

AA2011-3

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

PRIVATELY OWNED

J A 8 0 D G

March 25, 2011

Japan Transport Safety Board

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

Norihiro Goto
Chairman,
Japan Transport Safety Board

Note:

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

AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATELY OWNED
DG-800B (MOTOR GLIDER, ONE-SEATER), JA80DG
HOKUEI TOWN, TOHAKU DISTRICT, TOTTORI PREFECTURE
AT ABOUT 14:00 JST, JUNE 24, 2010

February 25, 2011

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

1. PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

On June 24 (Thursday), 2010, a privately owned DG-800B, registered JA80DG, landed at a gliding field in Nishitakao, Hokuei Town, Tohaku District, Tottori Prefecture, at about 14:00 Japan Standard Time (JST: UTC+ 9hr, unless otherwise stated all times are indicated in JST on a 24-hour clock), at the end of a familiarization flight. At that time, the aircraft sustained damage by hitting its aft fuselage against the edge of the approach end of the gliding field.

There was only the captain on board the aircraft, and the captain was not injured.

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

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On June 25, 2010, the Japan Transport Safety Board, upon receiving information about the occurrence of the accident, designated an investigator-in-charge and another investigator to investigate this accident.

1.2.2 Representative from Foreign Authorities

An accredited representative of Germany, 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

June 26, 2010 On-site investigation and Interviews

June 27, 2010 Aircraft examination and Interviews

1.2.4 Comments from Parties Relevant to the Cause of the Accident

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

1.2.5 Comments from the Participating State

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

2. FACTUAL INFORMATION

2.1 History of the Flight

A privately owned DG-800B, registered JA80DG (hereinafter referred to as “the Aircraft”), had planned to make a round-trip familiarization flight to Tsuyama City on June 24, 2010, with only the captain on board, after taking off from a gliding field (hereinafter referred to as “the Gliding Field”) in Nishitakao, Hokuei Town, Tohaku District, Tottori Prefecture.

The outline of the flight plan for the Aircraft was as follows:

Flight rules : Visual flight rules (VFR), Departure aerodrome : Nishitakao, Estimated off-block time : 12:30, Cruising speed : 70 knots, Cruising altitude : VFR, Route : Tsuyama, Destination aerodrome : Nishitakao, Estimated flight time : 2 h and 00 min, Purpose of flight : Familiarization flight, Fuel load expressed in endurance : 3 h and 00 min, Number of persons aboard : one

The history of the flight up to the time of the accident is summarized below, based on the statements of the captain of the Aircraft.

At about 8:30 on the day of the accident, the captain towed the Aircraft on a trailer from a garage in Kurayoshi City, Tottori Prefecture, to the Gliding Field. First of all, he mowed the grass in an area which is believed to become an obstacle to take-off and landing. Then he assembled the Aircraft and confirmed there was no problem with the Aircraft. After having a lunch, he reported the flight plan by telephone to the Miho Airport Office of the Osaka Regional Civil Aviation Bureau. At about 12:37, he took off from the Gliding Field to the magnetic direction of 030°. The weather was fine with no cloud and it was good visibility. Judging from the windsock in the Gliding Field, the wind was blowing from the northeast at about 5 knots.

About 10 minutes after the take-off, when the Aircraft climbed to an altitude of about 6,000 feet, the engine was stopped and was taken into the fuselage and then, the Aircraft started gliding. The Aircraft flew toward Tsuyama City as planned, but because there were no cumulous as an indication of the presence of thermals seen at all in that direction, the captain decided to stay over a mountainous area in the northwestern part of Tsuyama City where presence of thermals were expected. After about an hour of thermal soaring*¹, the Aircraft returned to the area over the departure aerodrome. The Aircraft adjusted the altitude while circling in an area west of the Nishitakao Dam. In order to land on the Gliding Field in the magnetic direction of 030°, the Aircraft entered the downwind leg on the traffic pattern at an altitude of about 1,500 feet (an altitude of about 1,000 feet above ground level of the Gliding Field).

Just before entering the downwind leg, the captain opened the airbrake*² by half. After extending the landing gears, he moved the flaps to the full down position and after that, while holding the airbrake lever with the left hand, he controlled the descent rate with the control stick on the right hand side and the airbrake. The captain supposed that, judging from the direction of windmills set up for wind power generator near the Gliding Field, the wind was blowing from the northeast, the same direction as at the time of take-off. He also supposed that the wind velocity was almost the same as at the time of take-off, because there had been no change in the weather condition.

After starting an approach at 110 km/h, the captain reduced the air speed to 82 km/h, which is 10 km/h over the stall speed in the last phase of the final approach. The captain usually takes aim at a place 30 meters inside from the edge of the approach end of the Gliding Field as the aiming point. But at that time, considering the possibility that the grass would twine around the wing-tip wheels causing work load increase after landing, he made his approach while aiming point at the closest possible point to the edge so that the Aircraft would stop in an area which is less farther from the edge and where the grass was not thick.

When the Aircraft came close to the edge of the boundary, the captain realized that the Aircraft's altitude was lower than an intended glide path*³. So, he closed, but not fully closed the airbrake, and raised the nose more than usual. He thought he could manage to control the Aircraft to glide onto the Gliding Field. But when the Aircraft passed the edge of the boundary of the Gliding Field, he felt a strong impact in the aft fuselage and at the same time, the Aircraft nearly fell forward with the nose lowered and the Aircraft contacted the ground with a big bang.

