

AA2012-7

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

HONDA AIRWAYS CO., LTD.

J A 3 3 U K

September 28, 2012



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

DAMAGE DURING LANDING
HONDA AIRWAYS CO., LTD.
CESSNA 172S, JA33UK
ON THE RUNWAY, KUMAMOTO AIRPORT
AT 13:14 LOCAL TIME, MARCH 24, 2011

August 24, 2012

Adopted by the Japan Transport Safety Board

Chairman	Norihiro Goto
Member	Shinsuke Endoh
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Yuki Shuto
Member	Toshiaki Shinagawa

SYNOPSIS

Summary of the Accident

On Thursday March 24, 2011, a Cessna 172S, registration JA33UK, operated by Honda Airways Co. Ltd., took off from Kumamoto Airport for a solo flight. The airplane was damaged when it bounced during the landing at the airport.

A student pilot on board the airplane suffered no injury.

The airplane was damaged; however, no fire broke out.

Probable Causes

It is very likely that the airplane bounced upon landing followed by a nose-low hard contact with the runway resulting in damage of propeller blades and fuselage structure.

The student pilot's possible pushing of the control wheel or failure to apply back elevator pressure resulted in the nose-low contact with the runway upon the second settling.

1. PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary

On Thursday March 24, 2011, a Cessna 172S, registration JA33UK, operated by Honda Airways Co. Ltd., took off from Kumamoto Airport for a solo flight. The airplane was damaged when it bounced during the landing at the airport.

A student pilot on board the airplane suffered no injury.

The airplane was damaged; however, no fire broke out.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On March 25, 2011, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and one investigator to investigate this accident.

1.2.2 Representative of the Relevant State

An accredited representative of the United States of America, as the State of Design and Manufacture of the airplane involved in this accident participated in the investigation.

1.2.3 Implementation of the Investigation

March 26, 2011 On-site and airplane investigation, interviews.

1.2.4 Comments From Parties Relevant to the Cause of the Accident

Comments were obtained from parties relevant to the causes of the accident.

1.2.5 Comments From the Relevant State

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

2. FACTUAL INFORMATION

2.1 History of the Flight

A Cessna 172S, registration JA33UK, operated by Honda Airways Co. Ltd.*¹, took off from Kumamoto Airport with a student pilot on board for solo flight at 12:24, March 24, 2011.

The outline of the flight plan was as follows:

Flight rules: VFR

Departure aerodrome: Kumamoto Airport

Estimated off-block time: 12:15

Cruising speed: 105 kt

Cruising altitude: VFR

Route: KS1-3*²

Destination aerodrome: Kumamoto Airport

Total estimated elapsed time: 1 hr

Fuel load expressed in endurance: 4 hr

Persons on board: 1

The history of the flight up to the accident was summarized as follows according to the statements of the student pilot, the flight instructor in charge (FIIC), the flight instructor of the day (FIOD) as well as an air traffic controller.

a. The student pilot

On the day of the accident, the FIOD was in charge of the solo flight checkride for the student pilot. The FIOD granted him solo flight for air maneuvers.

The student pilot took off from the airport at 12:24 and returned there via Kiyama visual reporting point. He entered the base leg for runway 07 south traffic pattern. He set the flaps FULL DOWN on the mid-final at 75 kt. The runway threshold airspeed was 71 kt. He retarded the throttle to IDLE for touchdown, but the airplane sank suddenly, landed harder and bounced high. The sudden sink was an unexpected one. The height of bounce was as high as that of his past experience so that he continued landing procedures and applied the back elevator pressure for soft touchdown.

The airplane bounced again, this time higher. He executed a

*¹ The company provides flight training to the students of Aerospace Systems Engineering Department, Sojo University as in accordance with the contract with the university. The student pilot is a student of the university.

*² KS1-3 is one of the Civil Training and Testing Areas, published in the AIP JAPAN with pertinent information—coordinates and designated altitudes, etc.

go-around to avoid follow-on nose-low attitude. He didn't recall the onset of stall warning.

He advanced throttle to the maximum power, established a climb attitude and retracted the flaps to 20°. He found the primary flight display (PFD^{*3}) blacked out, and heard unusual sound from the engine or propeller, accompanied by unusual vibration. He felt uneasy and called the FIOD over the radio and told "Emergency, PFD is out." When the student pilot was on the north downwind, the PFD came on. He informed the FIOD of its recovery.

After receiving the landing clearance he landed on the runway 07 at 13:19. The post-flight check found the bent propeller blade tips.

He recalled his first roundout^{*4} had been executed within usual height range; and he had held the control column during the touchdown after the second bounce, with no push-pull movement of the column.

The FIIC pointed out that the student pilot had a tendency of premature roundout with larger pitch-up attitude. The FIIC instructed him to get visual cues for proper roundout timing through repeated landings on the same runway.

He taught him that a possible tail strike would occur at the pitch attitude of 12° to 13°; however, he didn't as to the pitch attitude for nose-low contact with the runway.

