AA2012-5

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

CIVIL AVIATION COLLEGE

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June 29, 2012

JTSB 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

CIVIL AVIATION COLLEGE
BEECHCRAFT A36, JA4167
IMMOBILE ON THE RUNWAY
ON RUNWAY AT MIYAZAKI AIRPORT, JAPAN
AT ABOUT 13:49 JST, NOVEMBER 5, 2010

May 25, 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

SYINOPSIS

<Summary of the Accident>

On November 5 (Friday), 2010, a Beechcraft A36, registerd JA4167, operated by the Civil Aviation College, took off from Miyazaki Airport for solo flight training at 13:09 Japan Standard Time (JST: UTC + 9hr, unless otherwise stated all times are indicated in JST on a 24-hour clock). The aircraft landed at Miyazaki Airport and then became immobile on the runway around 13:49.

There was one trainee pilot on board, who did not sustain any injuries.

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

<Probable Causes>

It is highly probable that the accident occurred as follows: the Aircraft bounced at touchdown, and subsequently fell into a state of porpoising without performing a go-around, eventually touched down with the nose gear severely hitting the runway first, sustained damage to the airframe and then became immobile on the runway.

Regarding the reason why the Aircraft bounced at touchdown, it is probable that, with the airspeed still slightly faster than it should have been after reducing the engine power to idle on passing the Runway Threshold, the Trainee judged that performing a flare in an ordinary manner under the circumstances would cause the aircraft to fly over the intended touchdown point and therefore he eased up on the flare. As a result, it is probable that neither airspeed nor rate of descent was reduced and the aircraft touched down with residual lift, which resulted in bouncing at touchdown due to the impact of the landing gear as it hit the runway.

As for the reason that the Trainee did not perform a go-around even after the Aircraft bounced, it is probable that he did not have the knowledge and skills that would have enabled him to perform a go-around without hesitation upon bounce.

<Recommendations>

○ REMARKS

In this accident, it is highly probable that, while doing a solo flight as part of the College's training program, the Trainee did not appropriately perform a flare to ensure the proper landing attitude at touchdown after passing the Runway Threshold for landing at Miyazaki Airport; as a result, the Aircraft bounced as the landing gear touched down, and subsequently, the Aircraft fell into a state of porpoising without performing a go-around, eventually touched down for the last time with the nose gear severely hitting the runway first, sustained damage to the airframe, and then became immobile on the runway.

At the College, following safety reports of Bouncing Events, preventative measures had been taken based on internal risk assessment. However, this accident occurred less than five months after the last of these bouncing events. Therefore, it is probable that the risk assessment and preventative measures undertaken at the College were not appropriate to address the unsafe events (those covered in the safety reports) that had occurred at the College.

Given the above, the College should take the following actions.

(1) The current risk assessment system should be improved so that it is implemented more appropriately.

(2) The education/training should be thoroughly conducted not to neglect the basics of touching down in the proper landing attitude and of performing a go-around without hesitation if it is not possible to maintain the proper landing attitude on touchdown (as in this “porpoising” accident).

(3) The safety education and the education/training on go-around that were provided after this accident should be repeated regularly in the future.

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Accident

On November 5 (Friday), 2010, a Beechcraft A36, registerd JA4167, operated by the Civil Aviation College, took off from Miyazaki Airport for solo flight training at 13:09 Japan Standard Time (JST: UTC + 9hr, unless otherwise stated all times are indicated in JST on a 24-hour clock). The aircraft landed at Miyazaki Airport and then became immobile on the runway around 13:49.

There was one trainee pilot on board, who did not sustain any injuries.

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

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On November 5, 2010, 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

November 6 and 7, 2010 On-site investigation, interviews, airframe examination and examination of relevant documents

1.2.4 Comments from 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 were invited from the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

On November 5, 2010, a Beechcraft A36 (hereinafter referred to as "the Aircraft"), registered JA4167, operated by the Civil Aviation College (hereinafter referred to as "the College"), took off from Miyazaki Airport for solo flight training with only a trainee pilot (hereinafter referred to as "the Trainee") on board.

The outline of the flight plan was as follows:

Flight rules:	Visual Flight Rules (VFR)
Departure aerodrome:	Miyazaki Airport
Estimated off-block time:	13:00
Cruising speed:	140 kt
Cruising altitude:	VFR
Route:	Kunitomi – Civil Training and Testing Area Kyushu No. 4 (hereinafter referred to as "the Training Area") - Arita - (Skipped)
Destination aerodrome:	Miyazaki Airport
Total estimated elapsed time:	2 h 50 min (for a total of 3 flights)
Fuel load expressed in endurance:	5 h 00 min
Persons on board:	1

The history of the flight up to the time of the accident is as outlined below according to Air Traffic Control (ATC) communications records and the statements of the Trainee, the alternate instructor, the instructor in charge and the air traffic controller at Miyazaki Airport.

2.1.1 History of the Flight Based on ATC Communications Records

13:09	The Aircraft took off from Miyazaki Airport for flight training in the Training Area.
13:44:00 – 09	The Aircraft reported to the Miyazaki Airport Traffic Control Tower (hereinafter referred to as "the Tower") that it had received airport information (the runway-in-use, weather information, etc.) and that it had reached a point (visual reporting point) 1,600 ft above Arita. The Aircraft then requested clearance for landing.
13:46:15	The Tower instructed the Aircraft to directly enter the base leg for Runway 09.
13:46:22	The Aircraft read back the instruction from the Tower.
13:46:45	The Aircraft entered the left-hand base leg for Runway 09.
13:46:50	The Tower reported to the Aircraft that, at Miyazaki Airport, the wind direction was 080° and wind velocity was 4 kt, and then cleared the Aircraft for landing on Runway 09.
13:46:55	The Aircraft read back the clearance for landing.

Around 13:49	The Aircraft landed on Runway 09 and then became immobile on the runway.
13:49:26	The Tower asked the Aircraft whether or not it could propel itself.
13:49:34	The Aircraft reported to the Tower that it could not propel itself and that the fuel valve was closed.
13:50:52	The Tower reported to the Aircraft that fire engines were on their way to the Aircraft.

2.1.2 Statements of Relevant Parties

(1) The Trainee

Around 12:00, the Trainee began preparing for the flight. He described to the alternate instructor the weather information, the Aircraft weight and balance, aeronautical information, etc, and then he conducted an exterior inspection of the Aircraft and found no problems. The Trainee had flown solo flight at Obihiro Airport, but never at Miyazaki Airport.

At 13:02, the Aircraft left the apron for takeoff. The preflight engine check was performed; consequently, the Aircraft took off from Runway 09. After flight training in the Training Area, the Aircraft reached a point 1,600 ft above Arita for landing at Miyazaki Airport where the Trainee contacted the Tower and was instructed by the Tower to directly enter the base leg for Runway 09. While the Trainee had never directly entered the base leg for Miyazaki Airport, he was nonetheless not worried because he had received about 12 hours of flight training from an onboard instructor at Miyazaki Airport and he had also observed direct entry into the base leg while sitting in the rear seat. According to airport information, there was a northeasterly wind with the velocity of 5 kt at Miyazaki Airport. The Trainee entered the base leg at an altitude of 1,000 ft and an airspeed of 90kt with the flaps at the approach position, the landing gear down, and an airspeed of 90 kt. He then received clearance to land from the Tower. The Trainee turned the Aircraft from the base leg, trying to line up onto the final leg with the 3° approach slope. However, the Aircraft overshot slightly from the intended course and the Trainee immediately made corrective maneuvers. At an altitude of 300 ft, the Trainee set the flaps fully down, confirmed that the airspeed was 90 kt, checked the approach path by the Precision Approach Path Indicator, and confirmed that the landing gear was down. At the threshold of Runway 09 (hereinafter "the Runway Threshold"), he set the engine to idle and initiated a flare*[1]. Feeling that the ground speed was slightly faster than normal, the Trainee made the flare less aggressive than normal in order not to fly over the touchdown point. He then confirmed that the main gear and then the nose gear touched down. After landing, the Trainee thought that the Aircraft would continue to roll; neverthless, the Aircraft suddenly lifted and, while the Trainee could not grasp what was going on, bounced a couple of times on the runway. The Aircraft then slowed down as its nose was skidding along the runway. The Trainee

*1 A "flare" maneuver is made immediately before touchdown in which the aircraft's nose is pulled up to reduce the airspeed and the rate of descent to help minimize landing impact.

did not make any major control while the Aircraft was bouncing. The Trainee had previously performed go-around maneuvers on his own judgment due to an incorrect approach path or premature initiation of flare. However, he had never experienced bounce. While the Trainee had received the lecture about porpoising*2, he could not understand why the Aircraft had lifted and did not see the need to perform a go-around.

