

AA2018-3

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**SCHOOL JUDICIAL ORGANIZATION
KIMIGAFUCHI GAKUEN (SOJO UNIVERSITY)**

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March 29, 2018



The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board and with Annex 13 to the Convention on International Civil Aviation is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Kazuhiro Nakahashi
Chairman,
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

AIRCRAFT DAMAGE CAUSED BY BELLY LANDING SCHOOL JUDICIAL ORGANIZATION KIMIGAFUCHI GAKUEN (SOJO UNIVERSITY), BEEHCRAFT 58, JA5304 AT AROUND 10:26, JUNE 29, 2017 NAGASAKI AIRPORT

February 9, 2018

Adopted by the Japan Transport Safety Board

Chairman Kazuhiro Nakahashi

Member Toru Miyashita

Member Toshiyuki Ishikawa

Member Yuichi Marui

Member Keiji Tanaka

Member Miwa Nakanishi

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Accident	On Thursday, June 29, 2017, a Beechcraft 58, registered JA5304, operated by School Judicial Organization KIMIGAFUCHI GAKUEN (Sojo University) made a belly landing which caused damages to the aircraft at Nagasaki Airport during a training flight.
1.2 Outline of the Accident Investigation	<p>On June 29, 2017, the Japan Transport Safety Board (JSTB) designated an investigator-in-charge and one other investigator to investigate this accident.</p> <p>An accredited representative of United States of America, as the State of Design and Manufacture, participated in the investigation.</p> <p>Comments were invited from the parties relevant to the cause of the accident and the relevant state.</p>

2. FACTUAL INFORMATION

2.1 History of the Flight	<p>According to the statements of a captain (hereinafter referred to as “the Captain”), a trainee (hereinafter referred to as “the Trainee”) , an observer (hereinafter referred to as “the Observer”) and a ground controller of Nagasaki airport traffic control tower (hereinafter referred to as “the Ground”) and also based on the communication records between the aircraft (hereinafter referred to as “the Aircraft”) and a local controller of Nagasaki airport traffic control tower (hereinafter referred to as “the Tower”) and the radar track recordings by the Nagasaki terminal control, the flight up to the accident was summarized below;</p> <p>At 09:12 Japan Standard Time (JST; UTC + 9 hours; unless otherwise stated, all times are indicated in JST using a 24-hour clock) on June 29, 2017, the Trainee controlled a Beechcraft 58 registered JA5304, operated by School Judicial Organization KIMIGAFUCHI GAKUEN (Sojo University) (hereinafter referred to as “the University”) to takeoff from the Kumamoto Airport for a promotion training to a captain (provide knowledge and flight skill required to operate by a single pilot as the captain of the same type of the Aircraft at the University) as the Trainee sat in the left front seat and the Captain in the right front seat as an instructor and the Observer in a rear seat to observe the training.</p> <p>After the Aircraft performed an air-work in the civil training and testing area at south of Nagasaki Airport (hereinafter referred to as “the Airport”), the Aircraft made an instrument approach training to the Airport and continued to commence Touch and Go Landing practice (hereinafter referred to as “TGL”) on the runway 14. The Aircraft made normal TGL twice, then made a short field TGL. The control of the Trainee was very stable, but because he landed longer than usual short field landing, the Captain decided for the Trainee to do a short field landing again as a full stop landing.</p> <p>At the downwind leg, the Captain explained the Trainee why the Trainee landed long beyond the aim point at the previous short field landing, how to correct it and others. The Trainee was putting the procedures and others in order from the approach of the short</p>
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	<p>field landing till the touchdown.</p> <p>The Observer heard the call that the Captain made when passing the abeam of the runway threshold (hereinafter referred to as “the Abeam”) on the downwind leg, which should normally be called by a pilot (the Trainee), but right after this, he could not see whether the landing gear-down procedures was done or not, which also normally should be done by the Trainee.</p> <p>The Trainee set flaps in full down position when entering the final approach, but he did not confirm the completion of the Landing Check List which should be done at the time to set the flaps in full down position and when become below the altitude of 500 ft Above Ground Level (hereinafter referred to as “AGL”), and did not recheck the landing gear-down and no landing gear warning horn which should be done at the altitude of 200 ft AGL, because his attention was focused on how to aim the touchdown point and how to control the Aircraft for a short field landing.</p> <p>The attention of the Captain was very low, because he was satisfied with the very stable control of the Aircraft by the Trainee.</p> <p>So, he did not aware that the Trainee missed the confirmation to complete the Landing Check List and the recheck of the landing gear-down and others.</p> <p>At 10:25:07, the landing gear warning horn was recorded in the communication records between the Tower and the Aircraft which was about to enter the final approach.</p> <p>The Captain felt the main wheels touched down almost at the predetermined position (near little past the touch down marking which is approximately 300 m from the runway threshold). Then, a mediastina crunch sound of the propellers hitting the ground was heard and they did not understand what was happening, and the Aircraft begun to deviate to the left and stopped on the runway.</p> <p>The Trainee had feelings that main landing wheels touched down near the intended position, but then heard the noise. He could not do anything because he did not understand the situation until the Aircraft stopped.</p> <p>The Observer confirmed that the Trainee set the flaps in full down position at the final approach. However, he did not have</p>
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certain memory of whether the Trainee did recheck the landing gear-down and no landing gear warning horn or not, in addition, he had feelings of the main landing wheels touched down but no feelings of the main landing wheels rolling. At the next instance, the Aircraft leaned to left and the noise started, then he heard the voice of the Captain like “Did it”.