The Aircraft came to a stop after running on the ground while slightly veering to the left from the center of the landing area. The captain stated that a clock mounted on the Aircraft showed

*¹ The thermal soaring means gliding for a long time while riding on thermals.

*² The airbrake means a system which has rectangular panels which vertically extend by stages on the upper side of the main wings. The panels, when extended, increase the air drag and reduce the lift and the glide ratio.

*³ The glide path means a descending path for aircraft in approach.

about 14:00.

After the Aircraft stopped, the captain confirmed there had been no injury to himself and then, he got out from the Aircraft and confirmed the deformation of the tail wheel, cracks in the aft part of the fuselage and a hole made on the canopy.

Later, the captain confirmed the place where the Aircraft stopped. The place, the point believed to be where the aft part of the fuselage contacted the ground, was about 120 meters from the edge of the Gliding Field. When the captain considered the situation later, he thought he might be able to avoid the tailstrike with the edge if he fully closed the airbrake when he realized just before landing that the altitude was lower than the intended glide path.

The accident occurred at about 14:00 at a place on the southern edge of the ground of the Gliding Field (Latitude 35°26'18" N, Longitude 133°42'12" E).

(See Figure 1 Estimated Flight Route, Figure 2 Estimated Flight Route and Accident Site, Photo 1-1 Accident Site (Viewed from the approach end), Photo 1-2 Accident Site (Viewed toward to the approach end))

2.2 Injuries to Persons

No one was injured.

2.3 Damage to the Aircraft

2.3.1 Extent of Damage

Substantial

2.3.2 Damage to the Aircraft Components

- (1) Abrasions on the lower nose
- (2) A round breakage hole in the canopy (over the cockpit)
- (3) A crack in the lower fuselage (about one centimeter wide, about 2 meters long)
- (4) Three cracks in both sides of the aft fuselage (about one centimeter wide, 15 to 20 centimeters long)
- (5) Deformation of the tail wheel fork

Among components for the flight control system, there were no abnormalities except the inoperative rudder system linked to the tail wheel sticking to the fuselage due to the deformation of the tail wheel fork.

(See Photo 2 Accident Aircraft)

2.4 Personnel Information

Captain	Male, Age 73	
Private pilot certificate (Glider)		October 15,1991
Type rating for High class glider		October 15,1991
Motor glider		February 6,1992
Class 2 aviation medical certificate		
Validity		September 7,2010
Total flight time (Glider and Motor glider)		418 h 00 min
Flight time in the last 30 days		3 h 40 min
Total flight time on the type of aircraft		274 h 47 min
Flight time in the last 30 days		3 h 40 min

2.5 Aircraft Information

2.5.1 Aircraft

Type	DG-800B
Serial number	8-142B66
Date of manufacture	November 25, 1998
Certificate of airworthiness	10-46-01
Validity	May 20, 2011
Category of airworthiness	Motor glider Utility U or Glider U
Total flight time	277 h 49 min
Flight time since last periodical check (Year Check on May 20, 2010)	3 h 40 min
Aspect ratio	27.4
Best glide ratio (Weight at the time of accident)	50.1
(See Figure 3 Three Angle View of DG-800B)	

2.5.2 Weight and Balance

When the accident occurred, the Aircraft's weight is estimated to have been 440 kilograms and the center of gravity is estimated to have been 349 millimeters aft of the reference line, both of which are estimated to have been within the allowable ranges (maximum takeoff weight of 525 kilograms, and 238 to 383 millimeters for the center of gravity range corresponding to the weight at the time of the accident.)

2.5.3 Stall Speed

According to a description in Clause 5-2.2 "Stall Speed" in the flight manual for the Aircraft, the stall speed for the aircraft weight and the position of flaps at the time of the accident is estimated at 69 km/h when the airbrakes are fully closed and 76 km/h when the airbrake is fully open.

2.6 Meteorological Information

(1) General Weather Outlook

A general weather outlook for Tottori Prefecture announced by the Tottori Regional Meteorological Observatory at 10:35 on June 24 was as follows:

Weather in Tottori Prefecture is fine covered with a high atmospheric pressure. On June 24, weather will be fine covered with a high atmospheric pressure.

(2) Wind Direction, Wind Velocity

The wind direction in terms of the magnetic direction and the average wind velocity, as observed with the wind power generator located about 800 meters north of the Gliding Field at almost the same elevation as that of the Gliding Field were as follows:

Time	12:30	13:00	13:30	14:00
Wind Direction	018°	014°	029°	013°
Average Wind Velocity	5 kt	5 kt	5 kt	4 kt

(Average wind velocity: Average for the preceding 10 minutes)

2.7 Information about Accident Site

2.7.1 Outline of the Gliding Field

The Gliding Field is located on a plateau with an elevation of about 160 meters (about 500

feet) east of the Nishitakao Dam in Hokuei Town, Tohaku District, Tottori Prefecture. The Gliding Field is a grass strip which has a flat area about 35 meters wide and about 320 meters long in the magnetic direction of 030°/ 210°.