After the Aircraft came to a stop, the Trainee shut off the fuel supply and turned off the ignition switch to prevent fires. Then, following the instructions from the alternate instructor transmitted over the radio, the Trainee shut off the power source and the generator, and exited from the Aircraft. The Aircraft showed no signs of a problem while flying.

The current touchdown zone marking at Miyazaki Airport was changed on October 17, 2010. The Trainee did not misunderstand the touchdown point because of the new marking.

(2) The air traffic controller (Ground Control)

While watching the Aircraft approach at the correct approach path, the air traffic controller felt that the airspeed was slightly faster than normal; therefore, he thought that the landing roll distance would be longer than normal. Soon after touchdown, he saw the Aircraft lift and thought that it would perform a go-around. However, the Aircraft's nose soon dipped. Sensing possible hazardous consequences, the controller prepared himself to make an emergency call using the crash phone*3. The Aircraft then made a second touchdown, on the nose gear and then the main gear. It then bounced up again, which pitched the nose up steeply. The Aircraft then appeared stalled with the nose down. The controller was now sure that this was going to be an accident. Soon after that, the Aircraft made a third touchdown on the nose gear first and then became immobile.

(3) The alternate instructor

The alternate instructor started his duties past 12 o'clock as a substitute for the instructor in charge. The alternate instructor confirmed that the Trainee had correctly performed the pre-flight check for solo flight and that the Trainee met the requirements on the solo flight check sheet, including physical conditions and knowledge and others. Based on this, the alternate instructor determined that the Trainee was fit for a solo flight. The alternate instructor then boarded the Aircraft with the Trainee to perform engine check. After confirming that there were no problems with the engine, the instructor exited the Aircraft.

In the operations administration building next to the apron, the alternate instructor watched with binoculars as the Aircraft made a stabilized approach. Before landing, he

*2 In "porpoising," the aircraft repeats a cycle of touchdown and lifting similar to bounce.

*3 The "crash phone" is an emergency call system connecting the tower directly to the airport fire department and all other relevant organizations.

felt that the flare was inadquate. He saw the Aircraft touching down a little more than 300 m beyond the Runway Threshold. In a normal landing, the main gear touches down first and the aircraft then keeps rolling in that attitude for a while. With the Aircraft, however, the nose gear touched down soon after the main gear did. The Aircraft then bounced without pitching nose up, as in porpoising, before making a second touchdown. The Aircraft then bounced again, made a third touchdown, and kept rolling on the ground before stopping near Taxiway N2. After confirming there was no outbreak of fire had started on the Aircraft, the alternate instructor contacted the Trainee to shut down the power source. Once before, the instructor had provided training to the Trainee while on board. At that time, the Trainee performed a stabilized flight.

(4) The instructor in charge

The instructor in charge provided the Trainee with 11 of a total of 12 instructor-on-board training flights conducted at Miyazaki Airport. The remaining flight was provided by the alternate instructor. The instructor in charge had other business to take care of on the day of the accident and therefore had asked the alternate instructor to take over from him as the instructor for the Trainee. The instructor in charge thought that the Trainee had been going through the training without any significant problems. Of the more than 30 landings that the Trainee had gone through with an instructor on board, he had never caused any bounce. In the pre-solo flight evaluation on the Trainee nine days before the accident, the instructor in charge determined that the Trainee was sufficiently competent for a solo flight.

While he believed that porpoising was likely to occur when a flare is not aggressive enough or the airspeed is excessive, the instructor had never provided specific guidance as to what actions to take or the criteria for initiating a go-around when facing porpoising. The flight training devise at the College is not capable of reproducing porpoising.

The accident occurred around 13:49 on the runway at Miyazaki Airport (Latitude 31°52'36"N, Longitude131°26'35"E).

(See Figure 1 – Estimated Flight Path, Photo 1 – Accident Aircraft)

2.2 Injuries to Persons

There were no injuries or deaths.

2.3 Damage to the Aircraft

2.3.1 Extent of Damage

The Aircraft sustained substantial damage.

2.3.2 Damage to the Aircraft Components

(1) Fuselage: Damaged
(2) Propeller: Bent blades
(3) Landing gear: Damaged

2.4 Other Damage

Runway center line lights: 2 damaged lamps

2.5 Personnel Information

(1) The Trainee: Male, age 25

Student Pilot Permission	
Expiration date	March 22, 2011
Total flight time	89 h 30 min
Solo flight time	12 h 00 min

(2) The alternate instructor: Male, age 50

Commercial Pilot Certificate (Airplane)	April 6, 2009
Type rating for single-engine aircraft (Land)	June 1, 2004
Class 1 Aviation Medical Certificate	
Expiration date	November 26, 2010
Flight Instructor Certificate	June 12, 2009
Total flight time	6,430 h 27 min
(Including flight time on rotorcraft	5,572 h 27 min)
Instructor flight time	838 h 30 min
(Including instructor flight time on rotorcraft	278 h 30 min)
Instructor flight time in the last 12 months	428 h 45 min
Flight time on the type of aircraft	819 h 30 min
Flight time in the last 30 days	57 h 00 min

(3) The instructor in charge: Male, age 38

Commercial Pilot Certificate (Airplane)	February 23, 2007
Type rating for single-engine aircraft (Land)	August 31, 1998
Type rating for multi-engine aircraft (Land)	August 31, 1998
Class 1 Aviation Medical Certificate	
Expiration date	June 20, 2011
Instrument Flight Certificate	August 31, 1998

Flight Instructor Certificate	February 20, 2009
Total flight time	1,619 h 19 min
Instructor flight time	736 h 15 min
Instructor flight time in the last 12 months	479 h 50 min
Flight time on the type of aircraft	725 h 10 min
Flight time in the last 30 days	48 h 25 min

2.6 Aircraft Information

2.6.1 Aircraft

Type	Beechcraft A36
Serial number	E-2754
Date of manufacture	October 14, 1992
Certificate of airworthiness	DAI-2010-344
Validity	September 30, 2011
Category of airworthiness	Airplane Utility (U)
Total flight time	10,043 h 47 min
Flight time since last periodical check (200-hr check on November 4, 2010)	0 h 45 min

(See Figure 2 – Three Angle Views of Beechcraft A36)

2.6.2 Weight and Balance

When the accident occurred, the Aircraft's weight is estimated to have been 3,040 pounds and its center of gravity is estimated to have been 78.8 inches aft of the reference point, both of which are estimated to have been within the allowable range (maximum gross weight of 3,100 pounds and a center of gravity range of 74.0 – 87.7 inches corresponding to the weight at the time of the accident).

2.7 Meteorological Information

Aeronautical weather observations made at Miyazaki Airport around the time of the accident were as follows:

13:00 Wind direction 060º, Wind velocity 3 kt, Wind direction fluctuation 020º – 100º, Visibility 20 km
Cloud: Amount 1/8, Type Cumulus, Cloud base 2,500 ft
Amount 3/8, Type Stratocumulus, Cloud base 3,500 ft
Amount 7/8, Type Stratocumulus, Cloud base 6,000 ft
Temperature 18°C , Dew point 9°C
Altimeter setting (QNH) 30.13 inHg

13:55 Wind direction 050º, Wind velocity 3 kt, Visibility 20 km
Cloud: Amount 1/8, Type Cumulus, Cloud base 2,500 ft
Amount 5/8, Type Stratocumulus, Cloud base 3,500 ft
Amount 7/8, Type Stratocumulus, Cloud base 5,000 ft

Temperature 18°C, Dew point 10°C
Altimeter setting (QNH) 30.13 inHg

2.8 Accident Site and Wreckage Information

2.8.1 Condition of the Accident Site

The runway of Miyazaki Airport is 2,500 meters long, 45 meters wide with its direction of 09/27. The Aircraft was found immobile on the runway, with the nose pointing to the east, about 747 meters beyond the Runway Threshold and about 3.4 meters on the left from the runway center line.

