direction of the ground roll using the left rudder. The Captain's task was overlapping, in parallel with this corrective action, he also needed to operate the flap lever and the carburetor heat to follow the touch and go procedure. Accordingly, the Captain moved the throttle lever to full open.

With these different factors from his routine touch and go procedure, it is somewhat likely that there was little allowance for the Captain both temporally and psychologically. It is probable that this is why the Captain was upset by the rapid leftward swerving of the Aircraft and could not take appropriate actions, and then the Aircraft veered off the runway.

The Captain could not decide to abort takeoff before the Aircraft veered off the runway. It is probably because the Captain was made temporally and psychologically pressed that the Captain could not make the decision to stop the rolling Aircraft in an unstable way and abort its takeoff, which was caused by following reasons as described above,

- The Captain was so upset by the bouncing of the Aircraft that he could not take appropriate actions to correct the ground roll direction as described above.
- The runway of Otone Field was too narrow, 20 m wide as described in 2.7, for the Captain to address these situation properly.

3.7 Striking Worker A

According to the statements of Site Leader and Worker B described in 2.1.2 (4) and (5), it is probable that around the time of the accident, Worker A was working toward the Runway 25 threshold, about 385 m from the Runway 25 threshold and around 25 m from the runway centerline, while complying the restricted area established by Manager A.

As described in 2.7, there were tire marks continuing until around the halfway marking on the runway but disappeared on the adjacent grass area and no trace of the Aircraft trajectory was found on it. According to the statements of the Captain described in 2.1.1 (1), the Captain did not have a clear recollection of how he operated the Aircraft after it veered off the runway; however, he remembered operating the right rudder in an attempt to bring the Aircraft back onto the runway. According to the statements of Club Member A described in 2.1.2 (2), the Aircraft, after veering off the runway, became airborne with extreme high pitch and rolled to the left but appeared unstable, and then suddenly pitched down and rolled to deep right, the tip of the right wing appeared to contact the ground. Also according to the statements of Passenger A described in 2.1.1 (2), the Aircraft, after

veering off the runway, rolled to the left and then rolled to the deep right.

Based on the above, it is probable that the Aircraft raised its nose by the Captain's operation of pulling the control yoke to become airborne and the Aircraft rolled to the left by operation of control yoke or the left rudder and was getting to lose the speed with excessive high pitch after veering off the runway.

As indicated in the supplements that had been produced by the manufacturer of the Aircraft described in 2.10.4, it is somewhat likely that the fact that the Aircraft exceeded the weight and balance operational limitations had an adverse effect on its stall characteristics and also contributed to the unstable flight.

It is highly probable that the Captain depressed the right rudder pedal in an attempt to bring the Aircraft back onto the runway from the state mentioned above. It is somewhat likely that at the same time he operated the control yoke to make a right turn. It is probable that as a result, the Aircraft rolled to deep right with nose-down attitude, flying close to the ground surface and the right wing struck Worker A, who was mowing grass.

As indicated by the statements of Site Leader and Worker B described in 2.1.2 (4) and (5), it is probable that Worker A did not notice the Aircraft approaching at all and was struck, since Worker A was focused on the grass mowing operating a mower while bending down his head and the flying sound of the Aircraft was drowned out by the loud noise of the mower.

According to the statement of Club Member A described in 2.1.2 (2) and the grooved skid marks by the tires and other matters at the site as described in 2.7, it is probable that after striking Worker A, the Aircraft skidded sideways while rolling to the left and its left landing gear contacted the ground and that the Aircraft then took a nose-down attitude and its nose gear and propeller blades touched down, scraping and mowing the grass area. It is probable that after its nose gear touched down, the Aircraft bounced back, causing its nose to move up and the tail to strike the ground, then it bounced forward again, and that this cycle was repeated while the Aircraft kept skidding sideways and eventually went back onto the runway.

It is probable that the Aircraft then stopped on the runway; and that, as the Aircraft was still being powered as stated by Passenger A described in 2.1.1 (2), Passenger A said to the Captain that they did not need power anymore; and that the Captain reduced the power and taxied the Aircraft to the apron.

(See Figure 1 – Marks Left at the Accident Site, Figure 2 – Estimated Flight Course and Ground Roll Track)

3.8 Captain's Flight Experience

As described in 2.10.1, the Captain received around 50 hours of flight training and obtained a private pilot certificate in 2004. From 2005, the flight of the Captain began less often, and he did not fly at all in 2009 and 2010. In 2011, he resumed flying. The Captain had accumulated a total flight time of about 110 hours.

As described in 2.10.13, considering that the Captain attended training workshops for aviation safety in 2005, 2007 and 2011 the years that he flew regularly, it is probable that he had a certain level of consciousness to acquire knowledge and to promote awareness on aviation safety.

It is highly probable that in 2012, the Captain had flown about 22 hours up to the day of the accident, which included 39 takeoffs/landings at Otone Field that were made with no problems. It is therefore probable that the Captain had been used to takeoffs and landings at Otone Field and had

acquired the basic flying techniques.

However, it is somewhat likely that the Captain did not have well-established capability to successfully handle the problems under the situations such as something unexpected happened to him or something made the Captain temporally and psychologically pressed.

(See Figure 4 – Captain's Flight Records for 2012)

3.9 Management at Otone Field for Pilot Compliance to Safety Rules

As described in 2.10.7, the permission specified in the proviso of Article 79 of the Civil Aeronautics Act is issued to those wishing to take off and land at places other than aerodromes. As described in 2.10.9, the Club failed to include the Captain in its application for the permission specified in the proviso of Article 79 of the Act while the Captain was expecting that everything regarding his application would be taken care of by the Club, resulting in the Captain using Otone Field without the permission.

As described in 2.10.7, those intending to apply for the permission prescribed in the proviso of Article 79 of the Act must submit a written application describing "measures to prevent accidents." In its application for the permission described in 2.10.9, JMGC stated as these measures that "the Otone Field managing rules shall be strictly observed" (as described in 2.10.10 (1)). Considering that the Captain had not fully understood the contents, procedures and criteria concerning the permission as described in 2.10.9 and that he had not met the conditions stipulated in Article 3 of the managing rules for the use of Otone Field (as described in 2.10.10 (1)), it is somewhat likely that the Captain did not fully understand the contents of the managing rules.

