AI2019-2

AIRCRAFT SERIOUS INCIDENT
INVESTIGATION REPORT

ACADEMIC CORPORATE BODY JAPAN AVIATION ACADEMY
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March 28, 2019

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 prevent future accidents and incidents. 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 SERIOUS INCIDENT INVESTIGATION REPORT

INABILITY TO OPERATE DUE TO DAMAGE TO LANDING GEAR DURING FORCED LANDING ON A GRASSY FIELD ABOUT 3 KM SOUTHWEST OF NOTO AIRPORT, JAPAN AT ABOUT 15:00 JST, SEPTEMBER 26, 2018

ACADEMIC CORPORATE BODY JAPAN AVIATION ACADEMY VALENTIN TAIFUN 17EII (MOTOR GLIDER: TWO SEATER), JA2451

February 22, 2019
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 THE INVESTIGATION

1.1 Summary of the Serious Incident	On Wednesday, September 26, 2018, a Valentin Taifun 17EII (motor glider), registered JA2451, owned by Japan Aviation Academy, took off from Noto Airport in order to make a test flight before the airworthiness inspection. During the flight, as causing trouble in its electric system, the aircraft tried to return to Noto Airport by gliding, but made a forced landing on a grassy field about 3 km short of Noto Airport, and sustained damage to the landing gear, therefore, the operation of the aircraft could not be continued.
1.2 Outline of the Serious Incident Investigation	This event falls under the "Case where aircraft landing gear is damaged and thus flight of the subject aircraft could not be continued" as stipulated in Item (viii), Article 166-4 of the Ordinance for Enforcement of Civil Aeronautics Act (Ordinance of Ministry of Transport No. 56 of 1952), and is classified as a serious incident. On September 27, 2018, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate this serious incident. An accredited representative of the Federal Republic of Germany, as the State of Design and Manufacture of the aircraft involved in this serious

	incident, participated in the investigation. Comments were invited from parties relevant to the cause of the serious incident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of the Pilot and the passenger, the history of flight is summarized as follows: At about 14:48 (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), on September 26, 2018, a Valentin Taifun 17EII (motor glider), registered JA2451, owned by Japan Aviation Academy (hereafter referred to as "the School"), took off from Noto Airport (hereinafter referred to as "the Airport) and was climbing through a light turbulence area in order to make a test flight before the airworthiness inspection, with the Pilot on the left seat and the passenger, who was assigned for the preparations of the airworthiness certification inspection (hereinafter referred to as "the Mechanic"), on the right seat. The Pilot decided to return to the Airport because the radio and electric powered instrument in the cockpit became inoperative immediately after making a position report at about 5 nm (about 9 km) southwest of the Airport and an altitude of around 2,500 ft. Afterwards, the Pilot turned off the master switch,*1 because he felt fumes like vinyl burning. But fumes were not eliminated and the Pilot recognized a thin white smoke ahead, therefore, he suspected an engine fire and turned off the ignition switch to shut down the engine. The Pilot tried to return to the Airport by gliding, but the Aircraft sank greatly, because the electric propeller control was not activated and he was not able to perform a propeller feathering*2. Thus, the Pilot judged that it would be impossible to reach the runway when considering the effect of headwind and a gear-down required later, and decided to head toward the grassy field where he had been thinking as a suitable site for a forced landing. As the Pilot was able to reach over the grassy field at an altitude of about 1,000 ft (about 500 ft Above Ground Level [AGL]), after manually conducting emergency gear down procedures,*3 he entered the traffic pattern and lowered the flaps gradually on the base leg.

*1 "Master switch" is a control switch in the Aircraft that connects the power output of battery and generator to avionics devices.
*2 "Feathering" means to adjust the propeller blade pitch angle to maximum and make the blades parallel to the air flow in order to reduce the propeller drag to a minimum during a flight with engine shutdown. The propeller feathering for the Aircraft can be performed by an electric propeller feathering control.
*3 "Emergency gear down procedures" means, in the case of the Aircraft, an emergency extending operation to manually open the electrical extension valve for the hydraulic fluid to flow back into the reservoir and lower the landing gear by gas spring struts, assisted by gravity force, in the event of an electric system failure.