Scratch marks were found stretching eastward over a distance of about 292 meters on the runway, starting from a point about 455 meters beyond the Runway Threshold. Two of the runway center line lights within the 292 meters range were broken.

In addition, the nose gear piston and tire were found on the runway, separated from the Aircraft.
(See Figure 1 – Estimated Flight Path)

2.8.2 Details of Aircraft Damage

(1)	Fuselage:	At the bottom area of the nose, the nose gear door was deformed and the keel was also worn. In addition, the VHF antenna at the bottom of the aft portion of the fuselage was bent rearward at around the middle and the antenna support had black scratch marks.
(2)	Propeller:	All three blades were bent rearward.
(3)	Landing gear:	The nose gear piston was separated from the Aircraft and the fork was broken.

(See Photo 2 – Damage to the Aircraft Components)

2.8.3 Control Systems

When the Aircraft stopped due to the accident, the flaps were in the full down position. In addition, the throttle lever was in the idle position, the propeller control lever was in the high-rpm position, and both the flap and landing gear levers were both in the down position.

The ailerons, the elevators and the rudder operated normally without any binding.

2.9 Other necessary Information

2.9.1 Aircraft Maneuvers before Landing

The College's Training Procedure for Single-engine Commercial Pilots (Operation Manual Annex 1) (hereinafter referred to as "the Training Procedure") states the following on aircraft control maneuvers before landing.

4-4 NORMAL LANDING

1. PROCEDURE

(See Figure 3 – Landing and Other Procedures)

2. Operating Procedure

① After rolling out to the base leg, set the propeller control lever to high rpm and turn off the air conditioner switch (Confirm that it is off). Complete the landing checklist before reaching the middle point of the base leg. Ensure that the final approach course is clear and prepare for a final turn. Continue approaching while planning ahead to get on the correct 3° glide path at the end of the final turn. At the start of the final turn, bank the aircraft to 25° (max. 30°). At the end of the final turn, the aircraft must be at about AGL 400 ft on a 3° glide path.

*② Continue approach, maintaining the correct path and an approach speed of 90 kt while keeping the aircraft on the extended center line. When max wind value is available, continue approach at (MAX – STEADY) × 1/2 + VTH *4. In case of calm wind, target power must be 15 inHg approximated. Set the flaps to full down before reaching AGL 200 ft.*

Final Check

This check must be performed for every landing. Before reaching AGL 200 ft, the following items must be checked and relevant callouts made.

(1) Landing Gear Down and Three Green, No Warning

Make final confirmation that the control lever is in down position as well as three green are on without any warnings. Call out, "Gear down & three green, no warning."

"No warning" means that the annunciators are not illuminated and the warning horn is not sounding."

(2) Runway Clear and Landing Clearance

Ensure that the runway is clear and ATC clearance has been issued. Call out, "Runway is clear. Cleared to land (Cleared touch and go)" or "Runway is clear."

** Flight crewmembers other than the pilot flying must so advise the pilot flying if the specified conditions are not met when passing 200 ft.*

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*4 "When max wind value is available, continue approaching at (MAX – STEADY) × 1/2 + VTH." – This means that when maximum instantaneous wind velocity is available, continue approaching at a speed obtained by adding VTH (runway threshold speed) to "(MAX (maximum instantaneous wind velocity) – STEADY (average wind velocity)) × 1/2."

* *If any of the gear-related annunciators are illuminated or the gear warning horn is triggered at or below 200 ft, execute the "go-around procedure specified in Chapter 4."*

③ *VTH 81 kt (VTH 85 kt Flaps Approach)*

Continue approaching while slowly reducing airspeed to achieve VTH 81 kt (VTH 85 kt). To reduce airspeed, power may need to be reduced by retarding the throttle. However, this may likely pitch the nose down, making the glide path lower. Apply final UP trim as the aircraft passes the threshold: approach flaps about 8° – 9° up and full flaps about 12° – 16° up.

④ *Touch Down*

After passing the threshold, start retarding the throttle, normally slowly. As power is reduced, the aircraft will sink. To keep the aircraft on the glide path to the touch down point, pull up the elevators smoothly as the aircraft sinks, thus bringing the nose up. Paying too much attention to the aircraft's descent may often result in the aircraft deviating off the runway center line. To prevent that, the ailerons and rudder must be operated as required to keep the aircraft aligned with the center line.

⑤ *After Touch Down*

After touchdown, hold the current attitude of the aircraft for a while. Utilizing the back pressure of the elevators, slowly touch down the nose gear onto the runway.

* *When making a full stop, use the brake effect of the flaps by setting them UP in the after landing procedure.*

(Omitted)

3. *KEY POINTS*

(1) *Planning for setting the correct approach glide path*
(2) *Maintaining the approach airspeed and applying appropriate trim*
(3) *Maintaining the approach course and glide path*
(4) *Appropriate timing for initiating a final turn and bank adjustment for alignment with the final course*
(5) *Airspeed reduction and glide path retention after flaps are fully down*
(6) *Stabilized descent and use of the elevators after VTH, alignment of airplane axis through rudder maneuvers to compensate for power reduction, and keeping the aircraft on the runway center line through aileron maneuvers*
(7) *Smooth back the elevators and keep the aircraft on the center line through rudder maneuvers after touchdown*

4-12 GO-AROUND PROCEDURE

1. *PROCEDURE*

(See Figure 3 – Landing and Other Procedures)

2. *Operating procedure*

If the pilot sees the need to perform a go-around during approach or after

touchdown, or if they are instructed to perform a go-around, immediately call out, "Go-around" and promptly perform the following procedure.

① *Maximum Power and Maintain Attitude*
Smoothly increase the throttle to full power to establish an attitude to maintain level flight.
* *If the aircraft is in a step nose up attitude due to premature flare* *5 *or after a flare maneuver, the nose needs to be pitched down slightly. Be careful not to apply elevator trim too aggressively to prevent excessive nose up.*

② *Flaps Approach*
After confirming that the airspeed is 80 kt (balked landing airspeed), set the flaps to the approach position.
If the flap control lever is set to the UP position by mistake, reset it to the approach position while monitoring the pitch angle. There is no need to panic.

③ *Go-Around Attitude*
Set the pitch angle to approximately +10°. Utilize the right rudder. In principle, climb straight in line with parallel the runway.
(Omitted)

(See Figure 4 – System of Manuals at the Civil Aviation College (Overview))

2.9.2 The College's Evaluation Standards for Touchdown Point

In the final competency check (Miyazaki Course) at the College, touchdown points are evaluated based on standards set by the College (hereinafter referred to as "the Evaluation Standards"). The Evaluation Standards are based on fixed distance marking and touchdown zone marking provisions in Article 79 of Ordinance for Enforcement of the Civil Aeronautics Act, prior to the revision dated July 1, 2008, which relates to the establishment criteria for airport etc.. The Evaluation Standards assign the highest ratings for touchdowns that are made on the fixed distance marking located 300 – 360 meters from the Runway Threshold. Touchdowns beyond the fixed distance marking are assigned lower ratings depending on the distance from the marking. Touchdowns beyond the touchdown zone marking located 450 – 472.5 meters from the Runway Threshold are assigned a FAIL rating.

The fixed distance marking and the touchdown zone marking at Miyazaki Airport on the day of the accident conformed to the revised Article 79 of Ordinance for Enforcement of the Civil Aeronautics Act. However, the Evaluation Standards had not been revised accordingly by that time and, according to the College, the criteria for the evaluation of distance from the Runway Threshold to the touchdown points remained unchanged.