Those performing takeoffs and landings at a Permitted Places for Takeoff/Landing must correctly understand the contents of the application for the permission prescribed in the proviso of Article 79 of the Act and the criteria for the permission and be committed to flight safety management at their own responsibility.

In addition, as the statement of the Captain described in 2.1.1 (1), on the day of the accident, he started preparing for the flight without visiting Manager A. At any Permitted Place for Takeoff/Landing where its manager is allocated, it is desirable for pilots to exchange information with the manager before flight, as having such an opportunity would enable pilots to gain any information that may contribute to flight safety and allow the manager to check that the pilots have the required permission for using the place.

3.10 Safety Management at Otone Field by the Japan Flying Association

As described in 3.9, pilots performing takeoffs and landings at a Permitted Place for Takeoff/Landing must be committed to flight safety management at their own responsibility. As described in 2.10.10 (1), the Japan Flying Association had been in charge of the management of Otone Field, having put in place rules for managing the field. As stated by Manager A described in 2.1.2 (1), Otone Field had been operated on a daily basis by JMGC.

3.10.1 Restrictions of Entry

Article 13 (Restrictions of entry) of the Otone Field managing rules, as described in 2.10.10 (1), stipulated that the manager may, when considers necessary for management purposes, restrict entry to the landing field or restrict acts of those who are allowed entry.

It is probable, however, that it was difficult for Manager A to recognize entry to Otone Filed of the Captain, who did not visit the clubhouse, and that it was also difficult to realize a flight by the

Captain, who did not hold the permission for Otone Field stipulated in the proviso of Article 79 of the Civil Aeronautics Act.

3.10.2 Restricted Area

Article 14 (Restricted area) of the Otone Field managing rules stipulates that no one shall enter any of the restricted area that the management may set up in the field. Article 17 (Prohibited Acts) of the rules stipulates that no person shall be permitted to enter landing strips, taxiways or aprons with no specific aim. It is probable that in order to secure the safety of the workers in conformity to the relevant standards in the Aeronautical Information Procedures Manual described in 2.10.8, Manager A established the restricted area stretching 13 m from the long sides of the runway as shown in Figure D so that the workers would not protrude above the transitional surfaces.

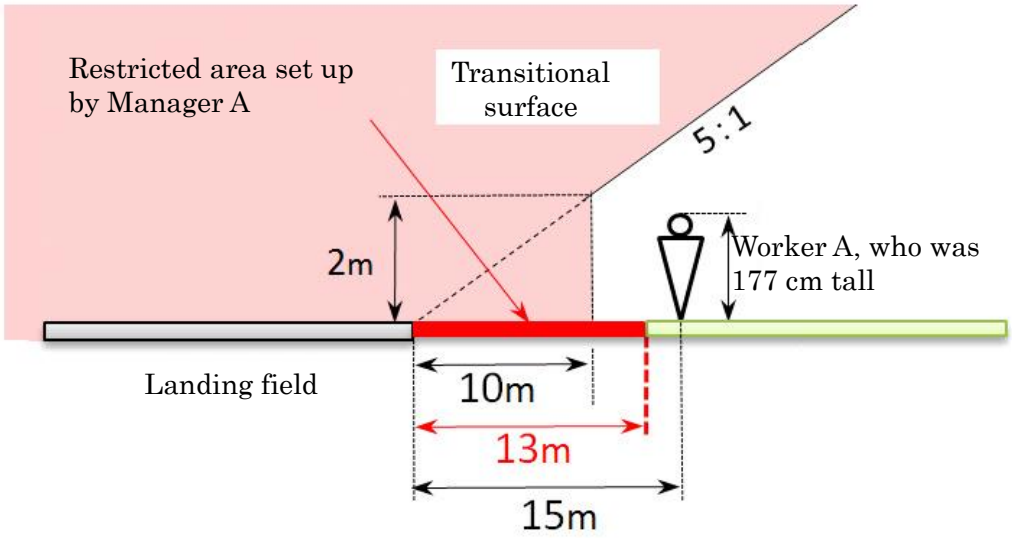


Figure D Restricted Area and Worker A's Position

3.10.3 Sharing the Operational Precautions

It is probable that, as described in 2.10.10 (2), Manager A had a meeting with Operation Supervisor and Site Leader, telling them about the establishment of the restricted area along the long side of the runway stretching 13 m away from the runway, to watch operation of the aircraft while working and never turn their back against aircraft, and to share these instructions with the other workers. According to the statements of Operation Supervisor and Site Leader as described in 2.1.2 (3) and (4), it is probable that these instructions were conveyed to the workers properly.

3.11 Workers' Awareness of Potential Dangers

Among instructions from Manager A, regarding "the restricted area," it is probable that safety cones were placed to clearly mark the restricted area as described in 2.10.10 (2), and that Site Leader kept properly reminding the workers about the restricted area as described in 2.1.2 (4). Based on this, it is probable that the workers were adequately aware of "the restricted area."

Regarding the instructions of "watching operation of aircraft while working and never turn their back against aircraft while mowing grass," according to the statements of Operation Supervisor and Site Leader described in 2.1.2 (3) and (4), it is probable that these instructions were conveyed to the workers. However, considering that Operation Supervisor did not organize a general briefing gathering all workers to explain the operational precautions according to the statement of Operation Supervisor as described in 2.1.2 (3), and that Site Leader thought that it would be sufficient to watch

aircraft as much as possible according to the statement of Site Leader as described in 2.1.2 (4), it is somewhat likely that these messages were not strong enough to convince the workers that caution was demanded and they should keep aware of the takeoff or landing aircraft at all times.

3.12 Personal Protective Gear Used by the Workers

As described in 2.10.11, a total of seven workers were mowing grass on the south side of the runway when the accident occurred. Two of the workers were from a local construction company and were wearing personal protective gear including protective helmets, protective glasses and whistles. On the other hand, the other five workers including Worker A from the event planning company were not wearing any protective gear.