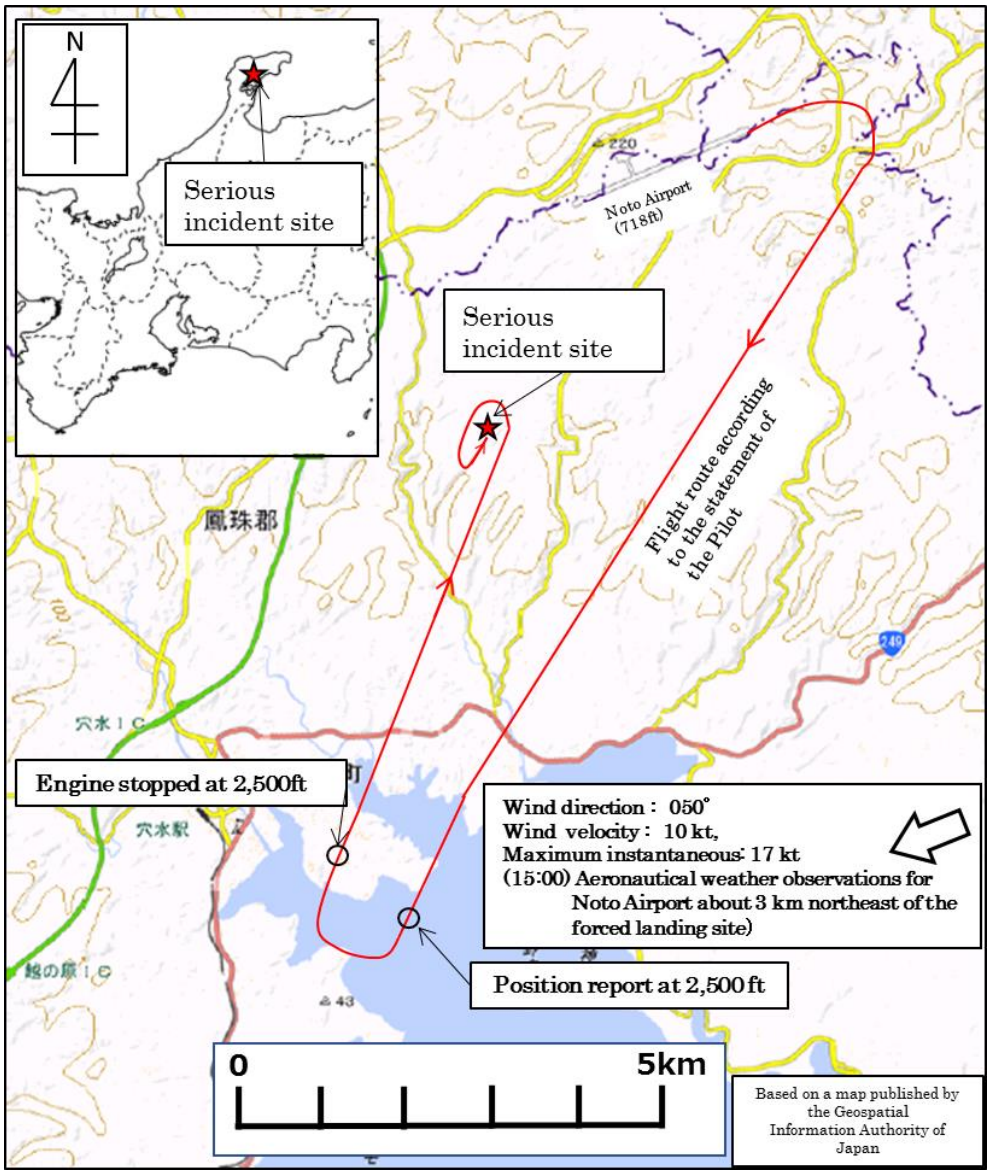


Figure 1: Estimated Flight Route

After that, as the Aircraft touched down smoothly, the Pilot thought that the Aircraft would be able to halt normally without any changes, but the nose began to veer to the left side after rolling for about 60 m. Therefore, the Pilot tried to control with the rudder pedal (linked to the nose gear steering), but the Aircraft stopped with its nose facing to the left abeam.