(See Figure 4 – System of Manuals at the Civil Aviation College (Overview))

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*5 "Premature flare" likely results when flare is started while the aircraft is still too high or flare is executed too fast. In either case, the pilot feels as if the aircraft has stopped descending (or the ground surface has stopped coming nearer). The aircraft is still at a considerable height from the runway surface. The best way to deal with this situation is to perform a go-around with smooth operation of the throttle.

2.9.3 Touchdown Maneuver

The "Airplane Operation Textbook" (hereinafter referred to as "the Operation Textbook") (published by the Japan Civil Aviation Promotion Foundation, supervised by the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism) used at the College as reference material states the following key points for normal landing. However, these points were not included in "the Training Procedure" used as a textbook at the College, or in the "Education Manual."

4.2.1 Normal landing

(Omitted)

(2) Flare maneuver

(Omitted)

As the aircraft comes close to runway, reduce airspeed and rate of descent while pitching the nose up to obtain lift. This flare maneuver must be performed such that the aircraft will be at the proper touchdown airspeed and in the proper landing attitude at the touchdown point.

(3) Touchdown

(Omitted)

In a normal landing, while maintaining a near-stall speed, touch down the main gear onto the runway surface the instant the wings are no longer able to support the weight of the aircraft. At that time, the weight of the aircraft is distributed equally between the wings and the main gear. As the aircraft slows down in the landing roll, the weight applied on the main gear gradually increases. If the aircraft is maintained in the proper landing attitude , the aircraft's lift will gradually weaken, and the nose will be ordinarily pitched down.

2.9.4 Risk Assessment Based on Safety Management Manual

The College had taken action according to the "Safety Report Management Procedure based on the Safety Management Manual" (trial from March 1, 2010, and implementation on August 2, 2010) (hereinafter referred to as "the Safety Report Procedure") for bouncing events experienced during solo flight training (hereinafter referred to as "Bouncing Events"). The Safety Report Procedure was established by the College in line with the "Safety Management Manual (Doc 9859)" of the International Civil Aviation Organization (ICAO). The probabilities of occurrence listed below were added by the College to the Safety Report Procedure.

Safety Report Procedure (Excerpts)

(Analysis / Evaluation)

Article 7 The Safety Committee shall review events submitted on Safety Reports, evaluate the probability of occurrence and the severity of occurrence, each on a scale of 5, and consider what actions to take on various combinations of probability and severity.

2. Probability of occurrence table

Value	*Meaning*	
5	*Likely to occur many times(has occurred frequently)*	*5 or more times/year*
4	*Likely to occur sometimes(has occurred infrequently)*	*3 or 4 times/year*
3	*Unlikely to occur, but possible(has occurred rarely)*	*1 or 2 times/year*
2	*Very unlikely to occur(not known to have occurred)*	*Once/several years*
1	*Almost inconceivable that the event will occur*	*Extremely improbable.*

3. Severity of occurrence table

Value	*Description*	*Severity of occurrence*
A	*Equipment destroyed or death*	*Catastrophic*
B	*A large reduction in safety margins, serious injury, major equipment damage*	*Hazardous*
C	*A significant reduction in safety margins, serious incident, injury to persons*	*Majour*
D	*Nuisance, Operating Limitations, Use of emergency procedures, minor incident*	*Minor*
E	*Little consequences*	*Negligible*

Article 8 Resaults of analysis and evaluation, for 5A, 5B, 5C, 4A, 4B and 3A, actions must immediately be considered and implemented in addition to taking the following measures.

(1) Flights are suspended until measures are in place and safety is ensured and maintained.

(2) – (3) (Omitted)

2. (Omitted)

3. Resaults of analysis and evaluation, for 5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 3E, 2A, 2B and 2C, measures are considered, including a review on whether or not these events are acceptable, and implemented as required.

4. Resaults of analysis and evaluation, for 2D, 2E and those with a probability of occurrence of 1, these events are acceptable. Measures are considered as required, and implemented as appropriate.

	A	*B*	*C*	*D*	*E*
5	***5A***	***5B***	***5C***	*5D*	*5E*
4	***4A***	***4B***	*4C*	*4D*	*4E*
3	***3A***	*3B*	*3C*	*3D*	*3E*

2	*2A*	*2B*	*2C*	*2D*	*2E*
1	*1A*	*1B*	*1C*	*1D*	*1E*

(See Figure 4 – System of Manuals at the Civil Aviation College (Overview))

2.9.5 Bouncing Events That Occurred in the Past

According to the College, a number of Bouncing Events occurred during solo flight in the about five-year period from August, 2005 to June, 2010 as listed in the following table. The College considered the period from March 1, 2010 to August 1, 2010, when the Safety Report Procedure was implemented, as a trial period for risk assessment.

As for the risk assessment of the April 2010 event, all three previous events occurred after 2005 were reviewed in the assessment process. As for the risk assessment of the June 2010 event, only the August 2005 event in which the airframe was damaged was reviewed in the assessment process while the other three events in which the airframe was not damaged (those that occurred in May 2007, October 2008 and April 2010) were excluded.

Date of occurrence	Summary/Synops	Preventative measures	Risk assessment
June 2010	As the aircraft appeared likely to overshoot the fixed distance marking, the trainee tried to correct the path by pitching the nose down (the procedures of the Training Manual were misunderstood). The aircraft touched down on the nose gear first and then bounced twice and stopped.	This event was shared among the instructors. In addition, a special session was held for the class in which the trainee was a member.	2B
April 2010	The flare was a little too moderate, causing the nose gear to touch down slightly before the main gear and making the aircraft porpoise and bounce then stopped. There was no damage to the airframe.	This event was shared among the instructors and other students.	2D
October 2008	The aircraft touched down on the nose gear first and bounced twice then stopped. There was no damage to the airframe.	The trainee was retrained on the correct attitude up to touchdown. This event was shared among the instructors and students.	-
May 2007	Earlier Power cut at landing and lack of coordination with flaring resulted in the nose and main gear touching down almost at the same time. The aircraft ballooned*6 twice before making a go-around. There was no damage to the airframe.	The trainee and other students were retrained on the go-around maneuver for when bouncing, porpoising, etc., occurs.	-

*6 "Ballooning," in which rapid flaring causes the aircraft to lift, likely occurs when the approach speed is too fast for landing. On the other hand, bounce typically occurs when flaring is delayed and is too moderate, failing to sufficiently dampen the rate of descent as the aircraft touches down and causing the aircraft to bounce up off the runway.

August 2005	Flaring was too late, causing the aircraft to bounce. The wheels and nose skin were deformed.	NA	-

2.9.6 Curriculum at the College

The College provides the following lectures related to Bouncing Events.

(1) Miyazaki Course

The lecture textbook on aerodynamics was used in the Miyazaki course states as follows: "Touching down with a steep rate of descent combined with inappropriate maneuvers immediately after the touchdown can lead to unstable porpoising in which the aircraft experiences a series of additional touchdowns and vertical bouncing. Porpoising occurs in short cycles, and the human response involves a time delay. That makes it difficult to restore the aircraft to normal conditions. For that reason, the pilot shall increase thrust immediately when porpoising has started, restore a safe flight status, and then try to land again."

(2) Obihiro Course

The following lectures are provided in line with the Training Manual:

① Final approach (from final turn to runway threshold)

a Altitude and the appearance of approach path indicator at the end of final turn

b Power (difference between approach flaps and full flaps)

c Trim

d Maneuver for when the center of air pressure has changed with flaps down

e Aiming

f Importance of final check

② Flare and touchdown (from runway threshold to touchdown)

a Use of the fixed distance marking as the target until passing the runway threshold (After passing the runway threshold, put priority on making a touchdown through safe flaring rather than aiming at the touchdown point.)

b Feel of aircraft sinking (Through an outside scan, the ground appears to rise.)

c Flaring (Pitch the nose up as the aircraft sinks.)

d Timing for power reduction (This depends on aircraft speed, altitude on passing the runway threshold, and the winds.)