Recovery instructions from a porpoise^{*5} or ballooning^{*6} given to the student pilot were to execute an immediate go-around.

b. FIIC

He instructed the student pilot to initiate a roundout at 10 m above ground level (AGL), level the pitch attitude at 4 m AGL, and round out according to the sink. He taught that a possible tail strike will occur at the pitch attitude of 12° to 13°.

The FIIC asked the FIOD to:

- (1) Check the student pilot's present landing skills because he hadn't flown since the previous checkride; and

^{*3} PFD (Primary Flight Display)—A display which provides information on pitch, roll, heading and course as well as altitude, airspeed and rate of climb/descent.

^{*4} Roundout—A slow, smooth transition from a normal approach attitude to a landing attitude, gradually reducing the rate of descent for gentle settling on the runway.

^{*5} Porpoicing—A condition where an improper recovery of bounce landing develops into the motion in which the airplane comes in nose first, setting off a series of motions that imitate the jumps and dives of a porpoise.

^{*6} Ballooning—A condition where a roundout done too rapidly stops descent and the airplane starts to climb.

- (2) Confirm that he no longer had the tendency of high roundout*⁷. If not, confirm he could apply corrective adjustments. If he could land without fail, grant him solo flight training for air maneuvers.

c. FIOD

The FIOD was asked by the FIIC to evaluate the student pilot's skill through repeated landing practices, and if he was successful, grant him solo air maneuvers, because the exclusive use of the training area was limited time-wise.

The first landing exhibited the student pilot's tendency of high roundout, as his evaluation paper stated, when the power was reduced in front of the runway threshold. The FIOD instructed him to hold pitch attitude and correct the timing of power reduction. The FIOD confirmed that he could apply corrective adjustments against would-be high roundout with FIOD's suggestions.

An ATC controller directed the airplane to do a short-field approach and landing during the second circuit. The FIOD confirmed that the student pilot had no experience of this type of landing. The FIOD decided to fly the airplane to show how to do it and handed back the control to the student pilot before entering the final because the student pilot was not good at the final approach. The student pilot demonstrated his competitiveness and made a safe landing as the FIOD had instructed.

The third landing was a normal approach. His intention was to deny the solo flight if the student pilot failed to demonstrate the correction of the pointed-out problems. The flight was done safely and satisfactorily so that the FIOD granted him solo flight.

The FIOD stayed in the flight operations room after seeing him off. He monitored the student pilot's whereabouts from entering the training airspace to the report over the visual reporting point at Mifune by hearing radio transmissions. The FIOD was attending other student pilot so that he didn't see the student pilot's final approach and following go-around.

The FIOD heard the radio transmissions between the student pilot and the ATC. The student pilot responded he executed the go-around due to quick and abrupt sink against the ATC's inquiry about reason of the go-around.

The student pilot reported the FIOD of the emergency. The FIOD was informed of the PFD black-out and instructed him to level-off the airplane and maintain the level attitude. Soon the student pilot reported the

*⁷ High roundout—A condition where a roundout is initiated too high from the runway or too rapidly.

recovery of the PFD. The FIOD instructed him to land and taxi into the ramp. He went to the ramp to find no unusual conditions of the airplane.

d. ATC controller

The ATC controller logged 13:14 as the airplane's first landing time after returning from the training area; however, he didn't see the detail due to his location far away from the touch-down point. The landing following the go-around took place at 13:19.

The accident occurred on the runway 07, Kumamoto Airport (32° 50' 14" N, 130° 51' 19" E) at 13:14.

(See Figure 1: Estimated Flight Route, Photo 1: Accident Airplane)

2.2 Injuries to Persons

Nobody suffered injuries.

2.3 Information on Damage to the Airplane

2.3.1 Extent of Damage

Substantial

2.3.2 Damage to the Airplane Components

- a. Fuselage: Damaged
- b. Propeller: Damaged

2.4 Personnel Information

a. Student pilot (Male, Age 21)

Flight training certificate (airplane):	Tou-Ji-Sou 202
Validity:	until June 29, 2011
Total flight time:	32 hr 15min
Flight time in the last 30 days:	11 hr 15 min
Solo flight time:	1 hr 30 min
The number of landings:	149
The number of landings in solo flight:	8

b. FFIC (Male, Age 58)

Airline transport pilot certificate (Airplane):	January 25, 1995
Flight Instructor certificate (Airplane):	August 16, 1975
Validity:	until July 24, 2011
Total flight time:	13,303 hr 07 min

Flight time in the last 30 days:	24 hr 50 min
Total time as flight instructor:	9,835 hr 53 min
Time as flight instructor in the last one year:	141 hr 21 min
Total flight time on the type of aircraft:	7,450 hr 45 min
Flight time in the last 30 days:	24 hr 50 min
c. FIOD (Male, Age 56)	
Commercial pilot certificate (airplane):	April 5, 1979
Rating	
for single engine airplane (land):	April 5, 1979
for multi engine airplane (land):	March 10, 2008
Flight instructor certificate (airplane):	July 11, 1995
Class 1 aviation medical certificate	
Validity:	until November 9, 2011
Total flight time:	6,376 hr 25 min
Flight time in the last 30 days:	13 hr 45 min
Total time as flight instructor:	1,048 hr 23 min
Time as flight instructor in the last one year:	149 hr 20 min
Total flight time on the type of aircraft:	338 hr 40 min
Flight time in the last 30 days:	13 hr 45 min

