

AA2016-5

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**PRIVATELY OWNED
J A 2 0 T D**

June 30, 2016

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

CRASH DURING ATTEMPTING TO OFF-FIELD LANDING
PRIVATELY OWNED, SCHEMPP-HIRTH DISCUS bT
(SINGLE-SEAT MOTOR GLIDER), JA20TD
URASU TOWN, KABATO DISTRICT, HOKKAIDO, JAPAN
AT 12:36 JST, MAY 30, 2015

June 3, 2016

Adopted by the Japan Transport Safety Board

Chairman	Kazuhiro Nakahashi
Member	Toru Miyashita
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Keiji Tanaka
Member	Miwa Nakanishi

SYNOPSIS

<Summary of the Accident>

On Saturday May 30, 2015, a privately owned Schempp-Hirth Discus bT, registered JA20TD, launched by aerotow from Takikawa Skypark for navigation training and was released from the towing aircraft in a point about 13 km west-southwest of Takikawa Skypark at an altitude of about 5,300 ft. At 12:36 Japan Standard Time (JST: UTC+9 hr: unless otherwise stated all times are indicated in JST), the glider crashed into the grassland about 11 km southwest of Takikawa Skypark at an elevation of about 85 m.

Only the captain was on board and fatally injured.

The glider was destroyed but there was no outbreak of fire.

<Probable Causes>

In this accident, it is probable that the Glider crashed because it greatly lost the height during left turning at low altitude when the captain attempted off-field landing in the grassland without ensuring the straight final approach course.

It is somewhat likely that the large loss of the height during left turning at low altitude was because the glider was nose up while turning to the left under the situation of no sufficient altitude, which decreased the airspeed, or because lack of coordinated turn control during the turning made it slid down to the left.

The main abbreviations used in this report are as follows:

AGL	: Above Ground Level
AMeDAS	: Automated Meteorological Data Acquisition System, Japan Meteorological Agency
c/g	: center of gravity
FAI	: Fédération Aéronautique Internationale
fpm	: feet per minute
GPS	: Global Positioning System
IAS	: Indicated Airspeed
Ltr	: liter
VFR	: Visual Flight Rules

Unit Conversion List

1 ft	: 0.3048 m
1 kt	: 1.852 km/h (0.5144 m/s)

1 . PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On Saturday May 30, 2015, a privately owned Schempp-Hirth Discus bT, registered JA20TD, launched by aerotow from Takikawa Skypark for navigation training and was released from the towing aircraft in a point about 13 km west-southwest of Takikawa Skypark at an altitude of about 5,300 ft. At 12:36 Japan Standard Time (JST: UTC+9 hr: unless otherwise stated all times are indicated in JST), the glider crashed into the grassland about 11 km southwest of Takikawa Skypark at an elevation of about 85 m.

Only the captain was on board and fatally injured.

The glider was destroyed but there was no outbreak of fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On May 30, 2015, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate this accident.

1.2.2 Representatives from the Relevant State

An accredited representative of Federal Republic of Germany, as the State of Design and Manufacture of the aircraft involved in the accident, participated in this investigation.

1.2.3 Implementation of the Investigation

May 31, 2015	On-site investigation and aircraft investigation
June 1, 2015	Interviews and wreckage investigation

1.2.4 Comments from the Parties Relevant to the Cause of the Accident

Comments were not invited from the person relevant to the cause of the accident because the pilot was fatally injured in 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 May 30, 2015, at 11:47, a privately owned Schempp-Hirth Discus bT, registered JA20TD (hereinafter referred to as “the Glider”), launched by aerotow from Takikawa Skypark (hereinafter referred to as "Skypark") and at 11:57, was released from the towing aircraft in a point about 13 km west-southwest of Skypark at an altitude of about 5,300 ft.