The Pilot applied the air brakes*4 as usual during approach, but he did not apply the main brakes intentionally after touch down that could be activated by setting the lever of air brakes to full open.

After the Aircraft stopped, the Pilot closed the emergency fuel shutoff valve, evacuated from the Aircraft, and confirmed that the Pilot and the Mechanic did not sustain any injuries. In addition, he found that the grassy field was getting wet from the rain on the previous day.

After confirming that it was at about 15:00 when the Aircraft stopped, the Mechanic got out of the Aircraft and made sure that its landing gear

*4 "Air brake" is an equipment panel stored on the Aircraft main wings, which can be opened with the lever moved to "Open" in order to increase drag, decrease lift and reduce the glide ratio.

	sustained damage.  Figure 2: The Condition of the Aircraft after Forced Landing This serious incident occurred at about 15:00 on September 26, 2018, on a grassy field located about 3 km southwest of Noto Airport (37° 16' 07" N, 136° 56' 17" E). (See Figure 6: Forced Landing Site Layout.)
2.2 Injuries to Persons	None
2.3 Damage to Aircraft	Extent of damage to the Aircraft: Minor damage (1) Gear down lock mechanism of the right main landing gear: Deformed, damaged 

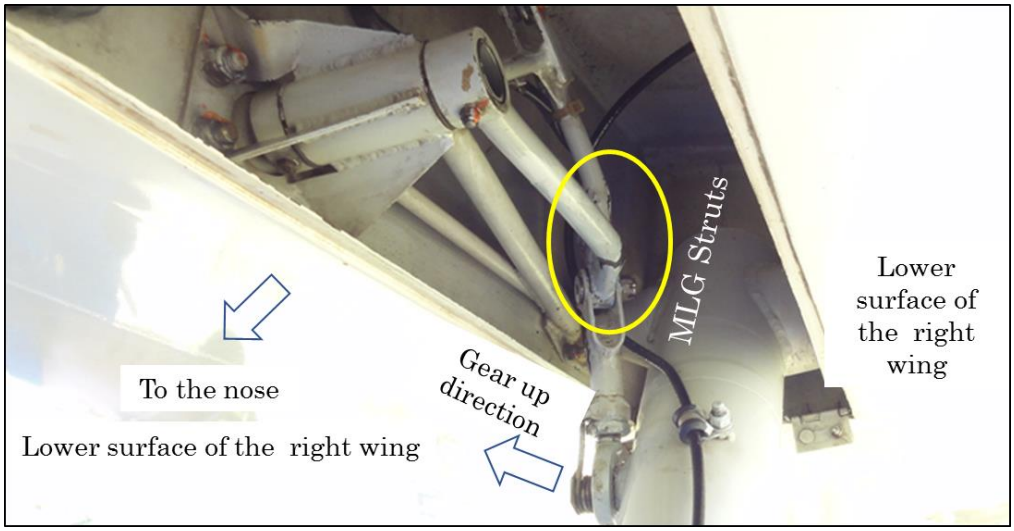


Figure 3: Damaged and deformed gear down lock mechanism of the right main landing gear