③ Landing roll

a How to set a target

b How to use the aircraft control systems (steering, rudder and brakes)

c How to use the brakes (60 kt as the threshold)

④ Incorrect maneuvers and corrections during landing operation

a Consideration of wind

b Course correction (by changing the axis of airplane)

c Path and speed correction (Be careful not to adjust the pitch or power in the

opposite direction.)

d Halving (for prevention of overcontrol)

e Precautions for taxiing

(3) Special sessions

The College provides special sessions as to preventative measures for reported events. As described in 2.9.5, a special session was held three days after the June 2010 bouncing event as the preventative measures, and the Trainee had participated in the session about five months prior to the accident. (The June 2010 bouncing event was assessed as 2B in the risk assessment by the College's Safety Committee held on July 12, 2010.) The outline of the materials used for the special session is as follows:.

① Ballooning and bounce

Descriptions about ballooning and bouncing, and incorrect landing maneuvers taken from the Operation Textbook

② Correction procedures after passing the runway threshold

a After passing the runway threshold, there is no need to correct the path by pitching the nose down. (Three trainees including the Trainee erroneously understood that after passing the runway threshold, the path must be corrected by pitching the nose down. Guidance was provided on the proper path correction method during the special session.)

b Even with the path higher than intended, wait for the aircraft to sink while maintaining the pitch angle. Flare the aircraft as appropriate as it descends.

③ Go-around

Recover from the bounce, set the control wheel to the neutral position and the throttle to the maximum power position.

3. ANALYSIS

3.1 Qualification of Personnel

The Trainee held a valid student pilot permission. Both the alternate instructor and the instructor in charge held a valid airman competence certificate, a valid flight instructor certificate, and a valid aviation medical certificate.

According to the statement in 2.1.2 (3), it is highly probable that the Trainee's physical condition was favorable on the day of the accident.

3.2 Airworthiness Certificate

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

3.3 Meteorological Conditions

It is highly probable that the weather conditions at the time of the accident did not have any relation to the occurrence of the accident.

3.4 Conditions of the Aircraft

According to the statements in 2.1.2 (1) and (3), and as described in 2.8.3, there were no abnormalities as to the function of the control and other systems of the Aircraft. Therefore, it is highly probable that the Aircraft were functioning properly at the time of the accident.

3.5 Situation of the Accident until Occurrence of Accident

3.5.1 Situation from Base Leg to Final Leg

According to the statement in 2.1.2 (1), it is probable that, after completing the flight training in the Training Area, the Trainee configured the flaps in the approach position, set the landing gear down and entered the base leg for Runway 09 at an altitude of 1,000 feet with an airspeed of about 90 knots, and that, while maintaining the airspeed, he entered the final leg at an approach angle of 3º as directed by the approach path indicator.

3.5.2 Situation from Final Leg to Touchdown to Stop

According to the statement in 2.1.2 (1), it is probable that, with deceleration insufficient after setting the flaps to the full down position at an altitude of about 300 ft and with the airspeed still a little too fast after reducing the engine power to idle on passing the Runway Threshold, the Trainee judged that performing a flare in an ordinary manner under the circumstances would cause the Aircraft to fly over the intended touchdown point and therefore he eased up on the flare. When performing a landing, it is important to keep the aircraft in the proper landing attitude on touchdown. To achieve this, it is important to properly adjust the approach speed and perform a flare as the aircraft sinks. However, given the insufficient deceleration and incorrect approach with the flare too moderate relative to the sink of the Aircraft as mentioned above, it is probable that the Trainee

was not able to keep the aircraft in the proper landing attitude. As a result, it is probable that the Aircraft bounced at touchdown due to the improper reduction in airspeed and rate of descent, thus touched down with residual lift, and the impact of the landing gear as it hit the runway.

According to the statements in 2.1.2 (1), (2) and (3), the descriptions of the accident site in 2.8.1 and the details of damage to the Aircraft in 2.8.2, it is probable that the Aircraft touched down with the main gear first and then the nose gear at a point about 330 m beyond the Runway Threshold. It is probable that, after touchdown, the Aircraft bounced in a near level attitude and touched down again on the nose gear first at a point about 400 m beyond the Runway Threshold, followed immediately by the main gear, and that, with the impact of the second touchdown, the Aircraft bounced again in porpoising with the nose up steeply. It is probable that the Aircraft touched down again on the nose gear first in the steep nose down attitude at a point about 455 m beyond the Runway Threshold, that the nose gear sustained damage from that impact, and that the Aircraft then skidded about 292 m on the runway with the nose pushed against the runway surface before becoming immobile. As for the reason that the VHF antenna on the bottom of the aft fuselage was bent rearward around the middle and had black scratch marks on the antenna support, it is probable that the tire came into contact with the antenna support when the nose gear fork was broken, judging from the color of the scratch marks and the way the marks were left

3.6 Review of the Risk Assessment Method

As described in the table in 2.9.5, there were three Bouncing Events at the College between 2005 and 2008. Taking into account these three events, there were four such events in five years up to and including April 2010, and five such events in five years up to and including June 2010. Therefore, it is probable that the College underestimated the probability of occurrence when it was assessed as 2 (once/several years) for the 2010 events. More noteworthy, the June 2010 event took place only about two months after the April 2010 event. Therefore, it is probable that the College clearly underestimated the event when it was assessed as 2 for the June 2010 event. As for the reason the event was underestimated, it is highly probable that, as described in 2.9.5, the College excluded the three events between 2005 and 2008 from the probability of occurrence analysis, having judged that these events were not so serious as to cause damage to the airframe. However, considering that the College had classified these events under the same category as the June 2010 event, the College should have included these events in the analysis.

As described in 2.9.6 (3), the College has provided the special sessions based on the results of risk assessment. However, considering that this accident was caused by the Trainee who had attended one of these special sessions, it is probable that the importance of flaring the aircraft to secure the proper landing attitude at touchdown was not fully conveyed to the Trainee. As for the reason for that, while it is probable that the probability of occurrence of Bouncing Events at the College rose following the April 2010 and June 2010 events, it is probable that the college underestimated the probability of occurrence and provided the special sessions on preventative measures only in the lectures, however the college didn't provide practical retraining or check the related skills levels, which contributed to the Trainee failing to grasp the importance of correct flaring. With these in mind, the College should review the current method for risk assessment so as to ensure that special sessions, practical retraining, and skills level check are conducted

accordingly.

3.7 Evaluation Standards for Touchdown Points and Review of the Training Method

As described in 2.1.2 (1), the Trainee judged that the airspeed on passing the Runway Threshold was slightly faster than it should have been and that a normal flare would cause the aircraft to fly over the intended touchdown point slightly. Even then, the Trainee should have performed a normal flare to ensure the proper landing attitude, and he should have performed a go-around if he judged that the aircraft would fly over the intended touchdown point and touch down outside the designated range.

As for the reason that the Trainee attached importance to the touchdown point as described in 2.9.6 (2), it is probable that the Miyazaki Course has trained students to touch down within a designated range with the aim of acquiring skills levels corresponding to those of commercial pilots, and the Trainee was aware of the significance of the intended touchdown point, whereas, the Obihiro Course has trained students to make a proper touchdown beyond the runway threshold regardless of the touchdown point with the aim of acquiring skills levels corresponding to those of private pilots. In addition, as described in 2.9.2, it is possible that touchdowns beyond the fixed distance marking are given lower ratings or a FAIL rating depending on how far the marking is missed under the Evaluation Standards, which contributed to making the Trainee nervous about making a precise touchdown. It is possible that, as a result, the Trainee was preoccupied with the intended touchdown point, and looked down too much as he performed a flare, which resulted in being a bit too moderate.

Given the above, it is important to ensure that trainees are trained not to neglect the basic that is to slow down the aircraft after setting the flaps fully down on the final leg, perform a precise approach for a touchdown within the designated range, and, once having decided to land, keep the proper landing attitude until touchdown.