It is probable that Manager A did not provide any advice to Operation Supervisor or Site Leader on the need to wear personal protective gear, thinking that working outside the restricted area would be safe, and that safety management of the workers from the event planning company should be taken care of by the company itself.

It is considered probable that Operation Supervisor and Site Leader did not instruct to wear personal protective gear and the other workers did not voluntarily wear them because they thought that the grass mowing operation was safe since the work site, although near aircraft traffic, was outside the restricted area specified by Manager A, and they themselves did not feel personal protective gear was necessary for this operation.

3.13 Involvement of Passenger A

Reflecting on such facts, that Passenger A did not touch the rudder controls or the control yoke throughout the flight as described in 2.1.1 (2), that Passenger A's involvement in the control maneuvers of the Aircraft was not mentioned in the comments made by either the Captain or the other passengers, and that Passenger A's advice was limited, it is highly probable that Passenger A's words and actions did not have any influence on the flight by the Captain.

According to the statement of Passenger A and Passenger B described in 2.1.1 (2) and (3), Passenger A took the right front seat just before boarding because Passenger A was requested to provide advice to the Captain on flying skill by Passenger B. Since Passenger A is a private pilot and was not an instructor on the flight, there had been no prior discussions including on possible takeover for controlling the Aircraft. It is therefore probable that there was not even a tacit agreement between Passenger A and the Captain on an instructor-trainee relationship. As Passenger A had felt no danger in the way the Captain controlled the Aircraft from takeoff to touchdown, it is highly probable that Passenger A had not thought about the possibility of the Aircraft veering off the runway after touchdown, and that the leftward veering of the Aircraft on the runway began so suddenly that it was not possible to take corrective action. Considering the time course of the Aircraft lifting and taking a steep nose-up attitude and the subsequent steep rightward rolling following its deviation from the runway, it is highly probable that it was difficult for Passenger A to take corrective action or take over the control of the Aircraft as these events happened in a short period of time.

3.14 Specified Pilot Competency Assessment System

As described in 2.10.12, in 2011 the Captain attended the guidance session on the amendments (Specified Pilot Competency Assessment System and Aviation Medical Certification System) to the Civil Aeronautics Act. It is therefore considered probable that the Captain had been striving to improve his knowledge and competence. When this accident occurred, the Captain had not

yet received the Equivalent Assessment for the system, which was to be come into force about one year and seven months later.

The oral examination of the assessment covers “the subjects of recent changes” and “the knowledge and learning to be regularly reviewed.” For pilots planning to fly, receiving the assessment every two years should provide them with sufficient opportunities to acquire the latest information including on aviation laws and regulations and incorporate it in their knowledge gained so far. The practical examination covers a broad range; starting from "confirmation before departure", the verification of flying skill about takeoff/landing, go-around, other maneuvers, and also, some oral questions regarding the judgment for such as aborted takeoff.

Based on the above, it is probable that the system helps improve the competency of pilots in general, which leads to contributing to preventing aircraft accidents and other serious incidents attributable to pilot errors and helps enhance aviation safety accordingly.

4. CONCLUSIONS

4.1 Summary of Analysis

(1) It is highly probable that the Captain started the Aircraft without confirming its weight and the location of the center of gravity among the matters prescribed in the Civil Aeronautics Act, initiating the flight although the Aircraft on the condition in excess of the operating limitations specified by the Act.

It is somewhat likely that the excess of operating limitations concerning the weight and the location of the center of gravity had an adverse effect on the characteristic and maneuverability of the Aircraft. (3.4)

(2) It is probable that the Aircraft bounced on the first touchdown because the flare was delayed or the amount of flare was not sufficient.

It is probable that the Aircraft veered to right of the runway centerline after the ensuing landing. (3.5)

(3) It is probable that the Captain tried to move the throttle lever to full open while correcting the direction of the ground roll of the Aircraft with the left rudder, which did not follow the standard touch and go procedure. As a result, all the force interacted on the Aircraft, driving it to abruptly swerve to the left with strength. (3.6)

(4) It is probable that the Captain was made temporally and psychologically pressed at that time. It is probably because the Captain was so upset by the rapid leftward swerving of the Aircraft that the Captain could not take appropriate actions and then the Aircraft veered off the runway. The Captain could not decide to abort takeoff before the Aircraft veered off the runway. (3.6)

(5) It is probable that the Aircraft, after veering off the runway, became airborne and getting to lose the speed with excessive high pitch. It is probable that the Captain operated the Aircraft to make it roll to the deep right with nose-down attitude, struck Worker A.

It is probable that Worker A, focused on the grass mowing, did not notice the Aircraft to approach and was struck. (3.7)

(6) It is probable that the Captain acquired basic flying techniques;however, it is possible that the Captain did not have well-established capability to successfully handle in such

the situations as something unexpected happened to him or something made the Captain temporally and psychologically pressed. (3.8)

(7) Those performing takeoffs and landings at Permitted Places for Takeoff/Landing must correctly understand the content of the application for the permission prescribed in the proviso of Article 79 of the Act and the criteria for the permission and be committed to flight safety management at their own responsibility.

At any Permitted Place for Takeoff/Landing where its manager is allocated, it is desirable for pilots to exchange information with the manager before flight, as having such an opportunity would enable pilots to gain any information that may contribute to flight safety and allow the manager to check that the pilots have the required permission for using the place. (3.9)

(8) It is probable that it was difficult for Manager A to realize a flight by the Captain, who did not hold the permission for Otone Field stipulated in the proviso of Article 79 of the Civil Aeronautics Act.