(2) Right hand nose landing gear attaching part: Damaged, detached

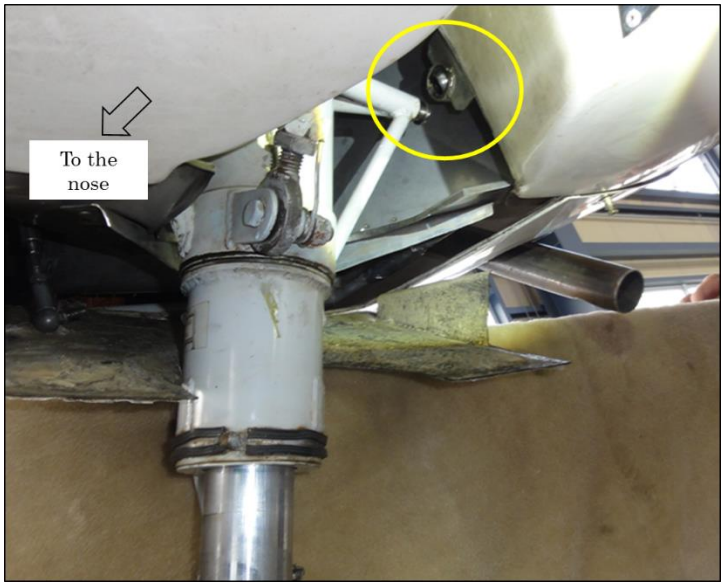
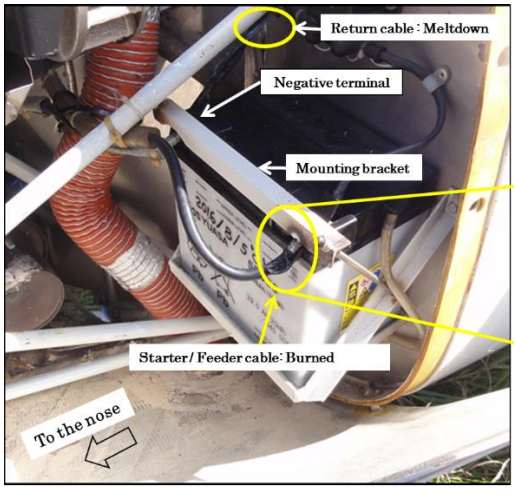


Figure 4: Detached right hand nose landing gear attaching part

(3) Starter / Feeder cable (part in proximity to the mounting bracket): Burned

(4) Return cable connected to the negative terminal: Meltdown



(Situation where the mounting bracket is removed)

	Figure 5: Damage around the Battery
2.4 Personnel Information	(1) Pilot Male, Age 58 Commercial pilot certificate (Glider) July 2, 1982 Type rating for motor glider Pilot competence assessment Expiry of practicable period for flight March 19, 2020 Class 1 aviation medical certificate Validity date: June 18, 2019 Total flight time 16,319 hours 10 minutes Flight time in the last 30 days 21 hours 05 minutes Flight time on the same type of aircraft 336 hours 45 minutes Flight time in the last 30 days 21 hours 05 minutes
2.5 Aircraft Information	(1) Type Valentin Taifun17EII Serial number 1130 Date of manufacture June 5, 1989 Certificate of Airworthiness No. 2017-34-08 Validity date September 27, 2018 Total flight time 1,580 hours 55 minutes Flight time since last periodical inspection (100-hour inspection on September 26, 2018) 1 hour 00 minute (2) When the serious incident occurred, the weight and the balance of the aircraft were both within the allowable range.
2.6 Meteorological Information	(1) Aeronautical Weather Observations for Noto Airport (excerpts) at 15:00 on September 26 Visibility 10 km, Cloud 1/8 Cumulus, 2,000 ft, 3/8 Layer Cumulus 3,000 ft, 7/8 Altostratus Height Unknown (2) Winds around the Runway 07 at Noto Airport(14:50 to 15:00) Wind direction: 050°, Average wind velocity: 10 kt, Maximum instantaneous wind velocity: 17 kt (3) According to the weather values observed at the Mitsui Automated weather station, Japan Meteorological Agency located in the site of Noto Airport, there was a precipitation of 1 mm or less per hour intermittently from 03:00 to 09:00 on September 25.
2.7 Forced Landing Site	The forced landing site located about 3 km southwest of Noto Airport was a hard ground grassy field about 30 m wide and 400 m long, which was dotted with silver grass. The brake marks of the left main wheel and then the right main wheel continued intermittently from about 40 m short of the position where the Aircraft stopped to the stop position. The Aircraft stopped with its nose facing to the left abeam relative to the approach direction (070°), its right main landing gear partially retracted and its right wing tip in contact with the ground.