At 10:26:27, the Captain reported to the Tower that “We are now gear up landing, stop on the runway”. The landing gear warning horn was recorded in this communication records.

The Captain did not have memory of touching the Landing Gear Handle till the Aircraft stopped. After it stopped, as the emergency shutdown procedures, he ordered the Trainee to cut off the mixture, battery and others in order to shut off the fuel and power supply and evacuated from the Aircraft after his reporting their evacuation to the Tower. At the time of his evacuating from the Aircraft, he saw the Landing Gear Handle at the down position.

After the Aircraft stopped on the runway, the Ground was using crash phone to report the situation to the relevant parties.

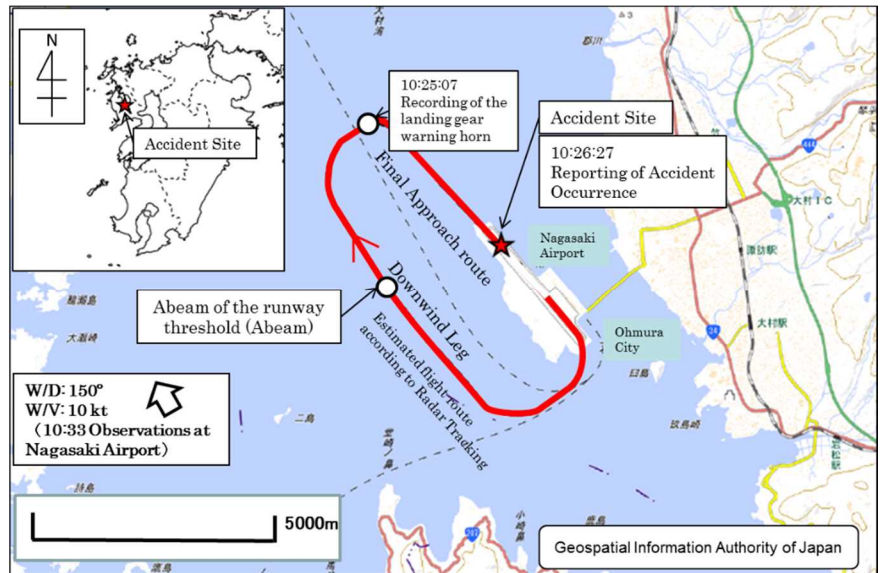


Fig 1 Estimated Flight Route Map

After the accident, because the propeller lever to change the position which should be following procedure of the landing gear-down was at the predetermined high rpm position and the Landing Gear Handle was at the down-position, therefore, the Captain and the Trainee guessed that the Trainee lowered the landing gear at

	<p>the Abeam just like usual.</p> <p>The accident occurred on the runway of the Airport (N32°55'29", E129°54'18") at around 10:26 on June 29, 2017.</p>
<p>2.2 Injuries to persons</p>	<p>None</p>
<p>2.3 Damage to Aircraft</p>	<p>(1) Extent of damages to the aircraft; Substantial</p> <p>(2) Damages to the Aircraft Components</p> <p>① Nose; Nose landing gear door; Scratch marks</p> <p>② Propeller and engine; Right and left propellers; deformed backward</p> <p>③ Fuselage and main wings Outer skin on bottom of the fuselage; damage Keel; deformed and damage Right and left flaps; deformed and damages (the left flap suffered bigger damages) Step; Scratch Marks (extensive) Inner doors of the right and left landing gears; scratch marks (in small scale) Actuator rod to operate the inner door of the left landing gears; deformed</p> <div data-bbox="571 1332 1200 1518" data-label="Image"> </div> <p style="text-align: center;">Photo 1 Damages of the Step</p>