(See Figure 1 Estimated Flight Route, Photo 1-1 Accident Site (Viewed from the approach end), Photo 1-2 Accident Site (Viewed toward to the approach end))

2.7.2 Situation at Accident Site

The edge of the ground on the side used for the Aircraft's approach is an angular part where the flat area of the Gliding Field and the steep slope of the plateau meet each other. The height of the steep slope of the plateau is about 4 meters. The area ahead from the bottom of the slope gradually becomes higher toward the south.

When the on-site investigation was conducted, there was no trace of tailstrike left in the area around the edge where the captain felt a strong impact. But broken pieces of the canopy were found at a point about 7 meters within the central part of the edge.

The place where the captain stated that the Aircraft stopped was about 3 meters to the left from the center line of the flat area as the landing and take-off area and about 120 meters within the edge.

The grass is less grown in the southern part about one third of the flat area of the Gliding Field while the grass is thickly grown at places to the north. The height of the grass was about 30 centimeters at some places in areas which are 8 meters or more away to both sides from the center line of the landing area.

(See Figure 2 Estimated Flight Route and Accident Site, Photo 1-1 Accident Site (Viewed from the approach end), Photo 1-2 Accident Site (Viewed toward to the approach end))

2.7.3 Flight Operations at the Time of Landing

A 1990 publication, written by Kakuichiro Harada and entitled "The Basics of Glider Operation" (publisher: Hobun Shorin Co., Ltd.) (hereinafter referred to as "the Operation Reference Book"), is widely used among glider operators in Japan. The publication includes the following descriptions: (Excerpt)

12. Flying a Traffic Pattern and Making a Landing (Basic Procedure for Flying a Traffic Pattern)

(From page 94 on)

When the aircraft has aligned itself with the runway in a final turn, the wings must be in a level, and the aiming point must be set at a point 50 to 70 meters short of the touchdown point (the runway end or a marked point) and the touchdown point must be the second aiming point.

*An approach must be made toward the first aiming point. The dive brake*⁴ must be used while considering the approach speed, the wind velocity and the wind direction, but the dive brake should not be fully opened from the beginning. When the pilot feels the altitude is high, the dive brake must be fully open. Attention must be paid to this operation because the speed changes with the use of the dive brake. It is important to learn the physical sense of the approach angle and the sinking rate toward the aiming point. (Omitted) The pilot should not think about adjusting the speed by only to use the elevator with the dive brake fully opened. The important thing is to adjust the dive brake, and in either case when the flight distance*

*⁴ The dive brake is equal to the airbrake of the Aircraft.

must be extended or it must be shortened, the pilot must keep in mind it depends on the adjustment of the dive brake.

An operation to flare must be performed gently at an altitude of one to 1.5 meters at the point for the first aiming point. After that, the aiming point must be shifted to the landing point. (Omitted)

The nose must be kept in a level position at a place in front of the touchdown point (the end of the limit value, for example, when the limit value is 60 meters) so that the aircraft will touch down with the landing gears in an attitude which is in parallel with the ground. (Omitted)

3. ANALYSIS

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

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

3.3 Weather at the Gliding Field

According to the statements of the captain described in 2.1 and the meteorological information described in 2.6, it is considered probable that weather was fine and visibility was good at the Gliding Field at the time when the accident occurred, with the wind blowing from the north-northeast at about 4 knots.

When a strong wind is blowing at the Gliding Field, it may be possible that, a wind blowing through the flat area to the south blows down from the steep slope at the southern edge, and then a downdraft occurs near the edge of the Gliding Field. But on the day of the accident, the wind was blowing almost from the head and the velocity was only about 4 knots. Therefore, it is considered probable that a downdraft that is strong enough to affect the aircraft control had not occurred.

3.4 Damage to the Aircraft

The result of an analysis concerning the damage to the Aircraft as described in 2.3 is shown below. It is considered highly probable that damage to all components mentioned there had been caused by force applied from outside when the accident occurred, and there had been no problems with the Aircraft before the accident.

As described in 2.1, the captain felt a strong impact in the aft part of the fuselage when the Aircraft passed the edge of the Gliding Field.

It is considered highly probable that the crack in the lower aft fuselage was caused when the aft fuselage struck the edge. The three cracks found in both sides of the aft fuselage were seen around the middle of the long crack left on the lower fuselage in the front to rear direction. Therefore, it is considered highly probable that this area had been hardest struck when the aft fuselage struck the edge .

It is considered highly probable that the abrasions on the lower nose were caused because the lower nose struck the ground when the Aircraft touched down with a loud sound while leaning the nose downward, after the aft fuselage struck the edge.

The place where the broken pieces of the canopy were found almost corresponds to the place

where the cockpit existed when the aft part of the fuselage struck the edge of the boundary. Therefore, it is considered highly probable that the captain's headset struck the canopy, partially damaging it, when the Aircraft nearly fell forward and the nose leaned downward in reaction to the impact caused when the aft fuselage struck the edge of the boundary.