It is probable that Manager A, in order to secure the safety of the workers and in conforming to the relevant standards in the Aeronautical Information Procedures Manual, establish the restricted area, and that Manager A had a meeting with Operation Supervisor and Site Leader and explained the precautions for grass mowing operation and told them to share these instructions with the other workers. (3.10)

(9) It is probable that the workers were adequately aware of "the restricted area." Regarding the instructions of "watching operation of the aircraft while working and never turn their back against aircraft," it is somewhat likely that these messages were not strong enough to convince the workers that they should keep aware of aircraft at all times. (3.11)

(10) When the accident occurred, the workers from the event planning company were not wearing any protective gear. It is probable that Manager A thought that working outside the restricted area would be safe, and that safety management of the workers from the event planning company should be taken care of by the company itself. It is probable that Operation Supervisor and Site Leader did not instruct to wear personal protective gear and the other workers did not voluntarily wear them because they thought that the grass mowing operation was safe since the work site, although near aircraft traffic, was outside the restricted area, and they themselves did not feel personal protective gear was necessary for this operation. (3.12)

(11) It is highly probable that Passenger A did not have any influence on the flight by the Captain, and that it was difficult for Passenger A to take corrective action or take over the control of the Aircraft as these events happened in a short period of time. (3.13)

(12) It is probable that Specified Pilot Competency Assessment System should contribute to preventing aircraft accidents and other serious incidents attributable to pilot errors and help enhance aviation safety accordingly. (3.14)

4.2 Probable Causes

It is highly probable that in this accident, the Aircraft veered off the runway at Otone Field during a touch and go attempt, striking a worker who was mowing grass.

With regard to the deviation of the Aircraft from the runway, it is highly probable that it was because the Captain moved the throttle lever to full open for takeoff concurrently with operating the left rudder to correct the direction of the landing roll, and that the Captain's maneuver was caused the aircraft to abruptly swerve to the left, which is the characteristic of the single-engine propeller airplane with a propeller rotating clockwise, and that the Captain could not take appropriate corrective actions.

With regard to the Captain's failure to correct the deflection of the aircraft, it is somewhat likely that the Captain was upset by the bouncing and other factors after the ensuing landing. In addition, it is somewhat likely that the Captain did not have well-established capability to successfully handle in such the situations as something unexpected happened to him or something made the Captain temporally and psychologically pressed.

Moreover, it is somewhat likely that the weight and the location of the center of gravity, which were both beyond the operating limitations, had an adverse effect on the characteristic and maneuverability of the Aircraft.

4.3 Other Safety Information

Compliance with the Civil Aeronautics Act is essential to secure aviation safety. The Act must be fully abided by whenever flying an aircraft. However, the Captain failed to meet the requirements in the following three respects:

1. He started the Aircraft without confirming the weight and the location of the center of gravity as stipulated in the "confirmation before departure" section of the Act.
2. He flew the Aircraft when it was beyond the operating limitations.
3. He had conducted takeoffs and landings at Otone Field without the relevant permission.

5. SAFETY ACTIONS

5.1 Safety Actions Taken

5.1.1 Safety Actions Taken by the Japan Flying Association

Following the accident, the Japan Flying Association integrated the managing rules and the flight operation rules for Otone Field into a single set of rules, the "Otone Field Management and Operation Rules." (The following are excerpts.)

4 - 1 (Restrictions of entry)
No person, except those permitted by persons boarding aircraft, maintenance workers or the management, shall enter the places (see Attachment 2) within the premises of the landing field that are designated by the management.

4 - 2 (Entry into areas near the landing field or its vicinities to prevent possible obstruction of flight operation)
No person shall enter areas surrounding the landing field during flight operation.
(See Figure 6 – Otone Field Management and Operation Rules: Attachment 2)

Following the accident, the Japan Flying Association installed fences along the borders of the restricted areas described above to clarify the specific area. In addition, shrub zones were established between the runway and the taxiway as shown in Figure 6 to secure a runway shoulder

zone, which was then designated as the restricted area. Entry into this area is permitted for grass mowing and other activities only upon no aircraft flying with securing the radio communication between the management and the workers.

5.1.2 Actions Taken by the Civil Aviation Bureau

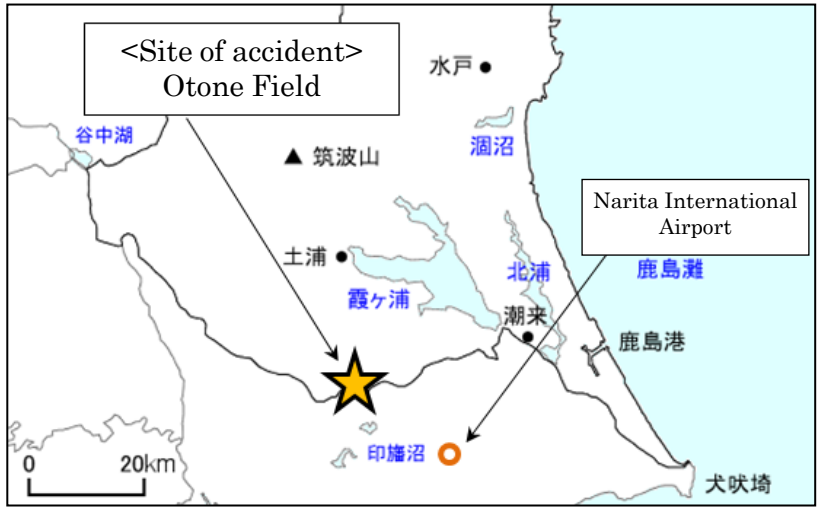
(1) Since it became obvious that takeoffs and landings without relevant permissions were conducted due to inadequate handling of the permit application procedure, the Civil Aviation Bureau ordered the management of the Otone Field to confirm the permission status for all aircraft and pilots involved at the Otone Field, and found them with no omission.

(2) Following this accident, the Civil Aviation Bureau also ordered the other landing fields allocating the management like Otone Field to conduct a similar verification above as the Otone Field did, and the Bureau also found them with no omission.

(3) The Civil Aviation Bureau presented examples of accidents and the web site of the Japan Transport Safety Board to the manager of landing fields conducting of management equivalent to aerodrome and such, and aroused their attentions to exercise close supervision at the fields and enhance their awareness of aviation safety there.

(4) The Civil Aviation Bureau informed the Regional Civil Aviation Bureaus and Airport Administrative Offices about the measures which the Otone Field management took to prevent recurrence, and the Civil Aviation Bureau extensively directed that they should supervise the management of other landing fields to offer the guidance in reference to the actions which Otone Field implemented.