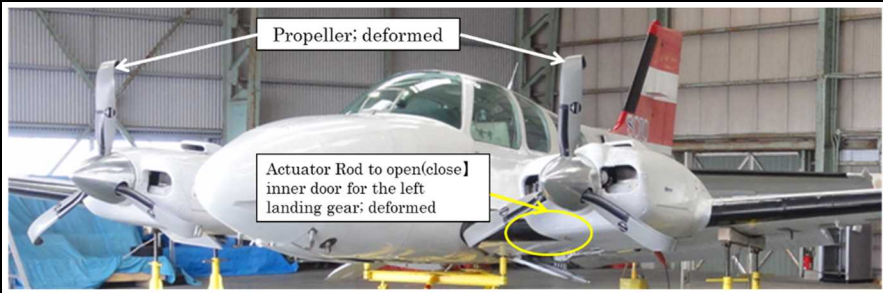


Photo 2 Damages of the front and rear

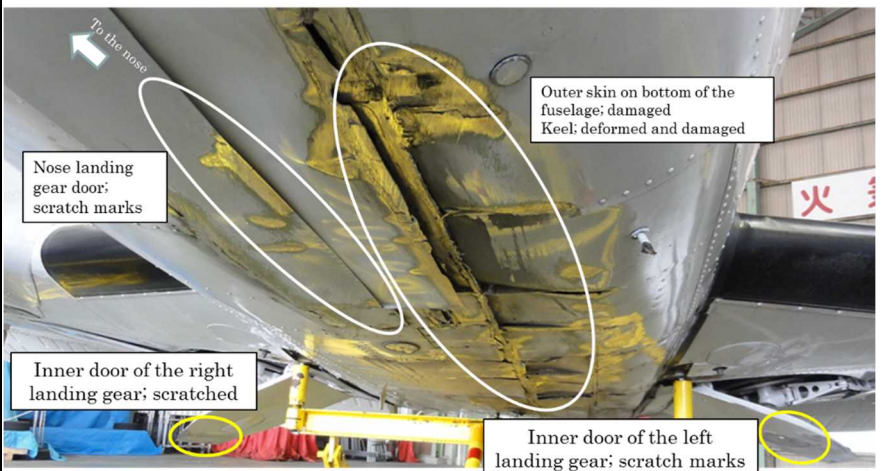


Photo 3 Damages of the undersurface

2.4 Personnel information	(1) Captain	Male, Age 68
	Airline transport pilot certificate (Airplane)	June 27, 1986
	Specific pilot competence certificate;	
	Expiration date of piloting capable period	May 17, 2018
	Type rating for multiple engine (land)	October 7, 1972
	Class 1 aviation medical certificate: validity	July 10, 2018
	Total flight time	18,760 hours 34 minutes
	Total flight time on the type of aircraft	477 hours 47 minutes
	Flight time in the last 30 days	19 hours 55 minutes
	(2) Trainee	Male, Age 63
	Commercial pilot certificate (Airplane)	January 12, 1982
	Specific pilot competence certificate;	
	Expiration date of piloting capable period	December 21, 2018
	Type rating for multiple engine (land)	January 12, 1982

Scratch marks which were caused by the propellers and the Aircraft, were starting from about 260 m before the stop position of the aircraft and were continued to the stop position of the Aircraft.