(See Figure 2 Estimated Flight Route and Accident Site, Photo 1-1 Accident Site (Viewed from the approach end), Photo 1-2 Accident Site (Viewed toward to the approach end), Photo 2 Accident Aircraft)

3.5 Situation up to the Occurrence of the Accident

(1) From Traffic Pattern to Final Approach

- ① According to the Operation Reference Book, when the aircraft aligned itself with the runway, the wings must be kept in a level and then, an approach must be made basically by setting the aiming point at a point 50 to 70 meters short of the touchdown point (the runway end or a marked point).
- ② According to the statements of the captain described in 2.1, it is considered probable that, he usually takes aim at a place 30 meters inside from the edge of the Gliding Field, correspond to the runway end, as the approach target, but in the accident, he made his approach while aiming at the closest possible point to the edge so that the Aircraft would stop in an area which is less farther from the edge where the grass was not thick, in order to minimize work after landing.
- ③ For gliders which cannot adjust the descent rate with the engine, the approach aiming point needs to be set at a place with an enough distance kept for landing, such as the runway threshold or a marked point, from the point of view of ensuring safety.
- ④ The captain should have set the approach aiming point well within the edge of the Gliding Field so that the Aircraft can land on the ground safely, while paying attention to properly maintaining the condition of the Gliding Field with no obstacle for work after landing or without minding labor work after landing.

(2) From Final Leg to Touchdown

- ① The Operation Reference Book says that because it is important to adjust the airbrake in the approach, the pilot must always keep in mind that the flight distance must be adjusted by using the airbrake. The book also says that the maximum possible attention must be paid to maintaining an appropriate glide path and that an operation to flare must be performed gently at an altitude of one to 1.5 meters at the approach aiming point and then, the nose kept in a level position at a place in front of the touchdown point so that the aircraft will touch down with the landing gears in an attitude which is in parallel with the ground.
- ② As described in 2.1, the captain stated that he reduced the air speed to 82 km/h, which is 10 km/h over the stall speed in the last phase of the final approach. As described in 2.5.3, the stall speed for the Aircraft with its airbrake half opened at the time of the accident is estimated at about 72 km/h, in the middle of the stall speeds for the conditions with the airbrake fully closed and fully opened. Therefore, if the captain's statements are accurate, it is considered probable that the allowance in the speed over the stall speed as intended by the captain had been kept even in the last phase of the final approach.
- ③ According to the captain's statement the situation was follow, When the Aircraft came

close to the edge of the boundary, he realized that the Aircraft's altitude was lower than an intended glide path. So, he closed, but not fully closed the airbrake, and raised the nose more than usual. He thought he could manage to control the Aircraft to glide onto the Gliding Field. But when the Aircraft passed the edge of the boundary of the Gliding Field, he felt a strong impact in the aft fuselage and at the same time, the Aircraft fell forward with the nose lowered and the Aircraft contacted the ground with a big bang.

- ④ With regard to the reason why the captain didn't realize until the final phase of the approach that the Aircraft's altitude had been too low to reach the Gliding Field while the airspeed had been maintained as intended, it is considered probable that, he had believed that the glide path became lower in altitude corresponding to the difference between the aiming point at that time and the usual aiming point, as a result, he failed to realize that the actual glide path became much lower than that corresponding to the difference.
- ⑤ Even when he realized the altitude had become lower than intended, he did not fully close the airbrake immediately, but he only returned the brake insufficiently. Therefore, it is considered probable that an increase in the lift and a decline in the air drag were insufficient. Furthermore, it is considered probable that because the captain raised the nose beyond the level position while expecting a momentary increase in the lift, the air drag increased at the same time. It is considered probable that, without being able to fully adjust the descent rate, the Aircraft struck its lowered aft fuselage against the edge of the Gliding Field and after that, the Aircraft fell forward on its touchdown and sustained damage.

3.6 Prevention of Recurrence of Similar Accidents

In order to prevent a recurrence of similar accidents, it is necessary for gliders which cannot adjust the descent rate with the engine to have the approach aiming point set at a place with an enough distance kept for landing inside the gliding field to secure safety. Efforts must be made in the approach to maintain an appropriate glide path. If the approach deviates from the intended path, the pilot must become aware of the deviation as soon as possible and adjust the approach by using the airbrake appropriately. Furthermore, the pilot needs to start an operation to flare gently when the aircraft came close to the approach aiming point and the touchdown must be made moderately first with the main landing gears, with the nose kept in a level position, while maintaining an attitude which is in parallel with the ground.

4. PROBABLE CAUSES

It is considered probable that this accident occurred as follows: because the captain had failed to realize in time that the Aircraft's altitude had been too low to reach the Gliding Field and also because he raised the nose beyond the level position after he realized the low altitude with closing the airbrake insufficiently, the Aircraft struck its lowered aft fuselage against the edge of the Gliding Field and then, the Aircraft fell forward on its touchdown and sustained damage without being able to fully adjust the descent rate.

It is considered probable that setting the approach aiming point at the edge of the Gliding Field, which was far short of usual aiming point, contributed to the delayed timing for the captain to realize that the Aircraft's altitude had been too low to reach the Gliding Field.