The flight plan of the Glider was as follows:

Flight rules: Visual flight rules (VFR)

Departure aerodrome: Skypark,

Estimated off-block time: 11:00

Cruising speed: VFR,

Route: Within 50 nm from Skypark,

Destination aerodrome: Skypark

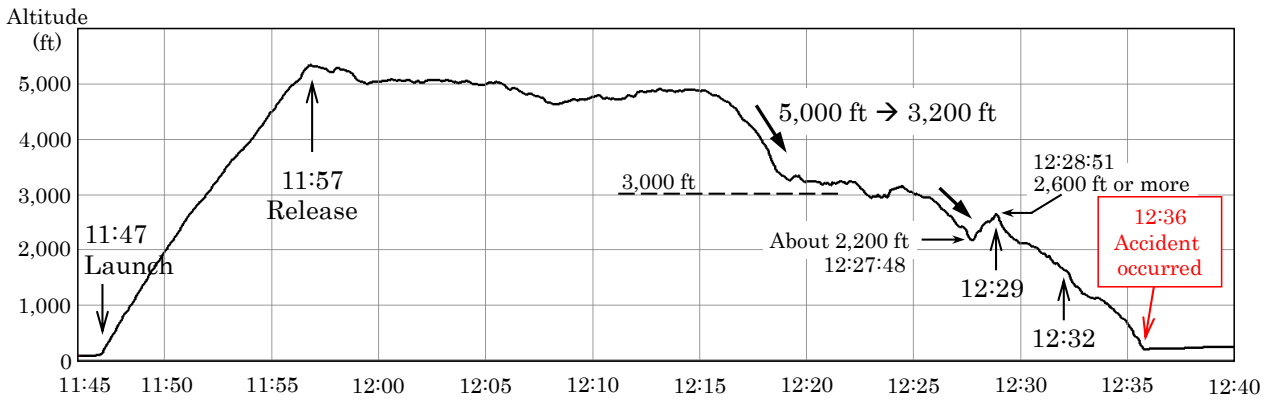
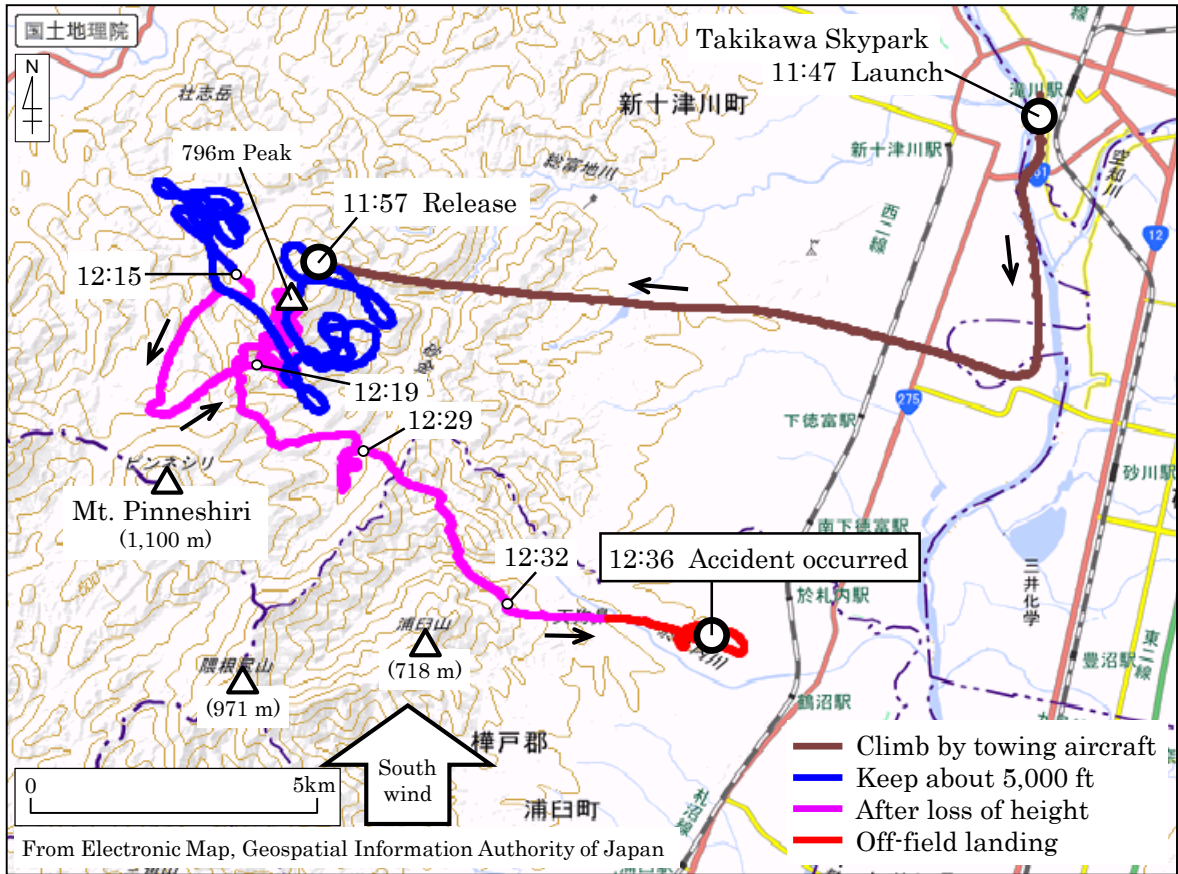
Total estimated elapsed time: Seven hours zero minutes,