Figure 1 Marks Left at the Accident Site



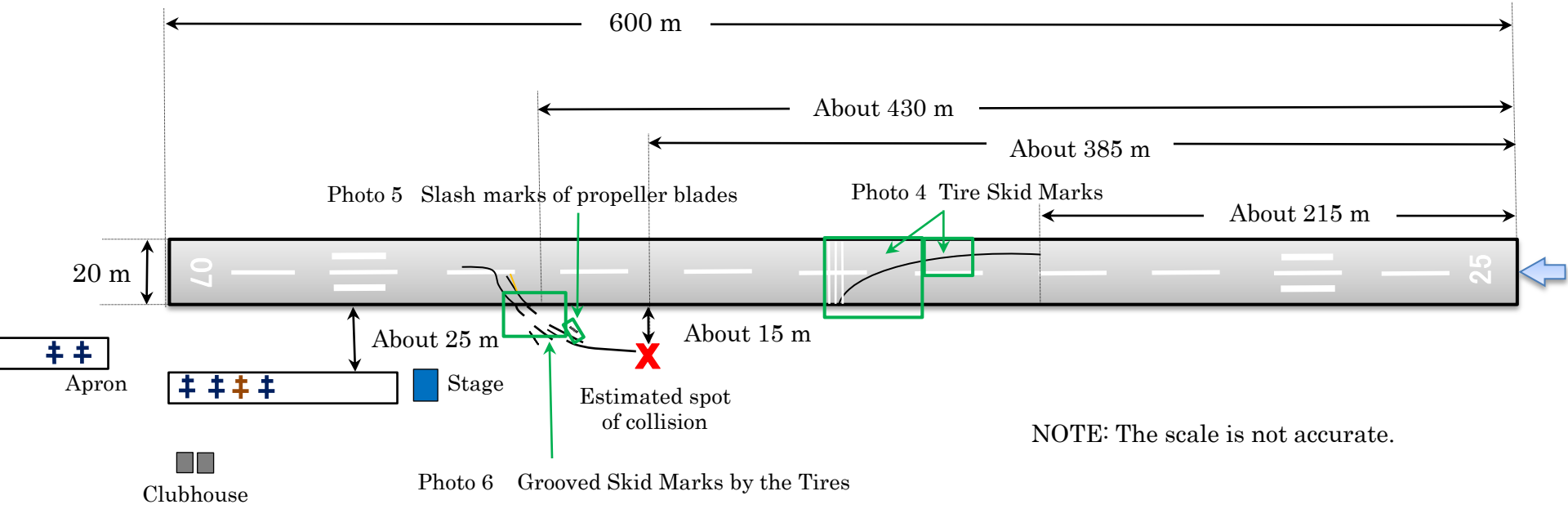
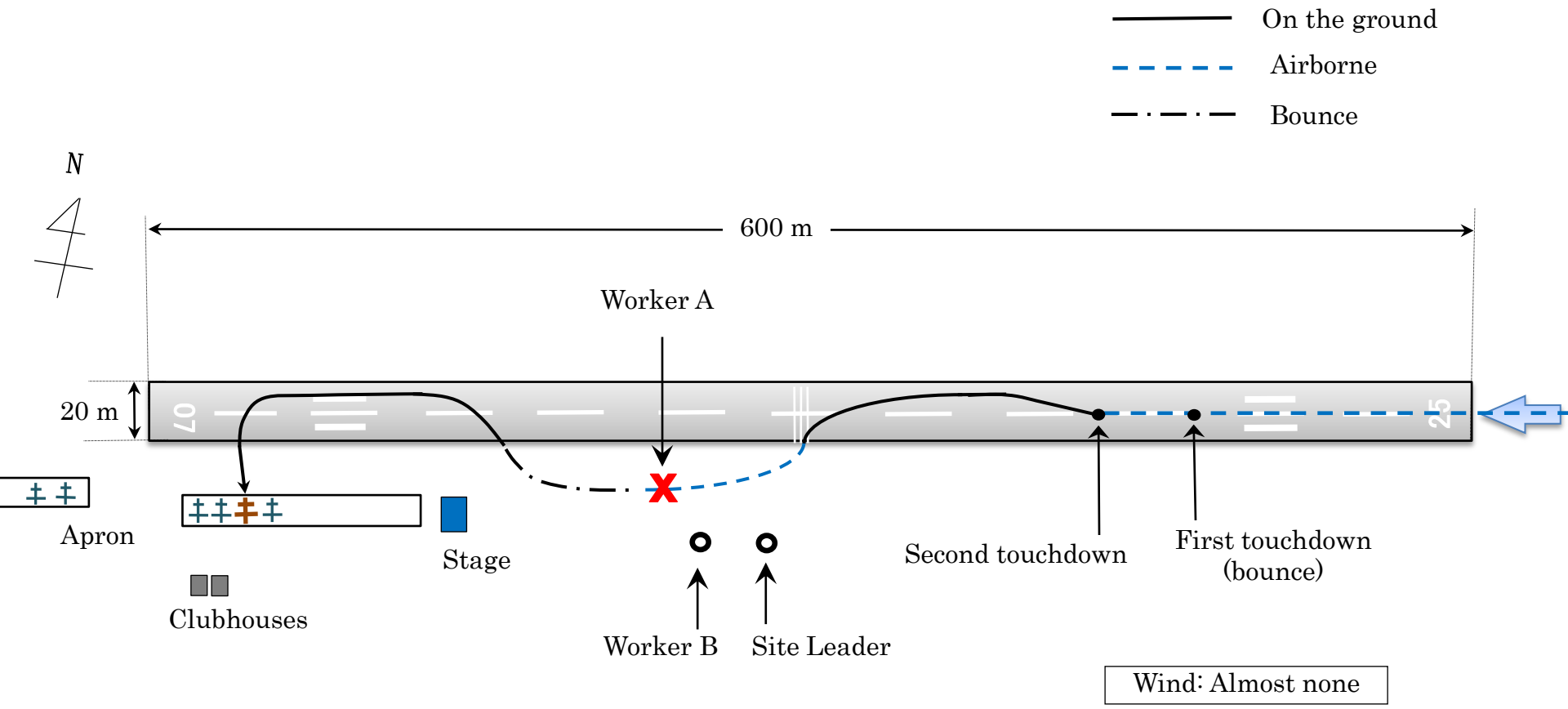


Figure 2 Estimated Flight Course and Ground Roll Track



The positions of Worker A, the Site Leader and Worker B are estimations. The figure is not to scale.