Figure1 Estimated Flight Route

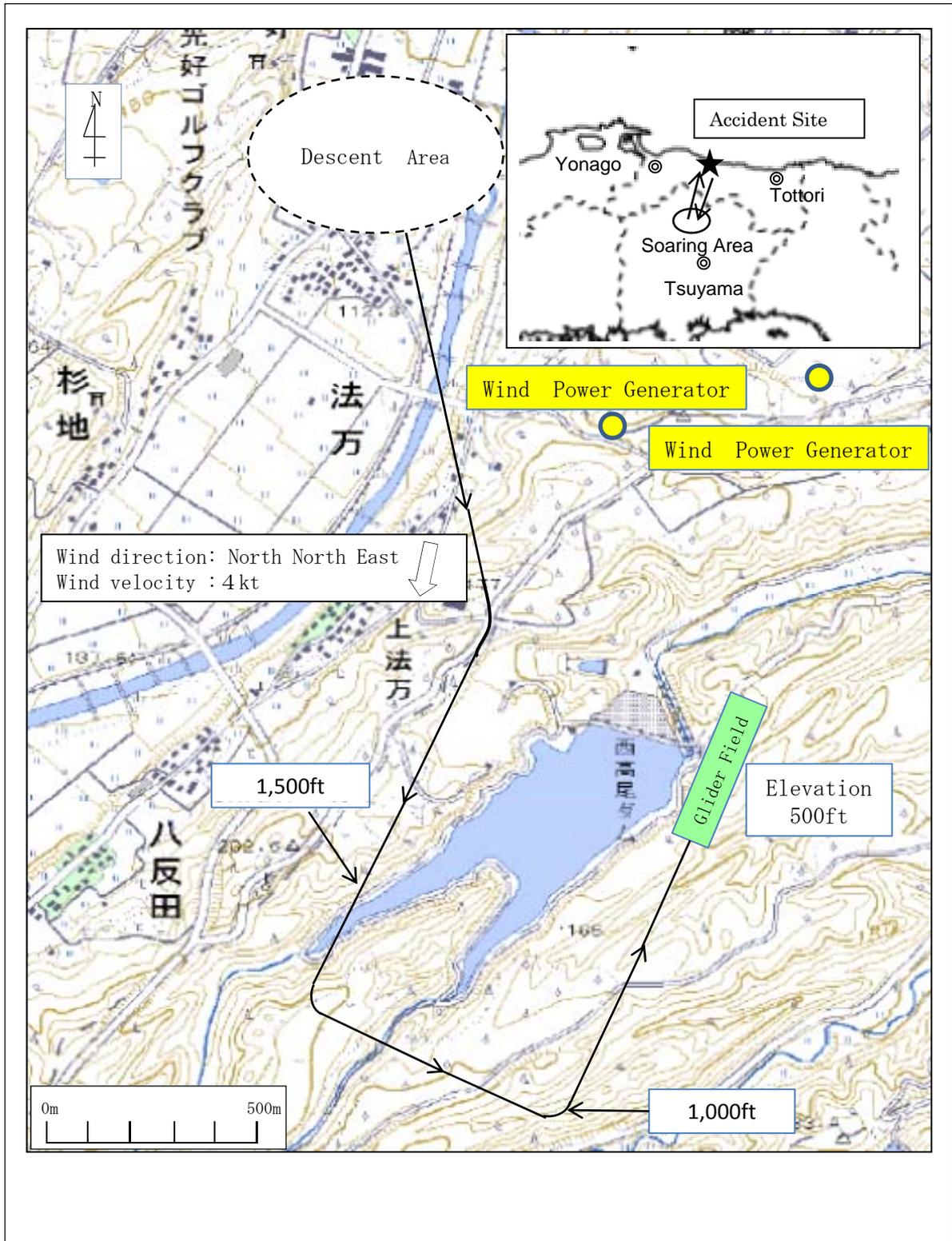


Figure 2 Estimated Flight Route and Accident Site