3.8 Review of the Education/Training Method on Go-Around

As described in 2.1.2 (1), the Trainee did not perform a go-around even after the Aircraft bounced severely on landing. It is probable that the Trainee did not have the knowledge or skills to perform a go-around without hesitation upon severe bounce. In addition, as described in 2.9.1, while the Training Manual does specify go-around procedures, it is probable that the Training Manual does not provide specific criteria for performing a go-around. Therefore, the College should clearly provide criteria, including specific examples, for performing a go-around and ensure that trainees are trained to perform a go-around without hesitation whenever it is not possible to touch down in the proper landing attitude (as in this “porpoising” accident).

4. PROBABLE CAUSES

It is highly probable that the accident occurred as follows: the Aircraft bounced at touchdown, and subsequently fell into a state of porpoising without performing a go-around, eventually touched down with the nose gear severely hitting the runway first, sustained damage to the airframe and then became immobile on the runway.

Regarding the reason why the Aircraft bounced at touchdown, it is probable that, with the airspeed still slightly faster than it should have been after reducing the engine power to idle on passing the Runway Threshold, the Trainee judged that performing a flare in an ordinary manner under the circumstances would cause the aircraft to fly over the intended touchdown point and therefore he eased up on the flare. As a result, it is probable that neither airspeed nor rate of descent was reduced and the aircraft touched down with residual lift, which resulted in bouncing at touchdown due to the impact of the landing gear as it hit the runway.

As for the reason that the Trainee did not perform a go-around even after the Aircraft bounced, it is probable that he did not have the knowledge and skills that would have enabled him to perform a go-around without hesitation upon bounce.

5. REMARKS

In this accident, it is highly probable that, while doing a solo flight as part of the College's training program, the Trainee did not appropriately perform a flare to ensure the proper landing attitude at touchdown after passing the Runway Threshold for landing at Miyazaki Airport; as a result, the Aircraft bounced as the landing gear touched down, and subsequently, the Aircraft fell into a state of porpoising without performing a go-around, eventually touched down for the last time with the nose gear severely hitting the runway first, sustained damage to the airframe, and then became immobile on the runway.

At the College, following safety reports of Bouncing Events, preventative measures had been taken based on internal risk assessment. However, this accident occurred less than five months after the last of these bouncing events. Therefore, it is probable that the risk assessment and preventative measures undertaken at the College were not appropriate to address the unsafe events (those covered in the safety reports) that had occurred at the College.

Given the above, the College should take the following actions.

(1) The current risk assessment system should be improved so that it is implemented more appropriately.

(2) The education/training should be thoroughly conducted not to neglect the basics of touching down in the proper landing attitude and of performing a go-around without hesitation if it is not possible to maintain the proper landing attitude on touchdown (as in this "porpoising" accident).

(3) The safety education and the education/training on go-around that were provided after this accident should be repeated regularly in the future.

6. ACTIONS TAKEN

Following this accident, the College has taken the following as preventative measures.

(1) As part of the safety education for the students and instructors, the College lectured the outline of the accident, the conditions under which a go-around must be performed, examples of an unsuccessful final approach and the need to check the airspeed on passing the runway threshold.

(2) The Training Manual was revised as follows:

① Set the flaps to the landing position on the base leg to ensure a stabilized final approach.

② Check the airspeed on the airspeed indicator on passing the runway threshold.

③ Standards including specific examples of when a go-around must be performed.

(3) The instructors for the Miyazaki Course were notified that, in their classes, they must stress the need to perform a go-around whenever porpoising is experienced.

(4) The following items were added to the skills qualification list for solo flight:

"Understands the criteria for performing go-around" and

"Capable of performing go-around at less than 50 ft to the ground with idle power."

(5) Training sessions were provided to all students who belonged to the same class as the Trainee in which the instructor reproduced high flare and ballooning and let the trainees decide whether or not to perform a go-around.

(6) Review was made on the risk assessment time period (five years) and the risk assessment method relating to the probability of occurrence (frequency).