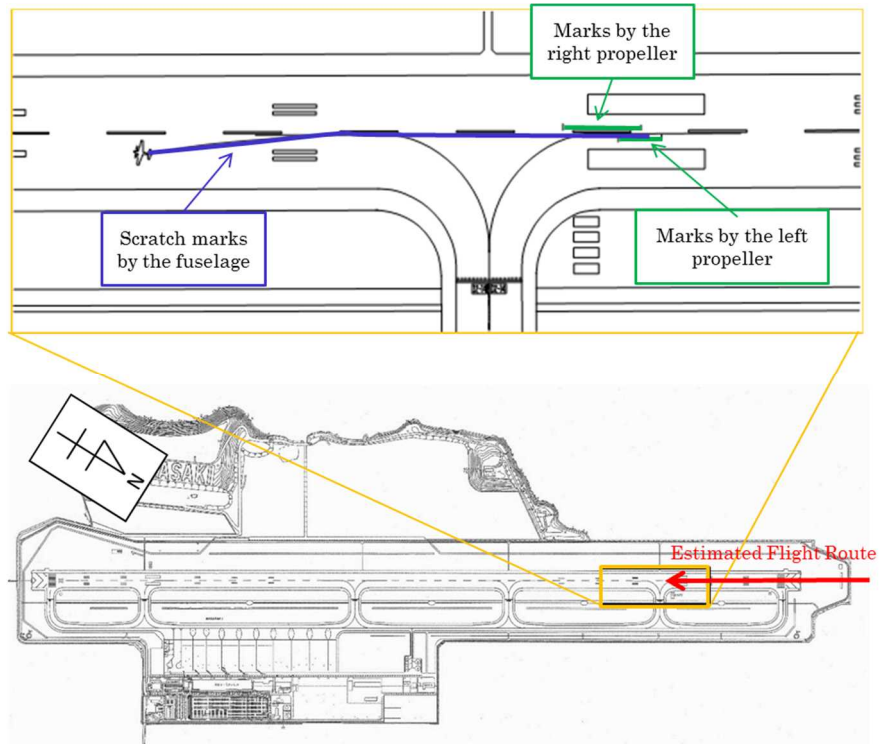


Fig 2 Accident Site

2.8 Additional information

(1) Outline of Landing Gear System and Investigation Results

The outline of the landing gear system and the investigation results of the Aircraft placed on a pedestal were as follows;

① Safety switch (detent) of Landing Gear Handle

The Landing Gear Handle has two positions which are to retract and to extend with dent (detent) in order to prevent switch to move opposite direction (return). When the Landing Gear Handle is operated, it has a mechanism to pull out the handle from the detent against the force of spring first, then move up or down.

At the time of investigation, the Landing Gear Handle was at down position, it was confirmed that the detention mechanism worked normally as moving Landing Gear Handle up and down.

② Landing gear warning device

In order not to land without extending landing gear, if any landing gear is at the position other than down lock position, the

throttle is retarded to below specified value or the flaps are set in full down position, the landing gear warning horn (intermittent sound) will be activated and the landing gear warning light will flash.

At the time of investigation, it was confirmed that there were no problems to activate a warning horn as changing the flaps position and throttle position with landing gear up.



Photo 5 Cockpit

③ Actuation of landing gear system

When an aircraft touched down and the main landing gear strut shortened more than the specified value, the safety switches equipped on both of the main landing gear struts will be activated and detect the situation of the Aircraft of being on the ground. When either one of safety switch detects an aircraft of being on the ground or both throttles will be retarded below specified value, the electrical circuit of the landing gear retraction will be opened, therefore if the Landing Gear Handle is pulled up, the landing gear would not be retracted.

When an aircraft is an airborne, the safety switch detects the aircraft of being mid-air and either one of throttle is at more than a specified value and the Landing Gear Handle is raised, the electrical circuit of the landing gear retraction will be closed, therefore the landing gear will be retracted.

At the time of investigation, it is confirmed that there are no abnormalities in the actuations of the landing gear system and down lock function of the Aircraft by retracting and extending

	<p>the landing gear as changing conditions of each safety switch and each throttle position.</p> <p>(According to the maintenance records of the Aircraft, the maintenance work and the following flight test on June 3, 2017, confirmed the normal operations of whole landing gear systems including the safety device on the Landing Gear Handle, the landing gear warning device and the extending and retracting mechanism of the landing gear.)</p> <p>(2) Regulations concerning the flight training (excerpts)</p> <p>The 3rd Volume of STP (Standard Training Procedure Manual) of the University have the following contents (Excerpts; JSTB adds () to explain terms and underlines to emphasize.);</p> <p>① General</p> <p>Operation concepts of Beechcraft 58 is a Single Pilot.</p> <p>② Aiming Point and Touchdown point</p> <p>Aiming Point is <u>the point at 322.5 m from the runway threshold</u> in principle. For the case of short field landing, Aiming Point should be the touchdown point.</p> <p>③ Normal Landing</p> <p>a. <u>Landing gear shall be lowered at the abeam of the runway threshold on the downwind leg</u> and “Three Green” lights shall be confirmed.</p> <p>b. <u>Set Propeller lever at High RPM.</u></p> <p>c. After lowering the landing gear, promptly start Landing Check List (except flaps).</p> <p>d. Lower flaps “Down” at the base leg then <u>complete Landing Check List.</u></p> <p>e. Call out “500” <u>below 500 ft AGL</u> and <u>confirm the completion of Landing Check List.</u></p> <p>f. <u>Near 200 ft AGL, recheck the landing gear-down</u>, confirm the landing clearance, no landing gear warning horn with point and call out.</p> <p>④ Short Field Landing (Same as normal landing except the following procedures)</p> <p>a. Predict landing to the short runway with obstructions on the final approach.</p>
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b. Make the final turn at the same altitude of normal landing and when heading to the final approach, set flaps “DN (Down Position)” and speed at VTH (Approach Speed at Threshold). (Establish 3.5 degrees approach path by using the decrease airspeed of about 15kts)

c. Control approach path by power on the final approach.