Flight purpose: Navigation training

The history of the flight up to the accident is summarized as follows, according to the records of GPS unit for glider use brought into the Glider by the captain (hereinafter referred to as "GPS unit") and the statements of relevant persons.

2.1.1 History of the Flight based on GPS Unit Records

- | | |
|----------------|--|
| 11:57-12:15 | After release, the Glider flew at an altitude of about 5,000 ft above the 796 m Peak (the mountain of 796 m above sea level) 13 km west-southwest of Skypark. |
| 12:15-12:19 | The Glider greatly lost the height to about 3,200 ft when it approached Mt. Pinneshiri (the mountain of 1,100 m above sea level, which is highest in the mountainous regions where the Glider flew) from the north side. |
| 12:19-12:29 | The Glider flew at an altitude of about 3,000 ft above the south of 796 m Peak. After around 12:25, the Glider flew from the mountainous regions in the southeast and once lost the height to about 2,200 ft before crossing a ridge line for plains, but climbed to an altitude of 2,600 ft or more at high climb rate. |
| 12:30 or later | During the flight for the southeast, the ground speed (described later in 2.12.1) of the Glider was temporarily decreased and thereafter increased to exceed 120 km/h around an altitude of 1,800 ft. |
| 12:32 or later | During the flight for the east, the ground speed of the Glider exceeded 150 km/h around an altitude of 1,500 ft. |
| 12:36 | The Glider crashed during the left turning at low altitude. |



2.1.2 Statements of Relevant Persons

(1) Two witnesses in flight

The forecast was for southwest winds up to 30 kt above an altitude of 5,000 ft; therefore, two pilots were on board and launched to check the wave (mountain wave) conditions on the north side of Mt. Pinneshiri at 11:08. An glider was towed to Mt. Pinneshiri and released from the towing aircraft at around 11:20 at an altitude of 4,500 ft on the north side of Mt. Pinneshiri. The wind was from the south-southeast direction at about 25 kt.

There was cloud; therefore, all-call was made to confirm positions of gliders flying in the vicinity at around 12:10. He reported his position as being on the north side of Mt. Pinneshiri at an altitude of 4,100 ft, and the Glider was seen through rifts of cloud.

Then 10 to 15 minutes later, the Glider was seen flying east and down to an altitude of about 3,000 ft. The Glider safely crossed the last of mountain ridge toward the plains and headed for the valley at an altitude enough to return to Skypark.

(2) Head of the Glider Owners

The captain became a member of Takikawa Glider Club around 2010, and flew at Skypark also in late April of this year.

In Skypark, "Takikawa Glider Meeting 2015" (Glider workshop and competition), which was scheduled from May 23 to June 5, 2015, had been held, in which the captain participated. The captain stayed in Skypark and flew with several types of gliders (described later in 2.5.2) including the Glider every day. May 30, when the accident occurred, was the last day of the workshop.