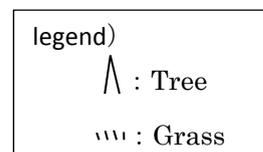
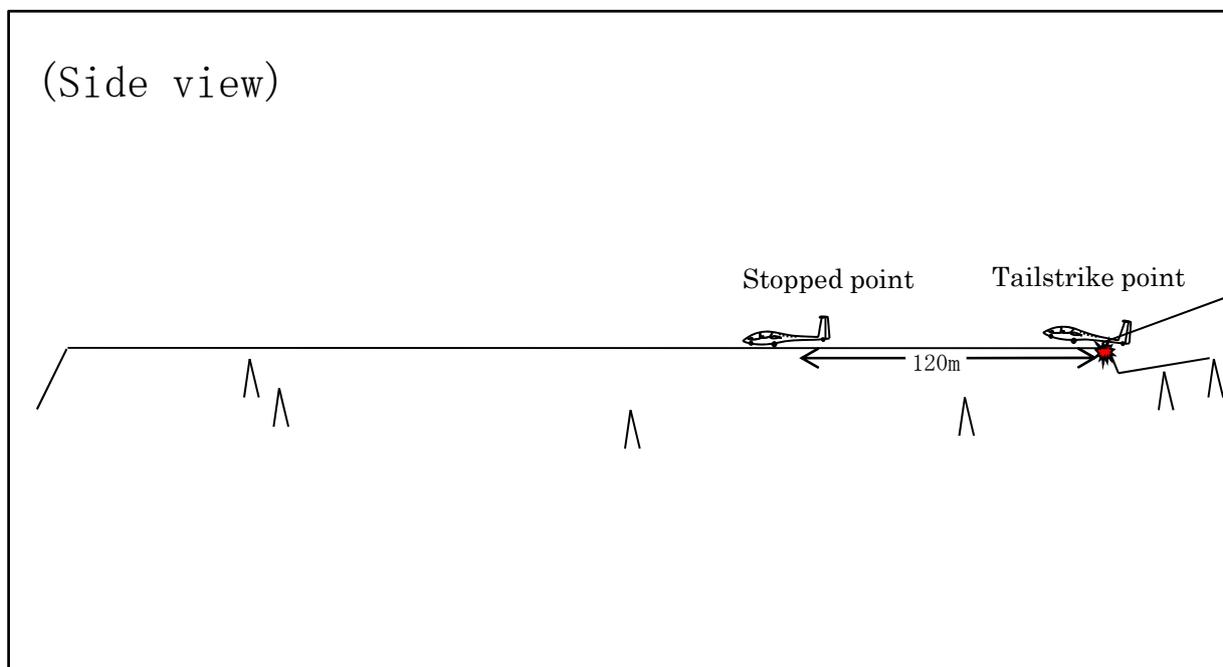
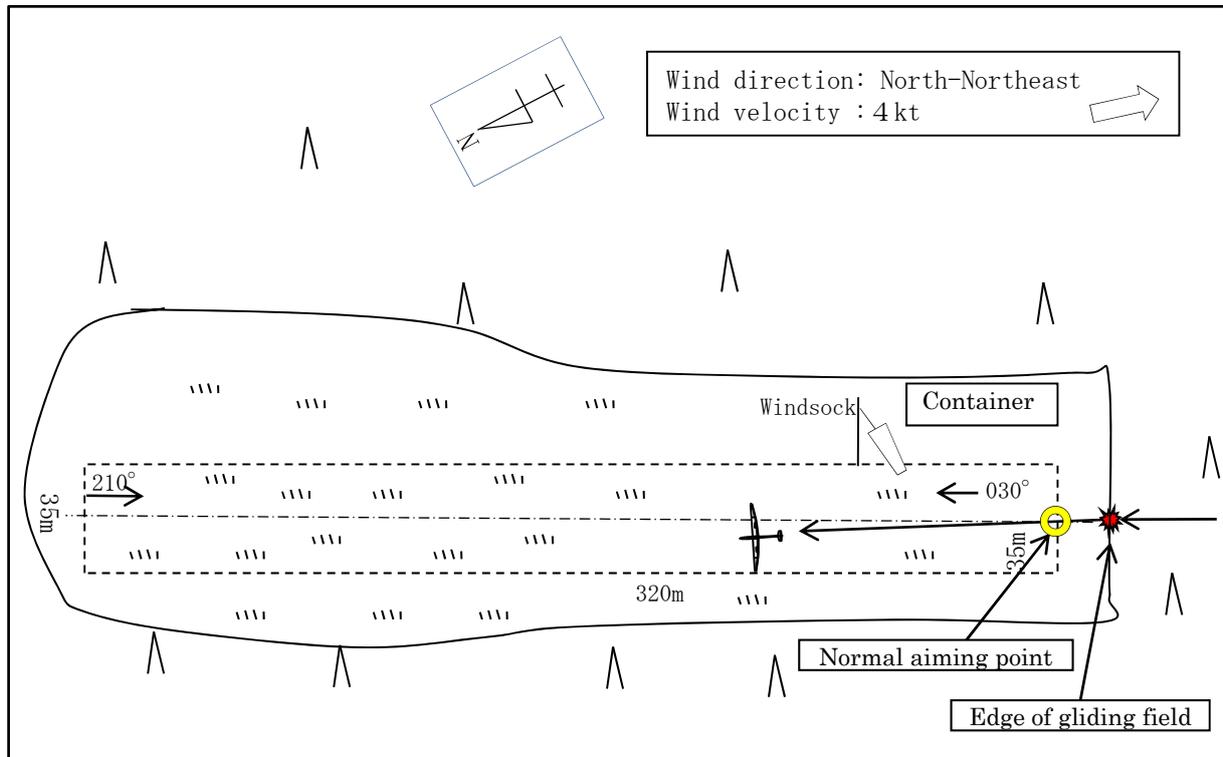