Figure 1　Estimated Flight Path

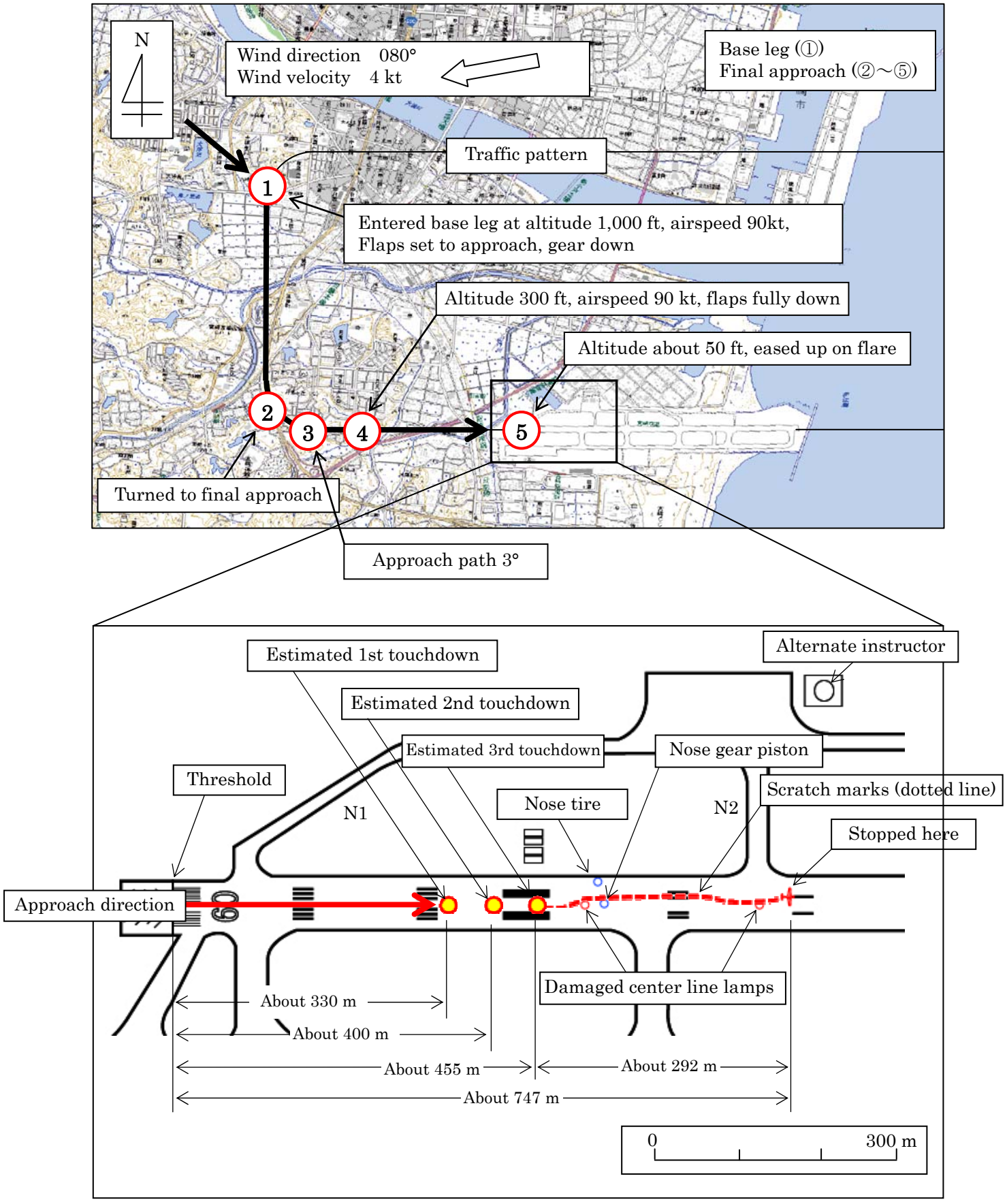


Figure 2　Three Angle Views of Beechcraft A36

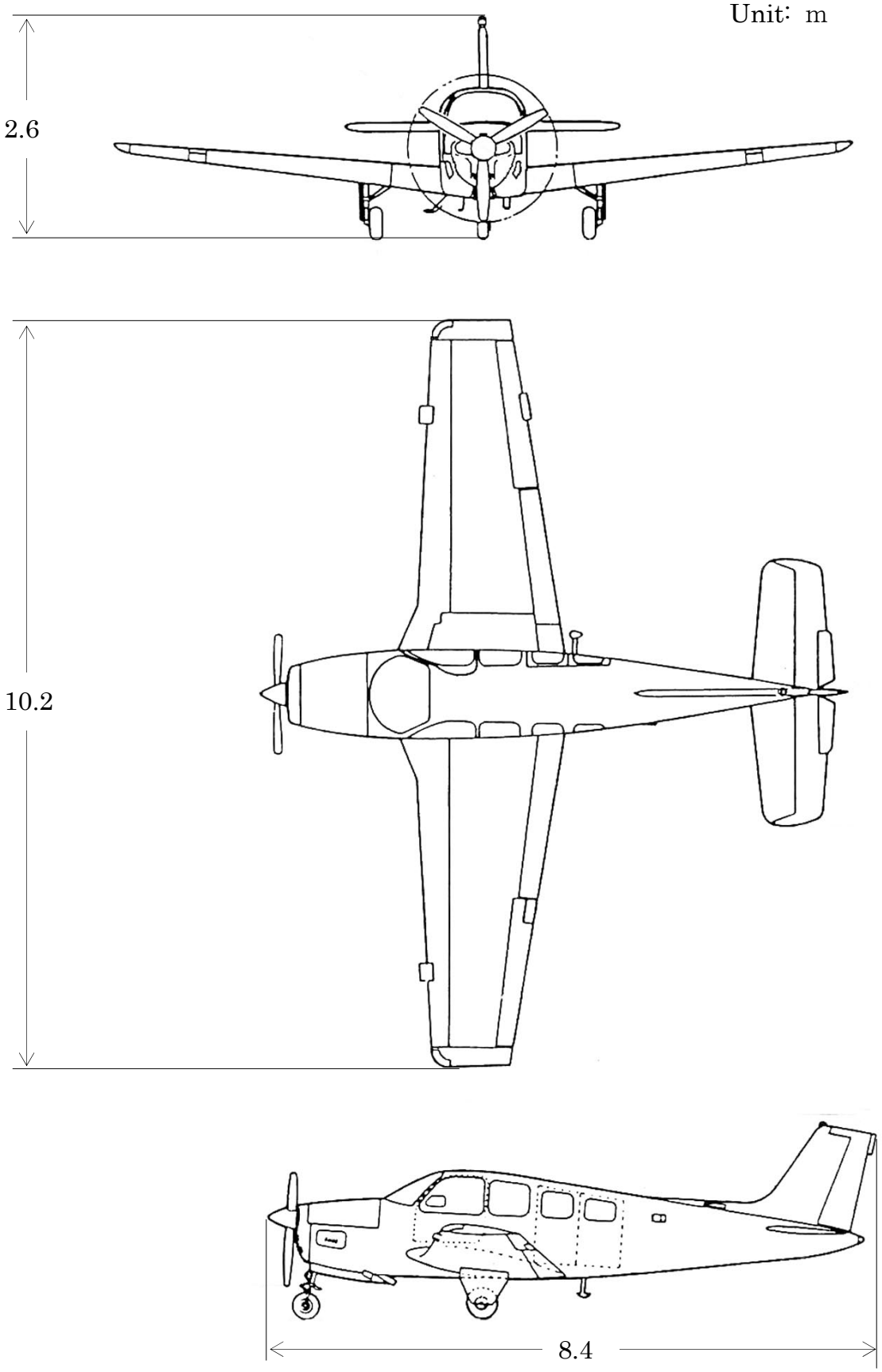
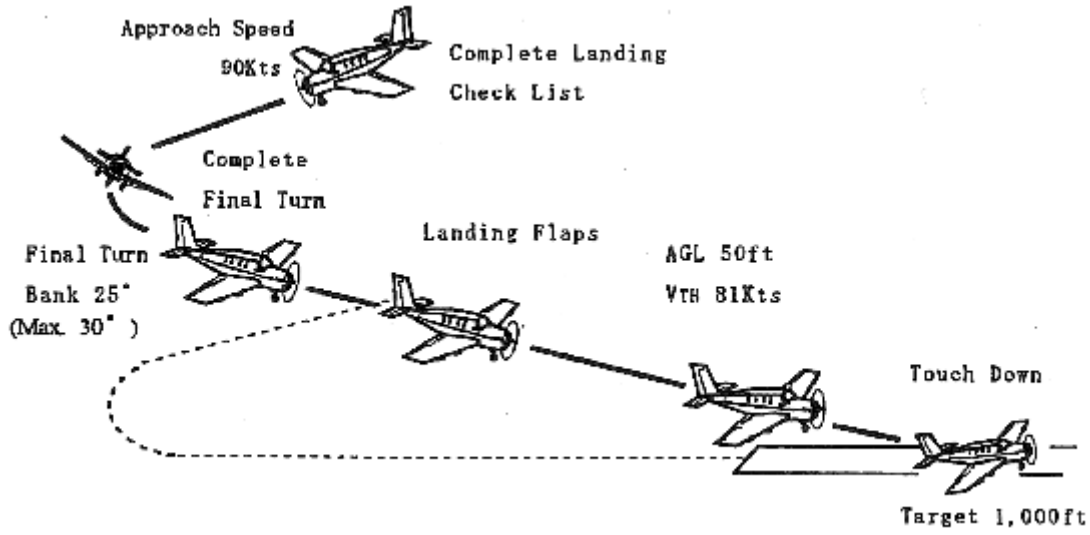