d. Retard throttle slowly at the threshold as rising the nose gradually, touch down at the predetermined point with the minimum speed

(3) Cases with the damages to the landing gear system due to the belly landing

In the aircraft accident investigation reports in Japan, the process of the accident cases which were resulting in belly landing because of touch down with no landing gear or unintentional gear up during landing roll. And damaged parts of the landing gear in each cases were as follows;

Table Accidents with damages to the landing gear system

	Process	Year	Damaged parts of the landing gear system
①	After touching down with no landing gear, lowered the landing gear	2002	Main landing gear doors; damaged, Actuator rods of the nose landing gear doors; deformed
②	After the normal touching down, unintentional gear up during landing roll	1996	Retract rods for nose and left main landing gears; broken Nose and main landing gears doors; damaged
③	Same as above	2008	Shear pin of retract rod for right main landing gear; broken, Retract rod for left main landing gear; deformed

3. ANALYSIS

3.1 Involvement of weather	None
3.2 Involvement of pilot	Yes
3.3 Involvement of equipment	None
3.4 Analysis of known items	<p>(1) Timing to lower the landing gear based on the damages of the Aircraft</p> <p>As described in 2.8 (3)①, according to the cases which lowered the landing gear immediately after the touch-down with no landing gear, only the actuator rods to open inner doors were deformed. On the other hand, as described in ② and ③, according to the cases which was caused by unintentional gear up during landing roll after the normal touch-down, because an aircraft was settling faster than retracting the landing gear, retract rods which actuate landing gear to be up had the weight load of an aircraft, therefore the retract rods were compressed, broken, deformed or the shear pins were broken.</p> <p>It is probable that because the damages of the Aircraft was almost same as the damages of ①case, the landing gear was begun to extend after the Aircraft touched down with landing gear-up condition and inner doors of main landing gears which was about to open had contacted with the runway surface and suffered damages. And after this, it is probable that actuator rods were trying to open the door further, were compressed and deformed.</p> <p>Furthermore, because an extent of the scratch was in a small scale, it is probable that the landing gear started to be extended shortly before the Aircraft stopped.</p> <p>(2) Handling during the traffic pattern</p> <p>The Captain and the Trainee guessed that the landing gear was lowered at the Abeam, but since the landing gear warning horn was recorded in the communication records at the time of entering to the final approach, it is highly probable that the landing gear was not at the down lock position at that time.</p> <p>As the results of the Aircraft inspection, since there was no</p>