2.5 Aircraft Information

2.5.1 Aircraft

Type:	Cessna 172S
Serial number:	172S10939
Date of manufacture:	April 2, 2009
Certificate of airworthiness:	Tou-22-477
Validity:	until December 15, 2011
Category of airworthiness:	Airplane, Normal N or Utility U
Total flight time:	566 hr 27 min
Flight time since last periodical check (100-hr Check on March 14, 2011):	20 hr 56 min
(See Figure 2: Three Angle View of Cessna 172S)	

2.5.2 Weight and Balance

When the accident occurred, the airplane weight was estimated to have been 2,033 lb and the center of gravity (CG) was estimated to have been 41.8 in. aft of the reference line, both within the allowable ranges (the maximum landing weight of 2,550 lb and the CG range of 35.8 to 47.3 in. corresponding to the weight at the time of the accident).

2.6 Meteorological Information

Aeronautical weather observations recorded at the airport around the time of the accident were as follows:

13:00 Wind direction 330°, Wind velocity 5 kt
directional fluctuation 250°-010°
Visibility 10 km or more
Clouds: Amount FEW, Type Cumulus, Cloud Base 4,000 ft,
Amount BKN, Type and Cloud Base Unknown,
Temperature 10 °C, Dew point -6 °C
Altimeter setting (QNH) 30.20 inHg

2.7 Information on Accident Site and Airplane Damage Description

2.7.1 Accident Site

The runway measures 3,000 m long by 45 m wide with 60 m-long paved overruns on either end. Outer end of the overrun is grass area. The runway direction is 07/25.

Two propeller scratch marks (85 cm apart) were found at the point 625 m from the runway 07 end. The airplane tire marks (made at the first touchdown) were not identified due to countless tire marks made by other airplanes.

2.7.2 Detailed Damage Description

a. Fuselage

The fire wall near the nose strut attaching points were buckled and distorted with loosened or uprooted rivets. The forward lower skin and forward portion of the cockpit floor were buckled and distorted.

b. Propeller blades

Of the two blades, one blade tip was bent rearward (70 mm from the tip), the other blade tip chipped away (10 mm from the tip).

c. Control system

Rearward shift of control wheel neutral point caused by the distortion of the fuselage lower portion restricted the elevator UP travel.

2.8 Attitude Which Causes a Nose-Low Contact With the Runway

With the nose oleo strut⁸ fully compressed, the angle between the ground and the line connecting the bent tip of the blade and the point where the nose tire meets the ground is 17.2°. This means that a nose-low attitude of 17.2° is necessary for the propeller blades to contact the runway.

(See Figure 3: Nose-low Angle Needed for Propeller Blades to Touch the Runway Surface, Photo 2: Propeller Contact Marks, Photo 3: Damaged Propeller Blades)

⁸ Oleo strut—An air-oil hydraulic shock absorber used in the landing gear of aircraft.

2.9 Airplane Flight Manual

Landing and go-around procedures are stipulated in Chapter 4 Normal Operation, the Airplane Flight Manual as follows:

Landing

Normal landing

1. *Airspeed: 65-75 KIAS (Flaps UP)*
2. *Flaps: as required (UP-10°: less than 110 KIAS, 10°-FULL: less than 85 KIAS)*
3. *Airspeed: 60-70 KIAS (Flaps FULL)*
4. *Elevator trim: adjust*
5. *Touchdown: with main gears*
6. *Landing roll: lower the nose gear gently*
7. *Brake application: minimum*

(Omitted)

Go-around

1. *Throttle: Maximum power (fully advanced)*
2. *Flaps: 20°*
3. *Climb airspeed: 60 KIAS*
4. *Flaps: 10° (after clearing obstacles), then UP (after reaching the safe altitude and 65 KIAS)*

2.10 Training and Evaluation

2.10.1 Evaluation

Student pilot's tendencies pointed out by the FIIC were as follows:

The student pilot tended to start a premature roundout leading to reduced airspeeds resulting in a premature stalled landing.

2.10.2 FIIC's Instruction for Roundout and Touchdown Operation

According to his statement he instructed the student pilot to:

- a. Maintain airspeed and angle of approach to the runway, reduce the power to IDLE 150-200 m in front of the aiming point marking, initiate roundout 10 m AGL, establish level attitude at 4 m AGL, and land on the marking rounding out proportionate to the airplane's downward motion; and
- b. Acquire a visual cue for proper roundout timing through repeated landings on the same runway.

2.10.3 Countermeasure Against Porpoise

The company's recovery policy from a porpoise was to execute a go-around upon bouncing to prevent repeated ones. Emphasis was on the quick decision of a go-around.