Figure 3 Three Angle Views of DG-800B

Unit : meter

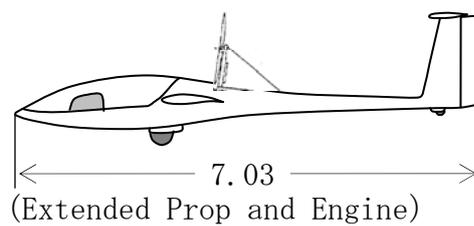
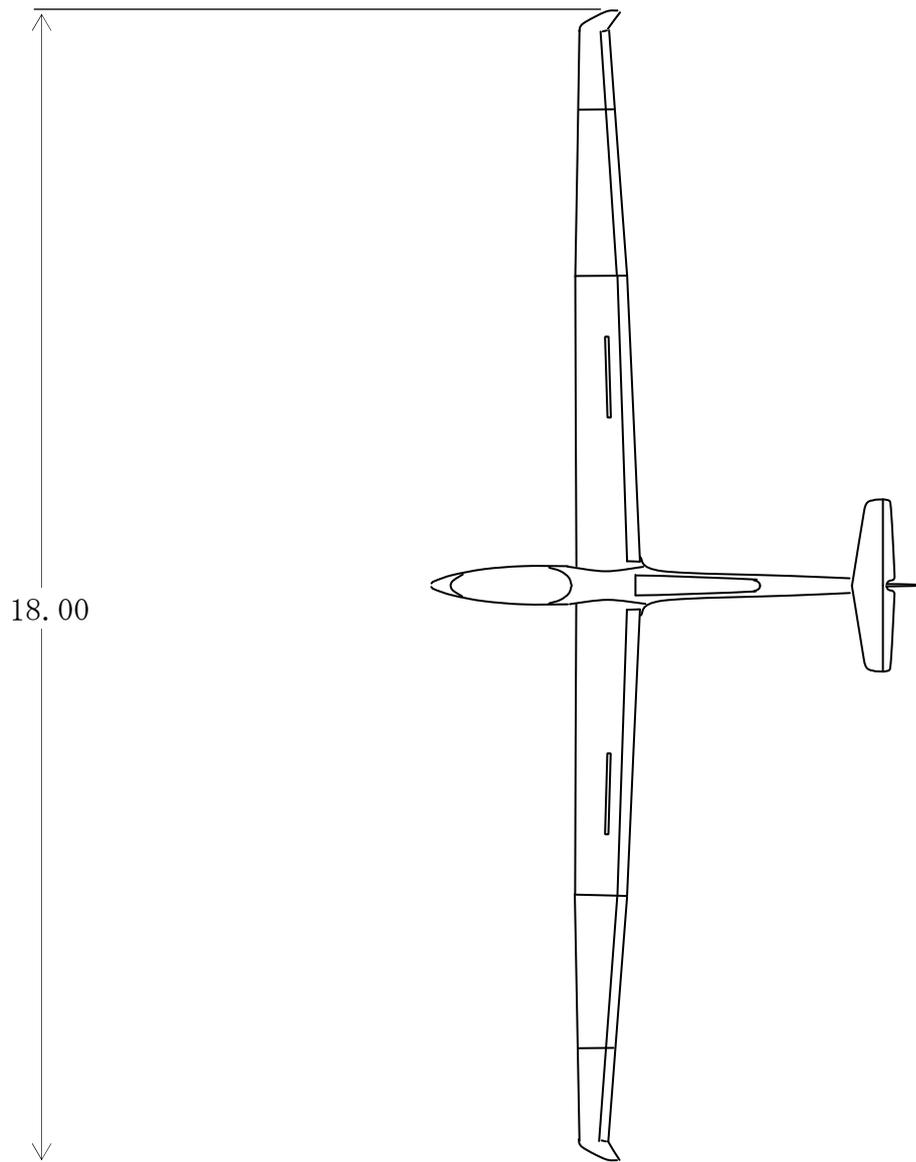
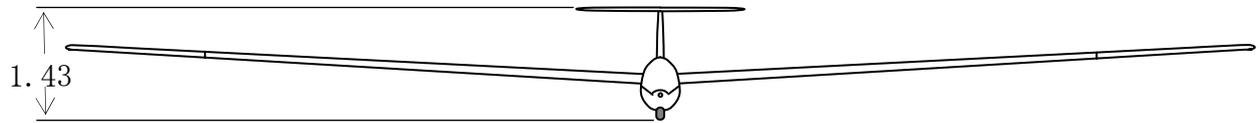


Photo 1-1 Accident Site
(Viewed from the approach end)