	<p>abnormality in the landing gear system, it is probable that regarding why it was not at down lock position when entering to the final approach because the landing gear down procedures were not executed.</p> <p>(3) Situation of belly landing</p> <p>Since the Observer stated that the Aircraft leaned to left without feelings of the main landing wheels rolling after the touchdown, it is probable that after the Aircraft approached without extending the landing gear, the step and the flaps rear end touched the runway surface at first, then the step at the right side of the fuselage support the Aircraft, so the Aircraft leaned to the left, the left propeller touched down and then the right propeller touched down, made belly landing and suffered the damages to the Aircraft.</p> <p>(4) Judgment and action taken by the Captain and the Trainee</p> <p>It is probable that the Captain was instructing about a short field landing on the downwind leg.</p> <p>Later, it is somewhat likely that because the Captain was making the Abeam call which a trainee as a pilot should make normally, the Trainee missed the timing to lower the landing gear following normal procedures.</p> <p>Regarding why the Captain made the Abeam call which normally should be made by a trainee, it is somewhat likely that because instructions by the Captain from earlier continued up to near the Abeam or the Trainee was focusing on the instruction and could not make a normal call. And then, it is probable that because the Trainee was putting the procedures in order from the approach for a short field landing till the touchdown, he was distracted by this and forgot to lower the landing gear on the downwind leg.</p> <p>Furthermore, regarding why the Captain and the Trainee guessed that the Trainee lowered the landing gear at the Abeam just like usual after the Accident, it is somewhat likely that they had confused their memories with the lowering the landing gear in the previous landing.</p> <p>After lowering the flaps at the final approach, it is probable that because the attention of the Trainee was focused on how to aim the</p>
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	<p>touchdown point and how to control the Aircraft for the short field landing, he forgot to confirm the completing of the Landing Check List and to recheck the landing gear-down during approach.</p> <p>It is probable that because the Captain had a lot of reliability about the control of the Trainee since the Trainee was able to follow the instruction of the Captain, the Captain was less attentive to monitor the other handling of the Trainee than the controlling the Aircraft, he did not notice that the Trainee did not lower the landing gear, did not confirm the completion of Landing Check List and did not recheck the landing gear-down.</p> <p>It is somewhat likely that because the Trainee did not have enough experience to control the same type of the aircraft, he was unfamiliar with the controlling the Aircraft, especially with how to correct the approach path by using power with the lowered flaps and the landing gear for a short field landing. It is somewhat likely that this unfamiliar side contributed to why the Trainee did not feel uncomfortable about power response and effectiveness and others when he continued the final approach with the no landing gear till the touchdown.</p> <p>It is somewhat likely that regarding why the both of the Captain and the Trainee had stated that they felt the main landing gears made touchdown was because of the sensation caused by touching the ground by the steps and others.</p> <p>Because the Captain had reported to the Tower about the Aircraft landed with landing gear up condition after the belly landing, it is possible that he confirmed the Landing Gear Handle position, and it is somewhat likely that he might move the Landing Gear Handle to down position during the confirmation.</p> <p>Regarding why the landing gear warning horn which was estimated of being activated during the final approach was not acknowledged, just like they forgot to recheck the landing gear-down, it is probable that because the minds of the Trainee was focusing on the control of the Aircraft and the Captain was losing his attentions.</p> <p>(5) Prevention of similar accident occurrences</p> <p>At the situation like the accident, in order to prevent the</p>
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	<p>accident caused by missing the landing gear-down procedures during the takeoff and landing practice, the following shall be considered in general.</p> <p>① Because there are risks that missing the procedure during landing or takeoff could result directly in an accident, all of instructors should instruct thoroughly about how to execute the procedures and to confirm by Check List to make sure with his full attention and at the same time, he should monitor the handling of a trainee certainly.</p> <p>② Instructor should implement his explaining, instructing and others when these activities would not disturb a normal procedures of a trainee. If it is not possible, instructor should suspend the training (leaving from the traffic pattern, go-around or others) to complete the required explanation, then restart the training.</p> <p>③ Instructor should try to secure the safety by his maintaining preparedness to take over the control of a trainee as necessary, he should be keeping the fact in his mind, the trainees even with abundant flight experiences might not be familiar with the type of aircraft.</p>
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4. PROBABLE CAUSES

<p>It is probable that the accident occurred because the Aircraft touched down without extending the landing gears which resulted in a belly landing and suffered the damages to the Aircraft.</p> <p>Regarding the reason why the Aircraft touched down without extending the landing gears, it is probable that it was caused by the followings.</p> <p>The Captain did not notice that the Trainee did not lower the landing gears and did not recheck the landing gear-down, because the Captain was less attentive to monitor the other handling of the Trainee than the controlling the Aircraft.</p> <p>The trainee was distracted by the short field landing procedures and the control of the Aircraft and forgot to lower the landing gear and re-confirm it.</p>

5. SAFETY ACTION

The University implemented the following safety actions;

(1) Add remarks to the guideline provided by the University for the instructor to perform the promotion training to a captain.

① Minimize the instruction right before the takeoff or landing at the low altitude as least as possible and implement the training with safety priority while viewing the overall.

② Regarding recognitions of safety which the Instructor Under Training (IUT) should be already considered to obtain based on experiences, be on alert same as novice.

③ Make IUT aware an importance of basic like confirmation by using check list during the training.

④ Make IUT aware regarding the landing gear warning horn in the training aircraft, it could be activated during a single engine training flight or the normal descent, because it is different from airliner and others which IUT had been experienced till then, when the horn is activated, IUT should identify and handle in accordance with specified procedures.

(2) The parts of Standard Training Procedure Manual which provided the confirmation procedure on the gear down procedure at the final approach were amended.

① After performing the Landing Check List by IUT or other trainee, instructor shall confirm its completion and record it by using reminder.

② At the final confirmation at 200 ft AGL, the confirmations shall be limited to the gear-down indication lights and ATC clearance.

(3) The safety actions were made sure for the relevant parties by the classroom study.