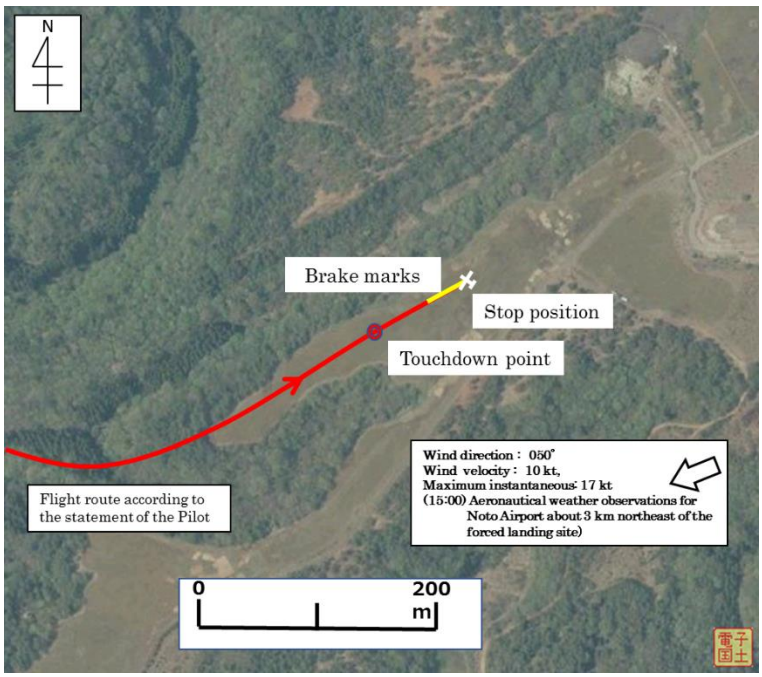


Figure 6: Forced Landing Site Layout

2.8 Additional Information

(1)Performance of the Aircraft

The flight manual has the following descriptions.

a. Landing performance

Condition Approach air speed : 57 kt, Temperature : 15 ° C,

Altitude : above sea level, Brake : not used

Landing distance to full stop: about 200 m

Landing distance across a 50 ft obstacle: about 350 m

b. Gliding performance

Condition Maximum takeoff weight : 850 kg,

Air speed: 65 kt, Flaps 0 °

Propeller: Feathered, Cowling flaps : Closed, no-wind

Maximum glide ratio : about 27.8 (calculated from gliding performance table)

Gliding distance from 1,800 ft AGL: about 14 km

(2) Battery inspection and maintenance

The Mechanic was assigned to perform a 100-hour inspection on the Aircraft for the preparations of the airworthiness certification inspection. During this 100-hour inspection, in accordance with the "Periodic Inspection List" where the School stipulated the details on its own, the Mechanic removed the battery to perform the inspection eight days before the serious incident occurred, and furthermore, he performed a preflight inspection on the day of the serious incident by opening the cover of the upper part of engine, though the cover was supposed to remain closed normally for a preflight inspection, but there were no obvious defects found in the feeder cable around the battery positive terminal that burned in this serious incident.

After the serious incident occurred, the Mechanic thought he had not fully confirmed that the mounting bracket was not in contact with the starter/feeder cable when installing the battery that had been removed for the

inspection.

There is the following description in the Periodic Inspection List for the same type of the aircraft in the School.

- Battery installation
  Are there any damages to the terminals and coating, deterioration, or corrosion?
  Is the amount of electrolytic solution appropriate? Is the charging state appropriate?

(3) Battery installation

Although there was no rules of the School for battery installation procedures, as shown in Figure 7, when installing the battery for the same type of the aircraft other than the Aircraft in the School, the mounting bracket is installed on the upper part of the battery, all the feeder cables from the positive terminal were wired rearward from under the protective covering made of plastic located below the mounting bracket in order to protect feeder cables from an electrical short circuit. In contrast to this, the mounting bracket of the Aircraft was installed in such a manner as shown in Figure 5 and by the blue arrow in Figure 7, and the starter/feeder cable without protective covering was installed below the mounting bracket.