The Glider was jointly owned by four people (excluding the captain) and had not flown until the captain used it on May 23 after flying for airworthiness inspection on May 18. Although he refueled the Glider with five liters of fuel together with the captain before flight on May 24, he did not remember the total fuel quantity in the fuel tank of the Glider that time.

After the airworthiness inspection, it was only the captain who flew with the Glider up to the accident.

(3) Dispatcher

At around 13:00 when about one hour had passed since the Glider launched and was released, there was no reply to the call for the Glider from Skypark with radio. Even after several calls every about 15 minutes, there was no reply.

At 14:45, the search for the Glider by aircraft was decided to be conducted, and then, it took off at 15:15. The crashing Glider was discovered and it was reported to the police and fire department at 15:45.

The accident occurred in a grassland (43° 28' 04" N, 141° 49' 22" E) at Urausu town, Kabato district, Hokkaido (about 11 km southwest of Skypark at an elevation of about 85 m) at 12:36, on May 30, 2015. (See Appendix 1: Estimated Flight Route, Appendix 2: Records of Altitude and Ground Speed)

2.2 Injuries to Persons

The captain was fatally injured.

2.3 Damage to the Aircraft

2.3.1 Extent of Damage

Destroyed (Nose broken, left main wing broken off and ruptured, fuselage broken)

2.4 Damage to Objective other than the Aircraft

None

2.5 Personnel Information

2.5.1 Pilot

(1) Captain Male, Age 44
Private pilot certificate (Glider)

July 31, 1992

Type rating for motor glider	July 5, 2002
Flight instructor certificate (Glider)	August 31, 1993
Class 2 aviation medical certificate	
Validity	February 4, 2017
Pilot Competency Assessment/Confirmation (Glider)	
Validity	March 16, 2016
Total flight time (excluding airplane)	1,195 hours 44 minutes (Launch 3,018 times)
	Glider 864 hours 16 minutes (Launch 2,927 times)
	Motor Glider 331 hours 28 minutes (Launch 91 times)
Flight time for the last 30 days	18 hours 34minutes (Launch nine times)
Flight time on the type of Aircraft	13 hours 45 minutes (Launch five times)
Flight time for the last 30 days	13 hours 45minutes (Launch five times)

2.5.2 Flight History for One Week before the Accident

According to the statements of relevant persons, flight records of the Glider, and the flight logbook of the captain, after May 23, 2015, he flew as follows:

Saturday, May 23	13:04 - 13:27 (0:23)	The Glider, engine was used for zero minutes
	13:43 - 14:54 (1:11)	The Glider, engine was used for three minutes
Sunday, May 24	10:46 - 14:16 (3:30)	The Glider, engine was used for five minutes
Monday, May 25	14:04 - 16:04 (2:00)	ASK 21 glider (Two-seater)
Tuesday, May 26	11:14 - 12:02 (0:48)	SF-28A motor glider (Two-seater)
Wednesday, May 27	11:31 - 17:22 (5:51)	The Glider, engine was used for zero minutes
Thursday, May 28	12:39 - 13:26 (0:47)	ASK 21 glider (Two-seater)
	13:35 - 14:49 (1:14)	ASK 21 glider (Two-seater)
Friday, May 29	11:20 - 14:20 (3:00)	The Glider, engine was used for 15 minutes
Saturday, May 30	11:47 -	The Glider <The accident occurred>

The captain sufficiently had both of flight experiences in the vicinity of Skypark and flight experiences by motor glider. According to the flight logbook of the captain, however, all flight experiences of him for the last two years were by self-launching type, and the flight by sustainer-type motor glider (described later in 2.6.5) was not found.