Figure 3 Weight and Balance Calculations

Weight and location of center of gravity at landing

Item	Weight (lb)	Arm (in)	Moment (in・lb)
Tare	1,545	40.5	62,573
Fuel 45.7 gal	270	48	12,960
Oil 6.0 qt	(Included in tare)		
Captain (left front seat)	132	37	4,884
Passenger A (right front seat)	137	37	5,069
Passenger B (left rear seat)	143	73	10,439
Passenger C (right rear seat)	148	73	10,804
Cargo	0	95	0
Total at landing	2,375	44.9	106,729

Weight and location of center of gravity at takeoff (Only the fuel is different from the above tab

Fuel 50.0 gal	296	48	14,208
Total at takeoff	2,401	45	107,977

*Specific gravity of fuel: 5.915 (lb/gal) <Specific gravity of the fuel taken from the Aircraft, corrected to temperature of 30°C>

Fuel at landing
Fuel discharged after the accident
173.2 l = 45.7gal

Fuel at takeoff (gal)
45.7 + 4.3 = 50.0

Flight phase	Required fuel (gal)
From taxi to takeoff	1.1
Climb to 1,500 ft	0.6
Flight of about 10 min	2
Descent	0.6
Total	4.3

Weight and location of center of gravity with Captain and Passenger B on board and the same fuel qu

Item	Weight (lb)	Arm (in)	Moment (in・lb)
Tare	1,545	40.5	62,573
Fuel 45.7 gal	270	48	12,960
Oil 6.0 qt	(Included in tare)		
Captain (left front seat)	132	37	4,884
Passenger B (left rear seat)	143	37	5,291
Cargo	0	95	0
Total at landing	2,090	41	85,708

Figure 4 Captain's Flight Records for 2012

Date	Aircraft	Place of departur	Place of arrival	Number of landings	Flight time	Cross-country flight	Captain*	Dual instruction*	Passenger in right front seat
8-Jan	(Piper)	Otone	Otone	1	0:40			○	
15-Jan	JA3814	Otone	Otone	3	0:30			○	
19-Feb	JA3814	Otone	Otone	3	0:45			○	
26-Feb	JA3814	Otone	Otone	5	0:55			○	
25-Mar	JA3814	Otone	Otone	4	1:00			○	
1-Apr	JA3814	Otone	Otone	1	1:55	1:55		○	
29-Apr	JA3814	Otone	Otone	3	0:25			○	
29-Apr	JA3814	Otone	Otone	4	0:40			○	
11-Jun	JA3814	Otone	Oshima	1	0:55	0:55		○	
11-Jun	JA3814	Oshima	Otone	1	1:20	1:20		○	
17-Jun	JA3814	Otone	Otone	1	0:50		○		Passenger B
23-Jun	JA3814	Otone	Otone	1	1:50	1:50	○		Passenger B
24-Jun	JA3814	Otone	Fukushima	1	1:20	1:20		○	
24-Jun	JA3814	Fukushima	Otone	1	1:15	1:15		○	
30-Jun	JA3814	Otone	Oshima	1	1:00	1:00	○		Passenger B
30-Jun	JA3814	Oshima	Otone	1	0:55	0:55	○		Passenger B
15-Jul	JA3814	Otone	Otone	1	1:43	1:43	○		Passenger B
22-Jul	JA3814	Otone	Otone	5	1:10		○		Passenger B
30-Jul	(Piper)	Otone	Oshima	1	1:05	1:05		○	
30-Jul	(Piper)	Oshima	Otone	1	0:50	0:50		○	
11-Aug	JA3814	Otone	Otone	3	1:00		○		Passenger B
Total				43	22:03	14:08			

*The ○ mark in the "Captain" and "Dual instruction" columns is indicating the Captain's flight status on each flight referring to his log book.