2.10.4 Flight Training Manual

3.5 Landing

3.5.1 Normal landing

a. Objective

To have a student pilot acquire proper and safe landing skills.

b. Parameters

Flap 30°

Air speed Base: 75 kt (FLAP 20°)

Final: 70 kt (FPAP 30°)

TTS (threshold target speed): 65 kt

c. Procedures

(1) Approach (Base to Final)

(a) Lower the flaps to 20° and maintain 75 kt. Start turning with 20° bank (30° maximum), roll out properly to align the airplane with the runway centerline.

(b) If the longitudinal axis of the airplane is not aligned, adjust the alignment with minimal bank angle.

(c) Use ground cues to align the airplane to the runway.

(d) Lower the flaps to 30° and maintain 70 kt. Control descent angle with power adjustment.

(e) Cross runway threshold at desired height and airspeed.

(2) Roundout

(a) Slowly reduce power to IDLE at 20 ft AGL maintaining runway alignment.

(b) To counter the nose-down tendency accompanied by power reduction, apply smooth back elevator pressure.

(c) Rotate the airplane depending on sink to establish level pitch attitude at 10 ft and maintain it.

(3) Touchdown

(a) In an ideal touchdown, a proper landing attitude is established and main gears touch the ground at stall airspeed.

(b) At this moment the wings support half of the airplane weight while the landing gears do the rest. The whole weight shifts to

landing gears as the speed of the landing roll decreases.

(c) Allow the nose gear to settle on the ground while the elevators are effective.

(d) Aggressive back pressure may cause a floating or bouncing.

(4) Landing roll

(a) Apply aileron inputs as much as they are necessary to keep wings level and maintain direction by rudder input while the nose gear is still in the air.

(b) Apply both brakes evenly after the settlement of the nose gear.

(c) Aggressive application of brakes to the extent of the locked wheels should be avoided. Avoid continually applied brakes.

d. Safety tips

(1) Stabilized angle of approach

(2) Awareness to changing circumstances such as wind shift and wind shear

(3) Roundout

(4) Power control

(5) Gentle settlement of the nose gear

(6) Rolling on the runway center line

(7) Procedures after the touchdown

(8) Application of brakes

(9) Exit the runway at taxiing speed.

(3.5.2-3.5.6: omitted)

3.5.7 Go-around

a. Objective

To have a student pilot acquire skills to climb to a safe altitude after the decision to abort the landing by the touchdown.

b. Parameters

Power setting: Max

Pitch attitude: 10°

c. Procedure

(1) Go-around decision

(2) Callout "Go-around"

(3) Apply maximum power and establish 10° pitch attitude. Apply forward pressure on the control wheel to counter rising airplane nose accompanied by maximum power input, roughly retrim.

(4) After confirming arrested sink, set flaps at 20° to climb at V_x (56

kt).

(5) After reaching 200 ft, establish normal climb altitude at 60 kt, retract flaps and increase airspeed to V_y (74 kt).

d. Safety tips

(1) Take a rough trim for stabilization to counter strong nose-up tendency accompanied with maximum power input.

(2) Fly above the stall speed.

(3) Avoid steep bank. Maintain wing level until reaching safe altitude.

(4) Maintain pitch attitude when flaps are retracted.

(5) Shift attention to outside after establishing stabilized attitude.

Reference 1 (Omitted)

*Reference 2 The recovery from *ballooning or bouncing*

a. When heights are low

(1) Maintain heading

(2) Round out depending on airspeed.

b. When heights are medium and more

(1) Maintain heading

(2) Establish pitch level attitude

(3) Go-around

** In case of ballooning or bouncing, hold then attitude. Lowering nose for recovery will cause another bouncing developing into a porpoising.*

Reference 3 (Omitted)

2.10.5 Safety Criteria for Solo Flight

Company's Kumamoto office established the safety criteria for solo flight as follows, which includes screening procedures, knowledge, skills and experience needed for a student pilot.

3. Flight

a. A student pilot shall have checkrides with more than two instructors (preferably a chief instructor inclusive).

b. The checkride precedes the first solo flight.

c. In case of no flight training within a week, a student pilot shall have a checkride before the solo flight.

d. Until a student pilot accumulates three solo flights, a flight with an instructor is mandatory for the next solo flight.

- e. *A solo flight shall be supervised by a designated instructor (preferably the FIIC).*

(Omitted)

5. *Knowledge, skills and experience needed for a student pilot*

a. *Confirmation of knowledge*

An instructor shall grant solo flight after confirming that a student pilot is knowledgeable on the following:

- (1) *Operational limit, fuel consumption rate and endurance time of the airplane;*
- (2) *Terrain features and obstacles around an airport;*
- (3) *Procedures for exit from and entry into the traffic pattern;*
- (4) *Alternate airports;*
- (5) *Procedures in case of lost position;*
- (6) *Procedures for radio failure;*
- (7) *The airplane CG at takeoff and landing;*
- (8) *Flight rules under VFR (right of way, weather conditions, minimum safe altitude, etc.);*
- (9) *Specific look-out procedures; and*
- (10) *Training area information and necessary precautions such as avoiding built-up areas for stall training.*

b. *Flight skill confirmation*

An instructor shall grant solo flight after confirming that a student pilot is capable of:

- (1) *Taking off and landing in a safe manner;*
- (2) *Executing a safe go-around during landing;*
- (3) *Executing an emergency gear-down when instructed to do so (when flying a retractable gear airplane);*
- (4) *Performing emergency procedures;*
- (5) *Flying with proper look-outs;*
- (6) *Flying with proper understanding of the using airspace; and*
- (7) *Establishing radio communications with necessary parties.*

c. *Confirmation of experience*

An instructor shall grant solo flight after confirming that a student pilot has experience of:

- (a) *NO-FLAP and FULL-FLAP landing;*
- (b) *Crosswind landing;*
- (c) *POWER-OFF landing and simulated forced landing; and*
- (d) *Recovery from stall.*

3 ANALYSIS

3.1 Certificates

The Student pilot held a valid flight training flight certificate.

The FIIC and the FIOD held valid airman competence certificates and valid aviation medical certificates.

3.2 Certificate of Airworthiness

The airplane had a valid airworthiness certificate and had been maintained and inspected as prescribed.

3.3 Influence of Wind

As stated in 2.6, wind was 330° at 5 kt with directional fluctuations of 250°-010°, as observed at 13:00. The element of right cross wind to using runway 07 and directional fluctuation probably gave the student pilot a feeling of unexpected sudden sink.

3.4 Developments of the Accident

3.4.1 Up to the Runway Threshold

The student pilot probably established faster final speed—75 kt against 70 kt, and threshold speed—71 kt against 65 kt, as the FIIC had pointed out premature airspeed reduction deriving from the student pilot's tendency to rotate more than necessary during roundout.

3.4.2 The First Touchdown

The student pilot was instructed to land on the aiming point marking. He probably landed beyond the marking due to the left crosswind and tailwind effects as the wind was 330° at 5 kt with directional fluctuations of 250°-010°.

It is probable that the following elements all combined resulted in a bounce:

- a. Larger airspeed on final (75 kt against 70 kt);
- b. Effects of winds;
- c. Landing attitude not being established;
- d. Larger touchdown speed; and
- e. Sink rate.

3.4.3 The Second Touchdown

The student pilot stated that he had held the control wheel. As 70 mm inward bending of the blade tip needs at least 17.2° of pitch-down attitude, the student pilot

had possibly pushed the control wheel or failed to apply back elevator pressure to hold the pitch-down attitude, resulting in the nose-low contact with the runway.

Hard strikes of propeller blades very likely lead to the damage of fuselage structure.

3.4.4 Go-around

The student pilot stated that the height of the first bounce had been as high as that of his past experience so that he had continued landing procedures. He had been given instruction to execute a go-around upon bouncing. If he had done as instructed without hesitation, the accident could have been avoided.

The actual airplane damage at the time of the second bounce was very likely a dangerous one in terms of:

- a. Propeller blade tips being either bent or chipped off; and
- b. Restricted upward travel for elevators.

3.5 PFD Temporary Malfunction

In the absence of recurrent phenomena, the reason of the PFD black-out was not determined in the post accident examination.

3.6 Flight Training

The FIIC's instructions for the landing were to:

- a. Maintain airspeed and angle of approach to the runway, reduce the power to IDLE 150-200 m in front of the aiming point marking, start roundout 10 m AGL, establish level attitude at 4 m AGL and land on the marking; and
- b. Get visual cues for proper roundout timing through repeated landings on the same runway.

It is possible that the student pilot hadn't acquired the skills to meet the given instructions.

3.7 Measures of Recurrence Prevention

- a. It is necessary to develop teaching techniques to have student pilots acquire proper roundout height and touch-down attitude, and share them among instructors.
- b. As student pilots in early phase don't always acquire landing techniques, granting them solo flight needs to be cautious considering weather conditions and their preparedness.
- c. Flight training should be given to student pilots to give them decisiveness to execute a go-around through classroom and in-flight training to counter the

unexpected sink after passing over the runway threshold or bouncing after the first touchdown.

4 PROBABLE CAUSES

It is very likely that the airplane bounced upon landing, followed by a nose-low hard contact with the runway, resulting in damage of propeller blades and fuselage structure.

The student pilot's possible pushing of the control wheel or failure to apply back elevator pressure resulted in the nose-low contact with the runway upon the second settling.