Figure 3　Landing and Other Procedures

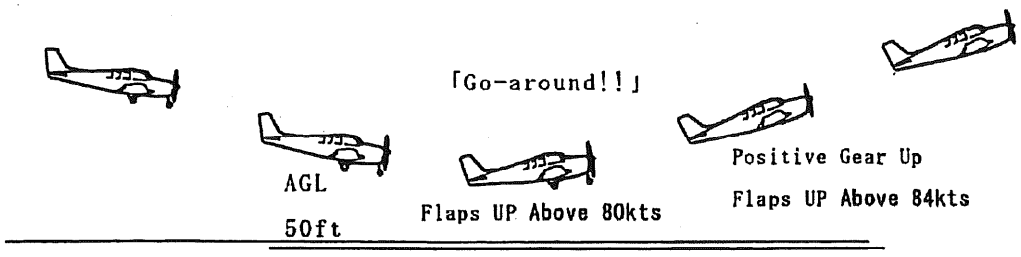
4-4 NORMAL LANDING

1. PROCEDURE



4-12 GO-AROUND PROCEDURE

1. PROCEDURE



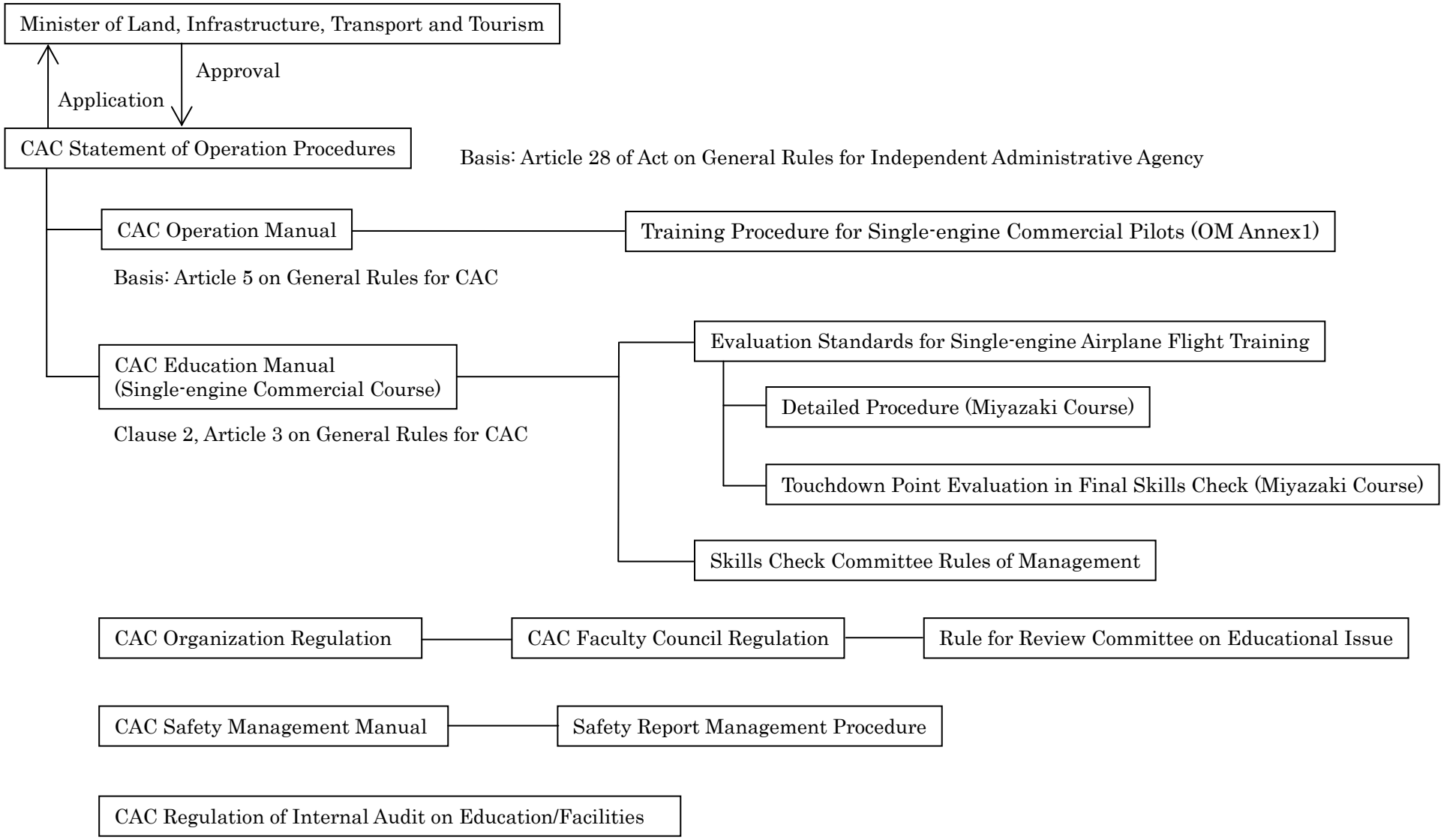
Source: The Training Manual used by the College (for the single-engine course)

Abbreviations:

AGL: above ground level

VTH: threshold speed

Figure 4　System of Manuals at the Civil Aviation College (CAC) (Overview)



(As of November 5, 2010)

Figure 5　Cause Analysis

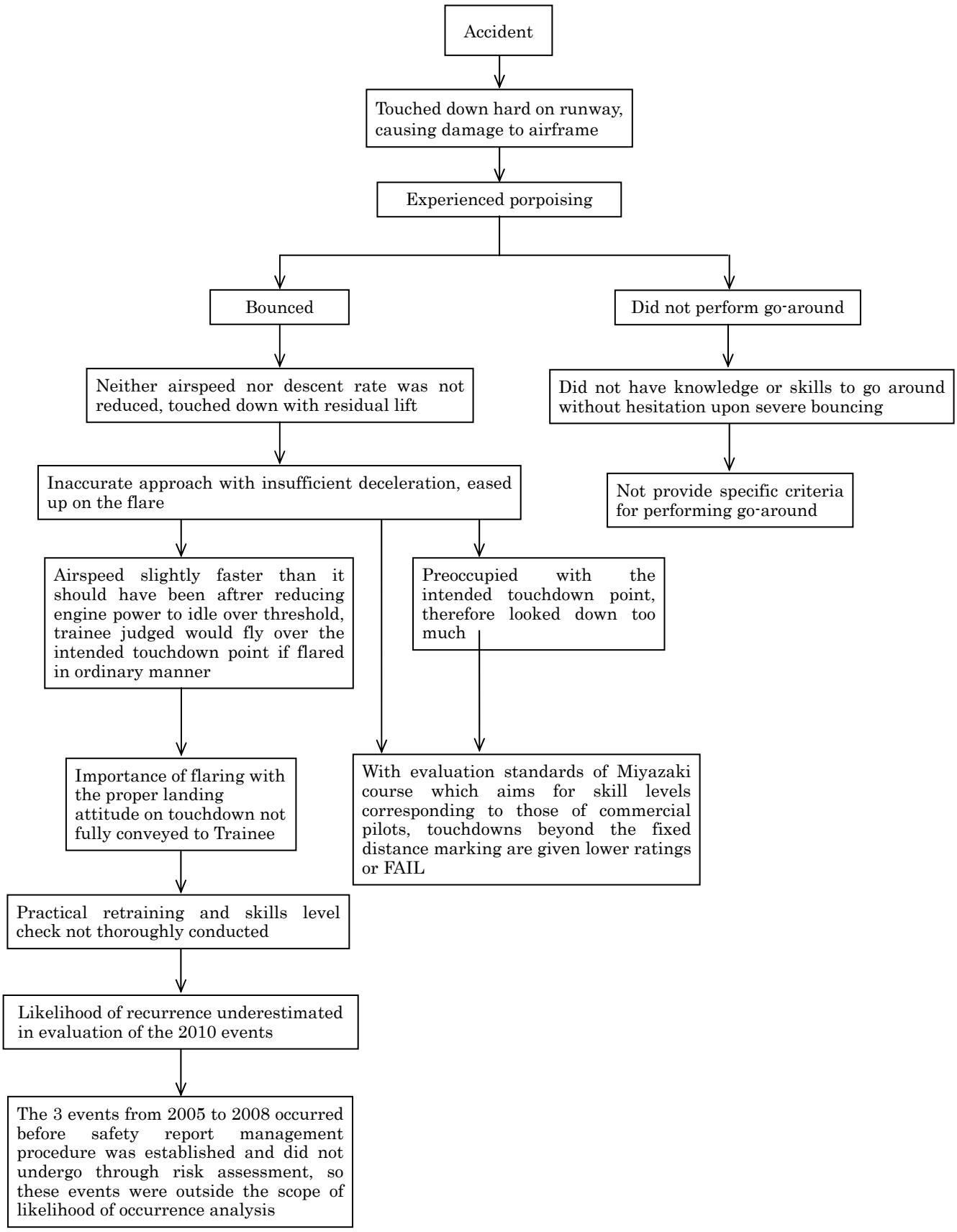


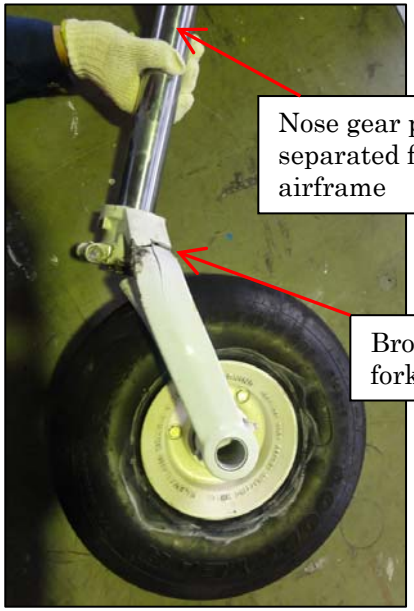
Photo 1　Accident Aircraft

Photo 2　Damages of the Aircraft

Bent propeller blades rearward

Black scratch marks on the VHF antenna support

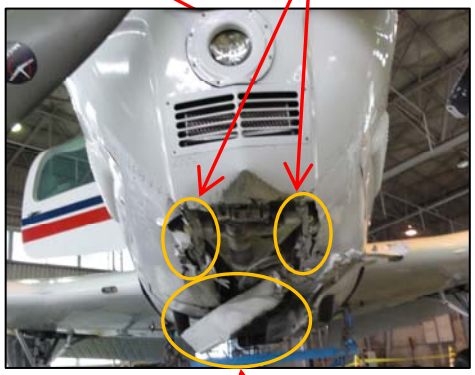
Bent VHF antenna



Nose gear piston separated from the airframe

Broken nose gear fork

Worn keel



Deformation damaged nose gear door