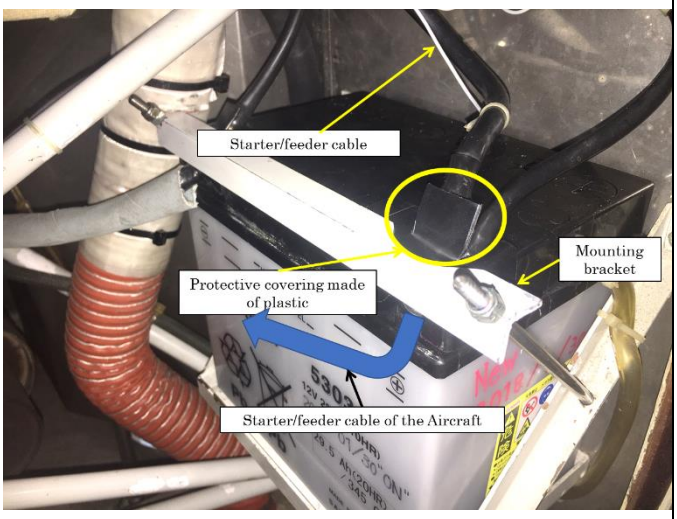


Figure 7: Battery installation for the same type of the aircraft other than the Aircraft in the School

(4) Inspection items for electrical wiring

a. There are following descriptions on page 398 in the "Standards for Aviation Maintenance Work" (published in 2016 by the Japan Aeronautical Engineers' Association), which was translated from the working standards for aviation inspection and maintenance work issued by the United State Federal Aviation Administration (FAA). (excerpts)

Section 8 Wire Inspection Items

11-96 General

Overall wire inspection shall be performed to ensure that electrical wires and cables are appropriately supported and protected, and that the wiring as a whole is in good condition. (omission) *It shall be confirmed to ensure the aircraft wiring meets the following requirements by a visual inspection on the aircraft wiring.*

q. Electrical wires and cables are distributed so that they would not rub

	against airframe or other components. b. There are following descriptions regarding the aircraft battery inspection and the electric wiring of the airframe on page 9-26 and 9-80 in the "Aviation Maintenance Technician Handbook-Airframe Volume1" (published in 2018 by the U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION Flight Standard Service. (excerpts) • *Aircraft Battery Inspection* *Inspect battery terminals and quickly disconnect plugs and pins for evidence of corrosion, pitting, arcing, and burns. Clean as required.* • *Routine preflight and postflight inspection procedures should include observation for evidence of physical damage, loose connections, and electrolyte loss.* • *Protection against Chafing* *Wires and wire groups should be protected against chafing or abrasion in those locations where contact with sharp surfaces or other wires would damage the insulation, or chafing could occur against the airframe or other components. Damage to the insulation can cause short circuits, malfunction, or inadvertent operation of equipment.*

3. ANALYSIS

3.1 Involvement of Weather	Yes
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	Yes
3.4 Analysis of Findings	(1) Influence of weather It is probable that during the time period of the serious incident, the Aircraft had a headwind blowing from an eastward direction at an average wind velocity of 10 kt and a maximum instantaneous wind velocity of 17 kt. It is also probable that in the grassy field, the forced landing site, there were a lot of slippery places scattered across because of the puddles formed after the rain on the previous day. (2) Situation from the occurrence of the malfunction up to the forced landing It is probable that according to the extent of damage to the Aircraft and the statement of the Pilot, after takeoff, when the Aircraft was climbing through a light turbulence area in the vicinity of about 9 km of southwest of the Airport, the core wire of the feeder cable to the starter connected to the positive terminal contacted with the mounting bracket of the battery, which caused an electrical short circuit and allowed a large current to flow to the return cable connected via the mounting bracket to the negative terminal, which led to the return cable's burning into a meltdown that allowed the electrical circuit to open, resulting in the electric power loss. And at this time, it is probable that a smoke was generated in the engine room. It was probable that afterward, on the way back to the Airport, the

Aircraft shut down the engine from an altitude of about 1,800 ft AGL to commence gliding and headed toward the Airport located about 8 km away, but it could not reach the Airport, and made a forced landing on a grassy field located about 3 km short of the Airport with its landing gear extended.

It was probable that the nose veered to the left after touchdown, and when the Aircraft slowed down rapidly while turning to the left and stopped with its nose facing to the left abeam relative to the approach direction, its right main wheel and the nose wheel received the leftwards force from the ground; and thus, its right main landing gear was damaged to be partially retracted, and the nose landing gear was detached because of the damage to the right hand nose landing gear attaching part, therefore, the operation of the Aircraft could not be continued.