Figure 1: Estimated Flight Route

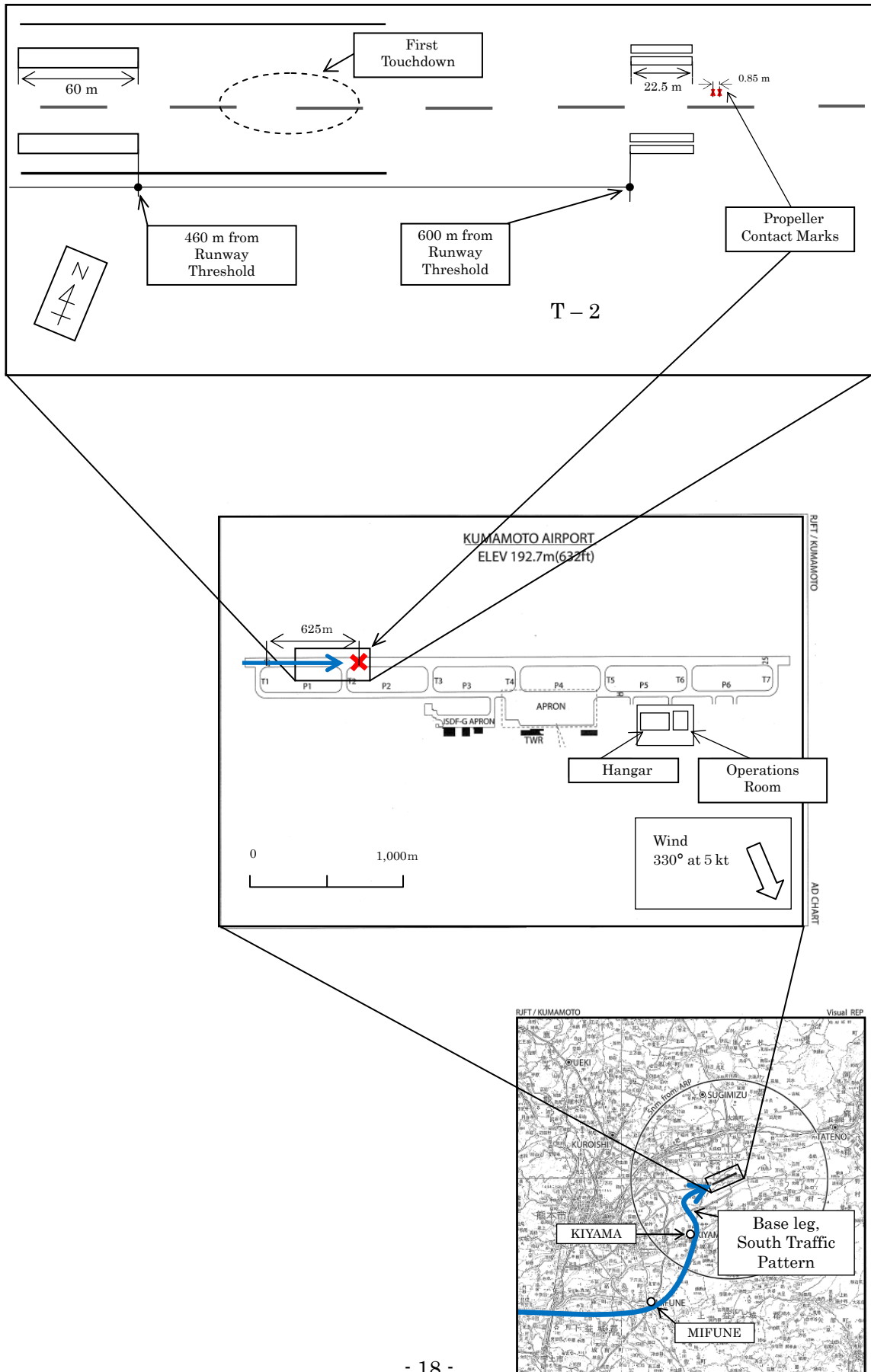


Figure2: Three Angle View of Cessna 172S

Unit : m