Figure 5　Three Angle View of Cessna 172N Ram

Unit: m

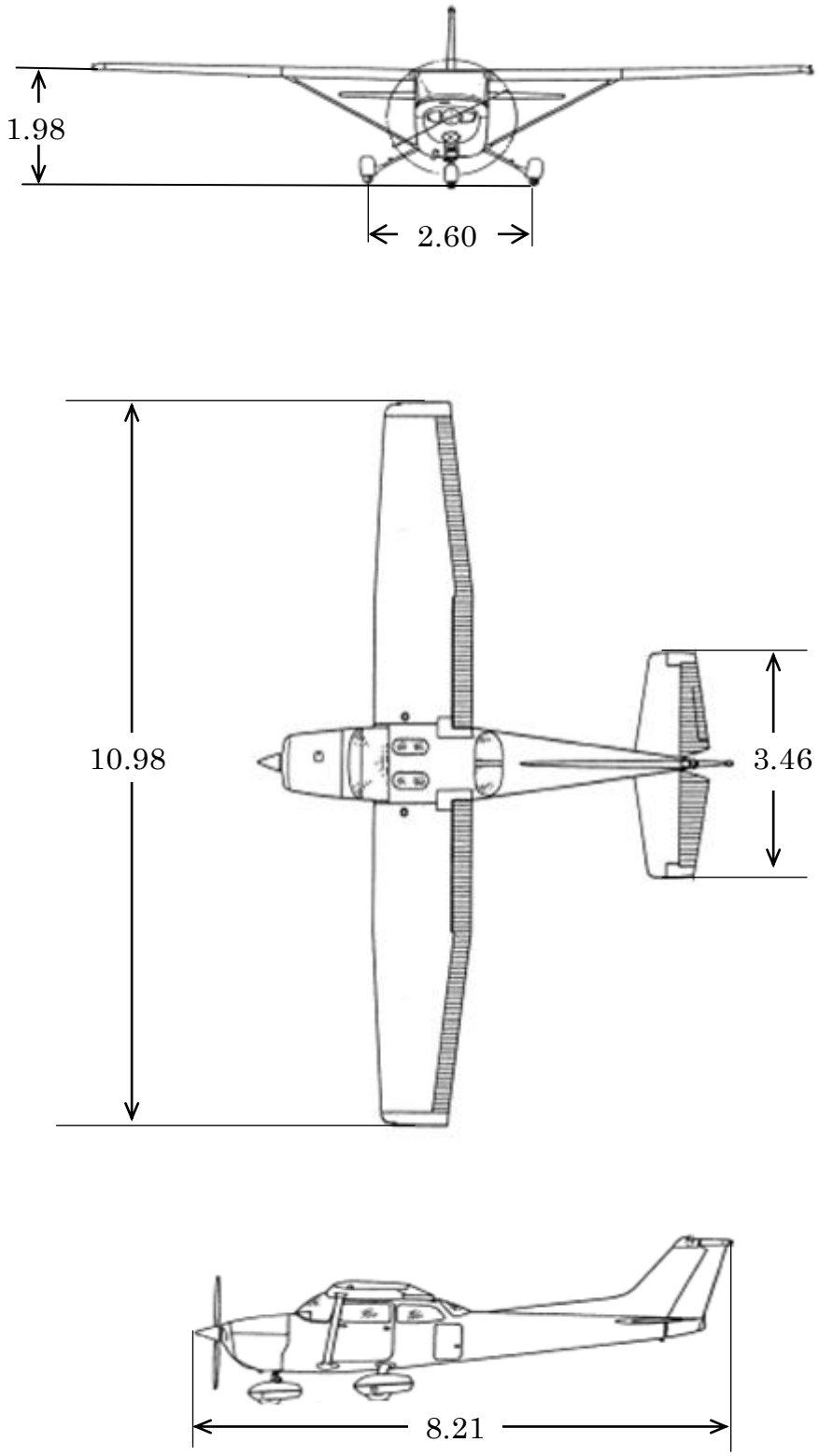
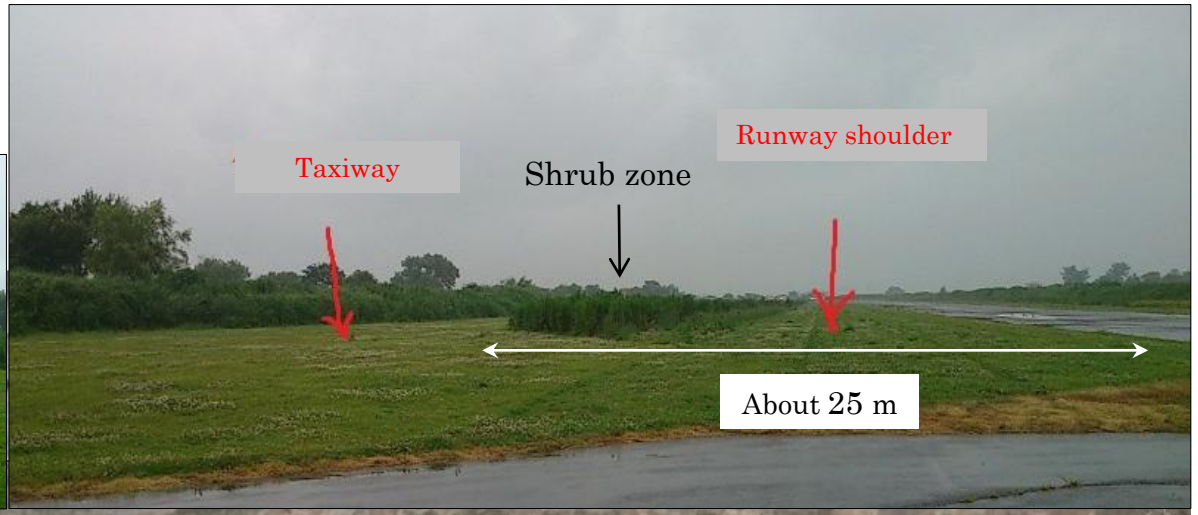