(3) Judgment and actions taken by the Pilot

It is probable that on the way back to the Airport due to causing trouble in the electronic system of the Aircraft during the takeoff climb, the Pilot suspected an engine fire, because fumes were felt continuously and a thin white smoke was coming from the engine room; therefore, he shut down the engine and commenced gliding.

It is probable that after conducting emergency gear down procedures, the Pilot made a forced landing on the grassy field where he had been thinking as a suitable site for a forced landing, because he judged that it would be impossible to reach the runway, by considering the performance of the Aircraft, as shown in 2.8 (1), which would not allow the pilot to feather the propeller in a headwind situation because of the electric power loss, and by estimating that the operation for gear-down required later would increase drag.

The Pilot stated that he did not apply the main brakes intentionally after touchdown, but it is somewhat likely that judging from the brake marks, the Pilot's hand holding the lever of airbrakes might temporarily move to the full open because of vibrations and others during landing and rolling on the grassy field, and furthermore, the nose veered to the left due to single-sided braking of left side affected by the grassy field condition where slippery places scattered due to the rain on the previous day.

It is probable that the Pilot was able to judge a situation in a calm manner and succeed in the forced landing without sticking to an emergency landing at the airfield, because he well grasped the performance of the Aircraft, and besides, he preselected the suitable site for a forced landing.

(4) Battery installation and inspection

It is somewhat likely that because the battery was not properly installed in the Aircraft and the starter/feeder cable was wired without any protective covering, it might be in contact with the mounting bracket.

In addition, at the 100-hour inspection, there was no obvious defect found in the feeder cable, but it is somewhat likely that during the engine ground run after the inspection and the subsequent test flight, the coating of the starter/feeder cable in contact with the mounting bracket sustained damage. However, during the preflight inspection, this defect was not detected,

	therefore, it is probable that while the Aircraft climbed through a light turbulence area after take-off, the core wire of the feeder cable contacted with the mounting bracket, which caused an electrical short circuit. In view of these facts that the way of installing the battery in the Aircraft was improper and different from that in the same type of aircraft owned by the School, and an electrical short circuit was caused, it is necessary for the School to establish appropriate battery installation procedures and review the current inspection procedures. (5) Prevention of similar serious incidents The following matters shall be considered in order to prevent similar serious incidents resulting from a battery short circuit. 1. The battery shall be installed not to interfere with electrical wiring. 2. At the inspection, it shall be confirmed in detail that the battery and electrical wiring are properly installed, and that there would be no defects in electrical wire.

4. PROBABLE CAUSES

In this serious incident, it is somewhat likely that because at the time of the forced landing on a grassy field, the Aircraft slowed down rapidly while its nose veered to the left due to single-sided braking of left side and stopped with its nose facing to the left abeam relative to the approach direction, its right main landing gear and the nose landing gear were damaged, therefore, the operation of the Aircraft could not be continued.

It is probable that the Aircraft made a forced landing on a grassy field, because the Pilot judged that it would be impossible to reach the runway, though he shut down the engine to commence gliding, since fumes were felt and a thin white smoke was seen on the way back to the Airport due to the electric power loss.

Regarding fumes and a white smoke recognized by the Pilot, it is probable that because the battery was not properly installed in the Aircraft and the defect in the coating of the battery wiring was not detected during the preflight inspection, the core wire of the feeder cable contacted with the mounting bracket of the battery, which caused an electrical short circuit, generating fumes and a white smoke.

5. SAFETY ACTIONS

The School has decided to take the recurrence preventive measures to address the following matters.

1. Battery installation procedures
   Battery installation procedures shall be established in consideration of protective covering for feeder cables.
2. Preflight inspection procedures
   The procedures shall be changed to describe that the engine cover (upper part) shall be opened every time to confirm the battery and wiring installation in the engine room.
3. Battery inspection procedures at a periodical inspection
   The procedures shall be changed to add the confirmation on the position of battery mounting bracket and the connecting condition of electrical wiring and battery terminals
4. Reconfirmation of Flight characteristics and emergency procedures, and in-flight

training.

5. Education by using an airplane and lectures shall be provided in regard to lessons learned from this serious incident and those related changes in operating procedures and others.