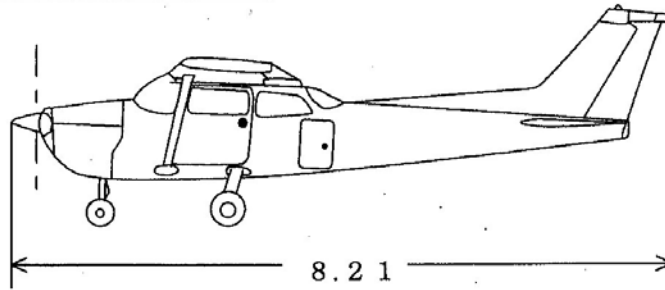
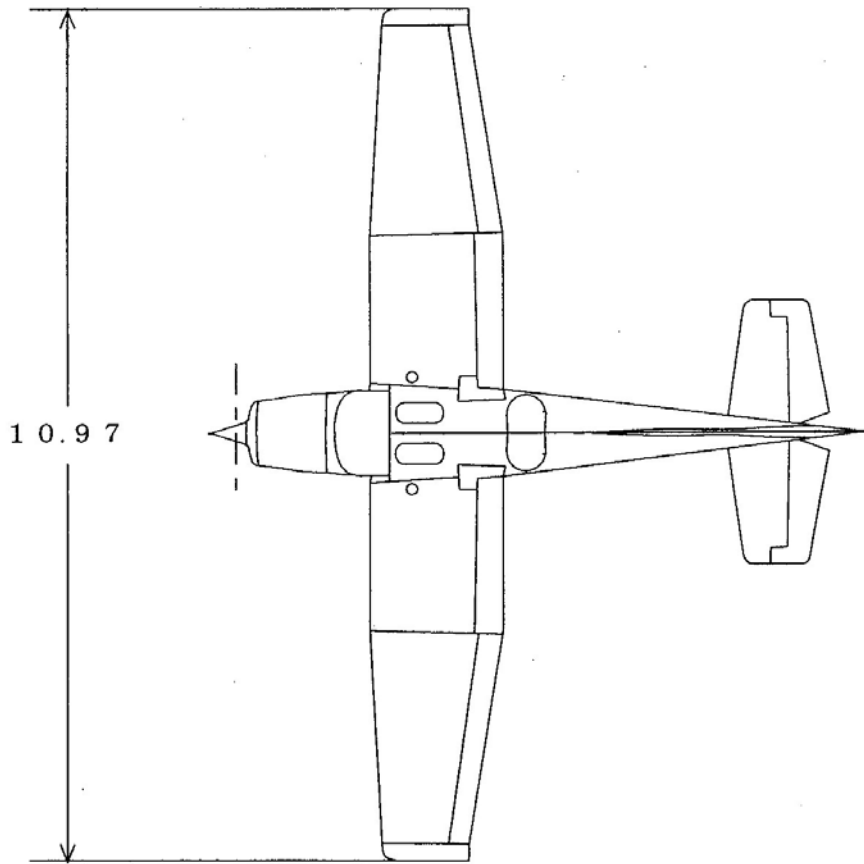
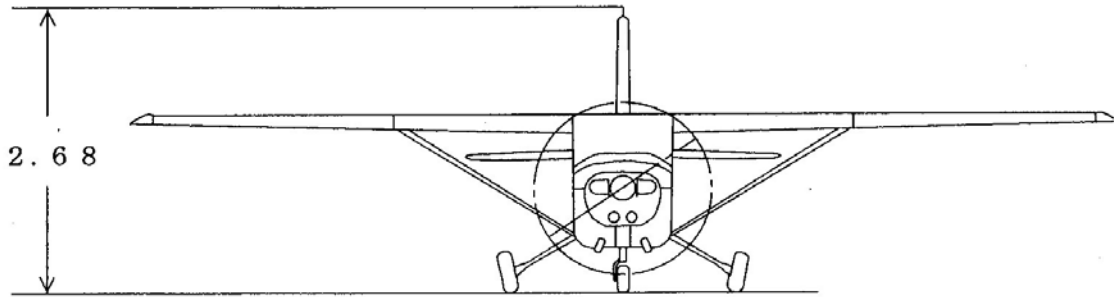
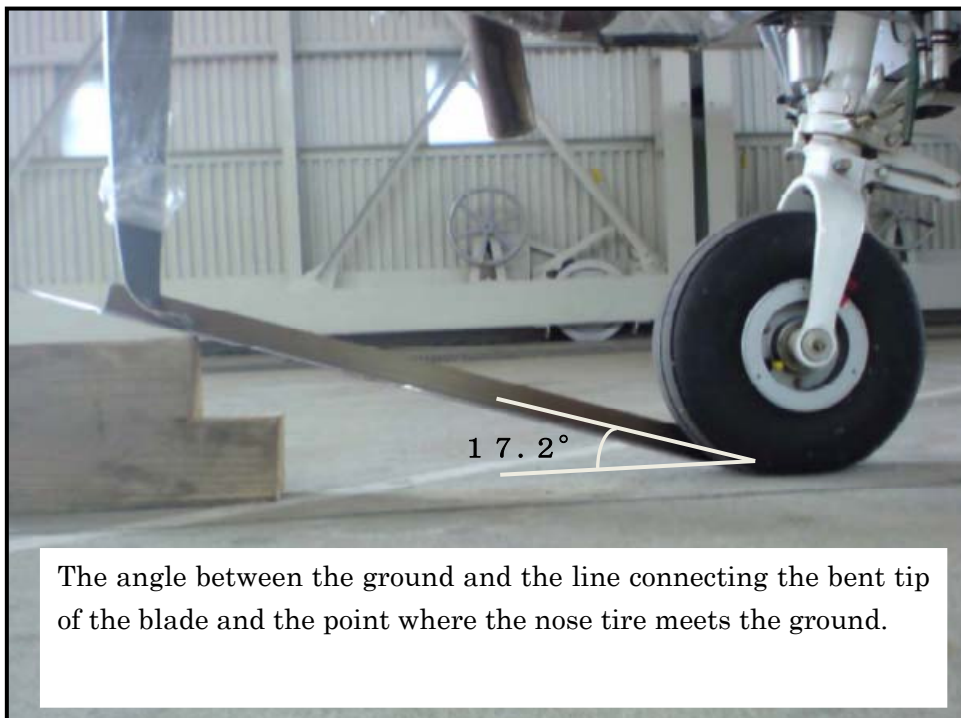