Figure 6 Otone Field Management and Operation Rules: Attachment 2

NOTE: Supplemented with photos and descriptions

Attachment 2

Otone Field no-entry area



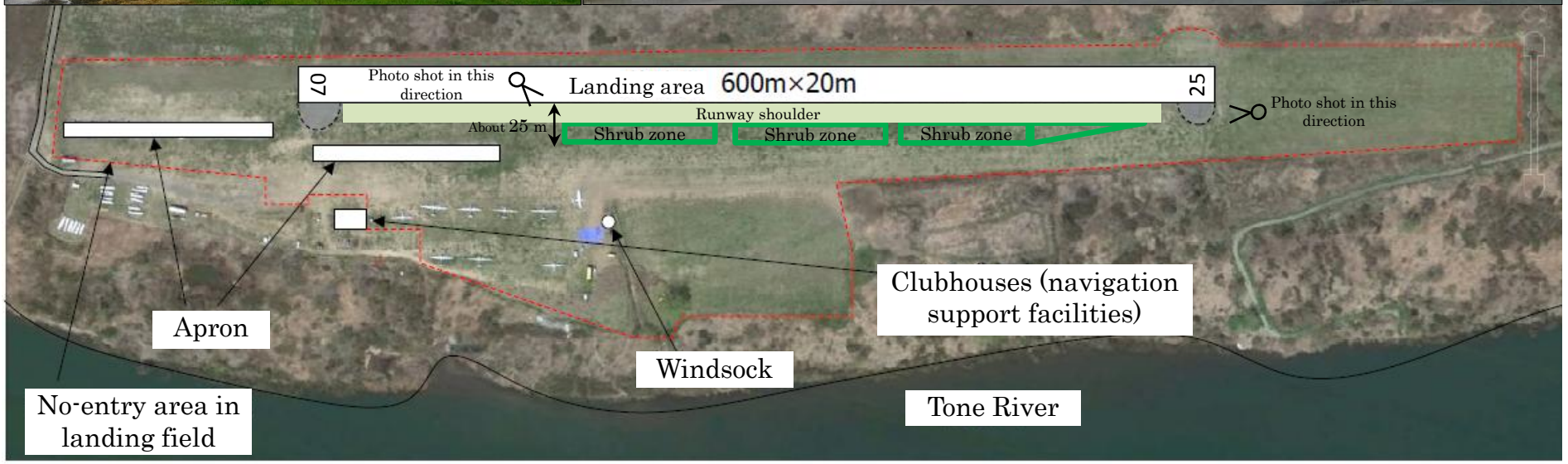
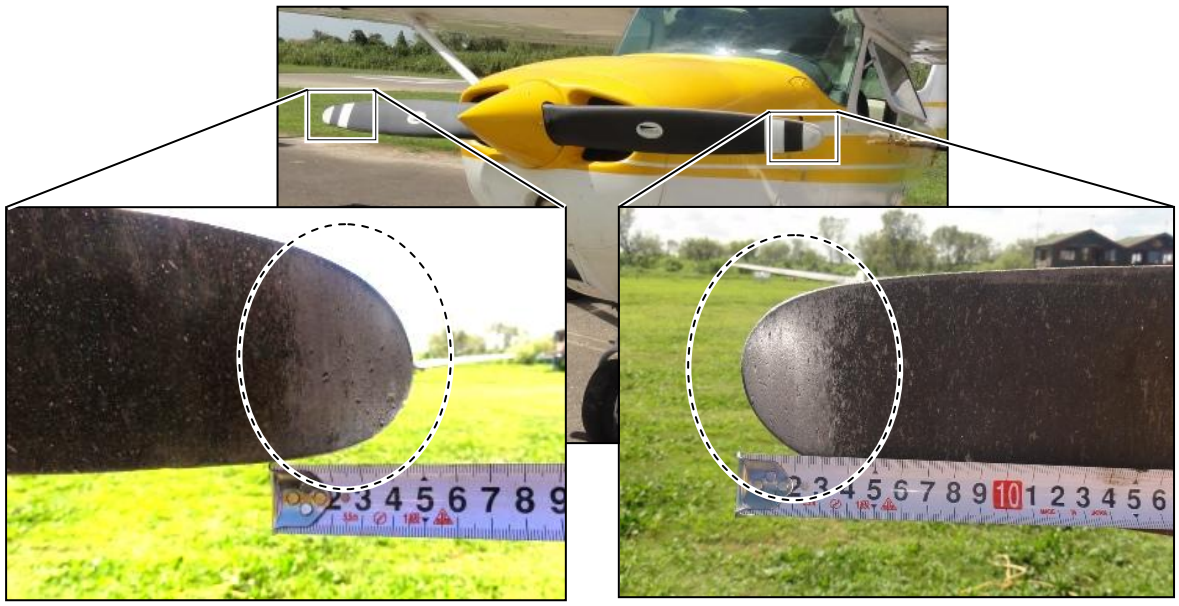


Photo 1　Accident Aircraft

Photo 2　Scratch Marks on the Propeller Blades



(Rear sides of the blades)

Photo 3　Damage to the Right Wing

Photo 4　Tire Marks on the Runway

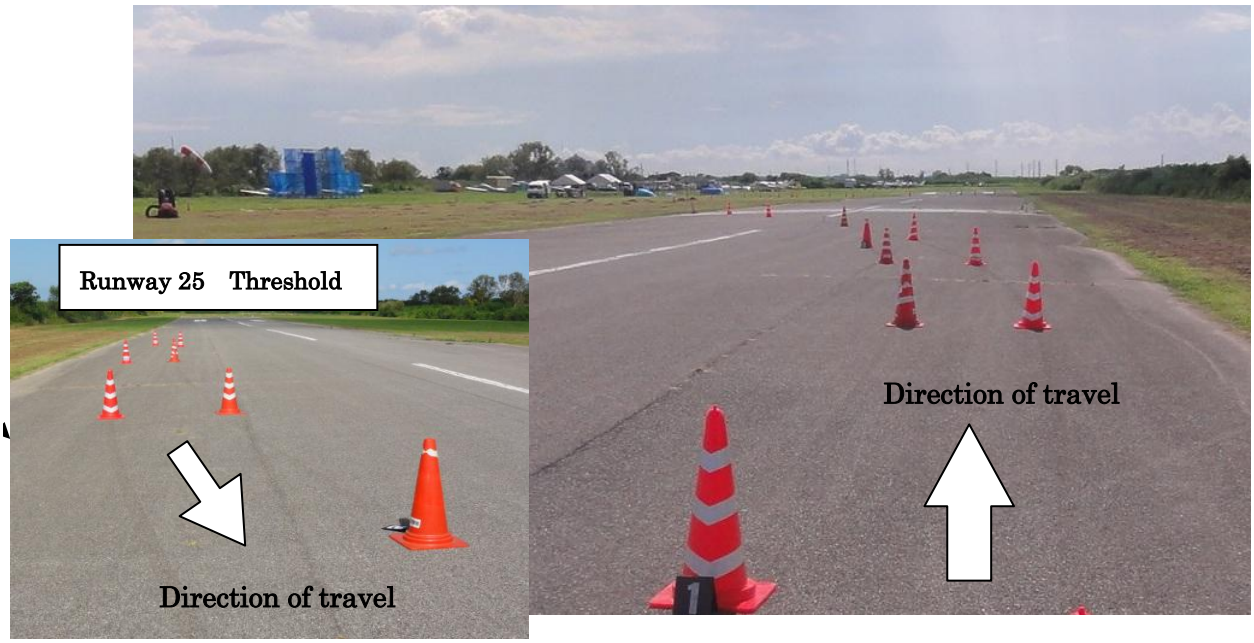


Photo 5　　Slash Marks of the Propeller Blades on the Grass Area

Photo 6　　Grooved Skid Marks by the Tires on the Grass Area