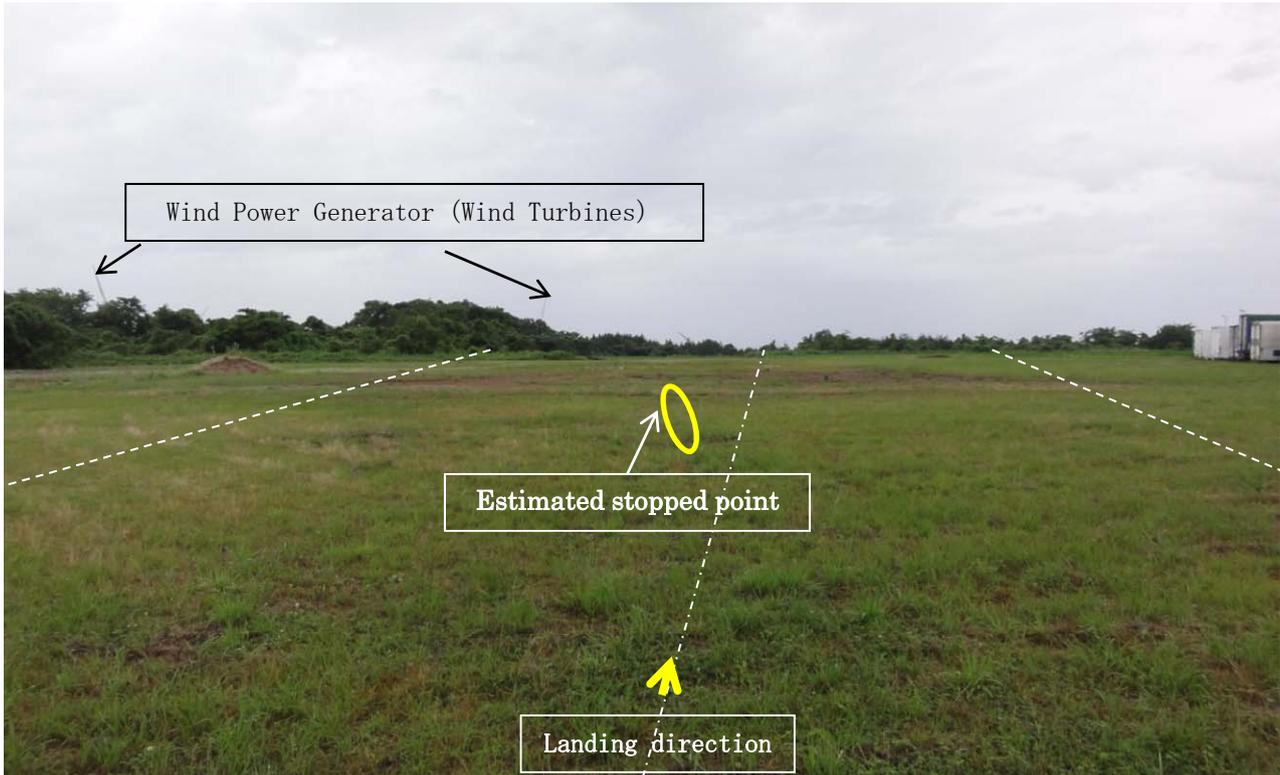


Photo 1-2 Accident Site
(Viewed toward to the approach end)

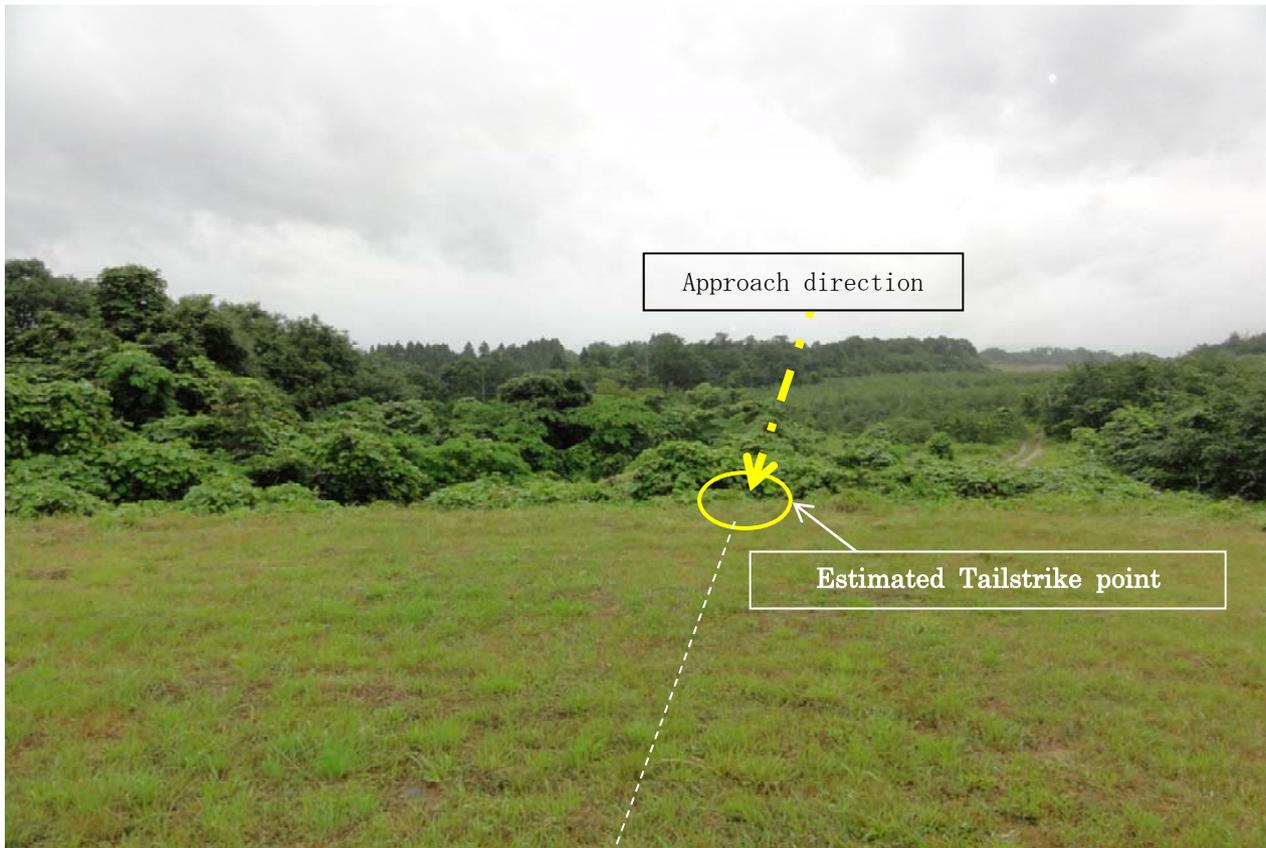


Photo 2 Accident Aircraft