Figure 3: Nose-low Angle Needed for Propeller Blades to Touch the Runway Surface



Nose oleo dumper not compressed



Nose oleo dumper fully compressed

Photo 1 : The Accident Aircraft

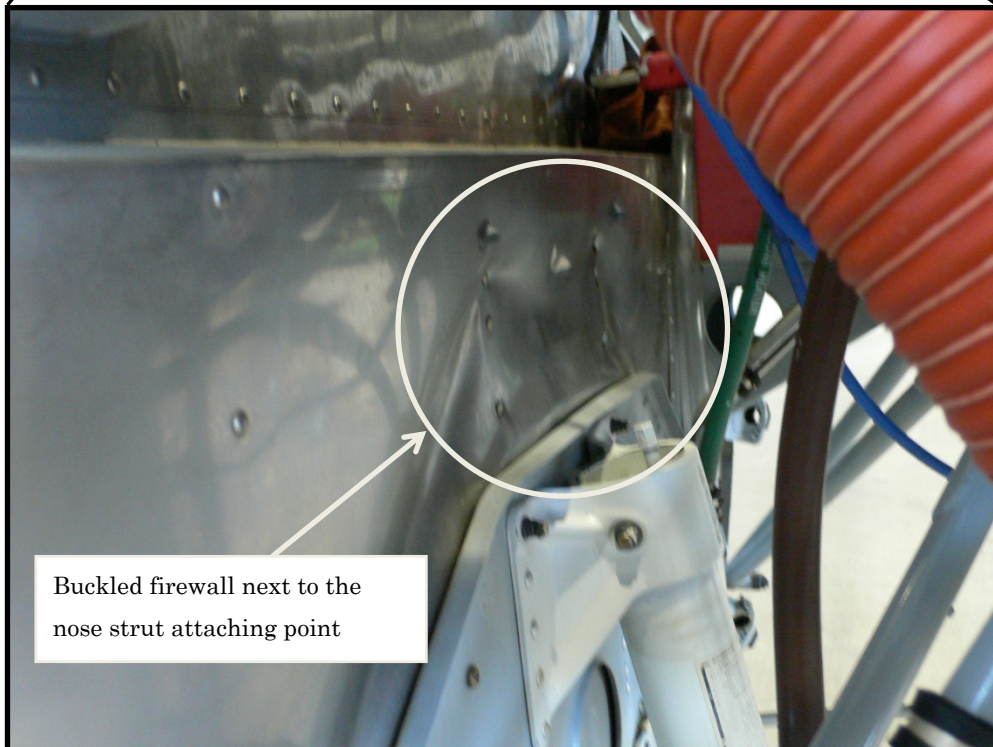


Photo 2: Propeller Contact Marks

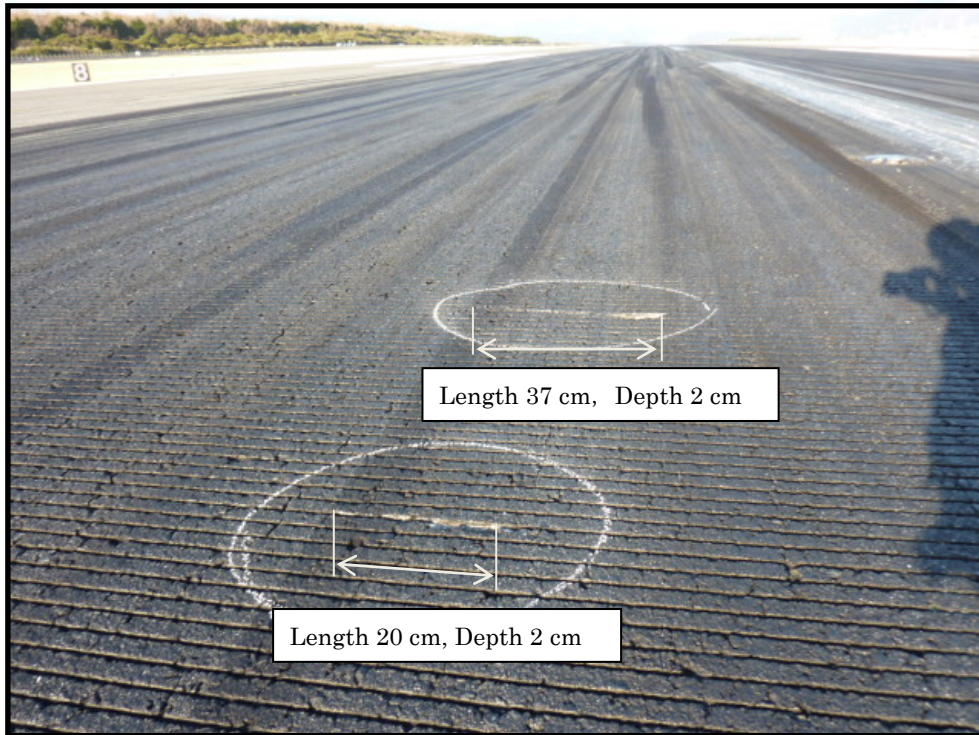


Photo 3: Damaged Propeller Blades