2.6 Aircraft Information

2.6.1 Aircraft

Type	Schempp-Hirth Discus bT
Serial Number	164
Date of manufacture	January 30, 1998
Airworthiness Certificate	No.2015-55-22

Validity	May 31, 2016
Category of airworthiness	Motor glider Utility U, or Glider Utility U
Total flight time	1,624 hours 05 minutes
Flight time since last periodical check (Annual inspection: May 18, 2015)	14 hours 13 minutes

(See Appendix 3: Three Angle View of Schempp-Hirth Discus bT)

2.6.2 Engine

The Glider was equipped with an in-line-two-cylinder-two-stroke aircraft engine (displacement 430 cc).

Type	SOLO 2350
Serial Number	433
Date of manufacture	November 13, 1997
Total time in service	100 hours 26 minutes

2.6.3 Weight and Balance

When the accident occurred, the weight of the Glider was estimated to have been about 390 kg and the position of center of gravity (c/g) was estimated to have been 373 mm. Although both of them were within the allowable range (the maximum landing weight of 450 kg with power plant installed, and the c/g range of 260 to 400 mm corresponding to the weight at the time of the accident), the c/g position was estimated to be in aft of the allowable range.

2.6.4 Fuel and Lubricating Oil

The fuel was high-octane gasoline and the lubricating oil was Castrol Power 1 2T.

According to the flight manual (2-4-1-3 and 5-3-3-2; described later in 2.12.3), the fuel tank capacity was 14 liters, in which non-usable fuel is 0.5 liters. Besides, the fuel consumption at the cruising speed is about 9.5 liters per hour.

2.6.5 Characteristics of the Aircraft

The aircraft is a motor glider in which an engine having a propeller made of five collapsible blades is retracted in the rear of the cockpit. Although it can use the engine to keep the altitude during flight, it cannot self-launch (take off by engine) and is called as a motor glider without self-launching capability (i.e. sustainer type or turbo type). (See Appendix 5: Engine Extended/Retracted)

The display units of flight instruments are “km/h” in airspeed indicator, “ft” in altimeter, and “m/s” in variometer indicator; therefore, these units are used in this report.

2.7 Meteorological Information

According to the records of the anemometer placed in Skypark about 11 km northeast of the accident site, the wind direction and wind velocity in the period when the Glider flied after release were as follows:

	<u>Wind direction/Velocity</u>	<u>Wind direction/Max. instantaneous velocity</u>	<u>Temperature</u>	<u>Sunshine duration</u>
12:00	South-southwest/4.9 m/s	South-southwest/8.7 m/s	23.6°C	0
13:00	Southwest/9.6 m/s	Southwest/13.7 m/s	25.6°C	0

The observations in the period related to the accident in AMeDAS sites located in the vicinity of the accident site ("Takikawa" about 15 km northeast, "Bibai" about 12 km south, and "Sorachi-yoshino" about 16 km north-northwest of the accident site) are as follows:

(Takikawa)

	Wind direction/Velocity	Wind direction/Max. instantaneous velocity	Temperature	Sunshine duration
12:20	South-southwest/2.8 m/s	South/4.6 m/s	22.2°C	0
12:30	South-southwest/3.3 m/s	South-southwest/5.0 m/s	22.4°C	0
12:40	South/2.5 m/s	South/5.3 m/s	22.4°C	0

(Bibai)

	Wind direction/Velocity	Wind direction/Max. instantaneous velocity	Temperature	Sunshine duration
12:20	South-southwest/7.8 m/s	Southwest/10.8 m/s	23.6°C	8 minutes
12:30	South-southwest/7.6 m/s	South-southwest/11.1 m/s	23.9°C	1 minute
12:40	South-southwest/7.2 m/s	South-southwest/9.6 m/s	23.6°C	0

(Sorachi-yoshino)

	Sunshine duration	(wind direction and wind velocity are omitted due to mountainous regions which are different from the accident site in the conditions)
11:40	10 minutes	
11:50	4 minutes	
12:00	0	
12:10	10 minutes	
12:20	10 minutes	
12:30	10 minutes	
12:40	2 minutes	

While there was no or less sunshine in the fields (Takikawa and Bibai), there was comparatively long sunshine duration in the mountainous region (Sorachi-yoshino)

On the day when the accident occurred, the rainfall was not observed in Skypark and these AMeDAS sites.

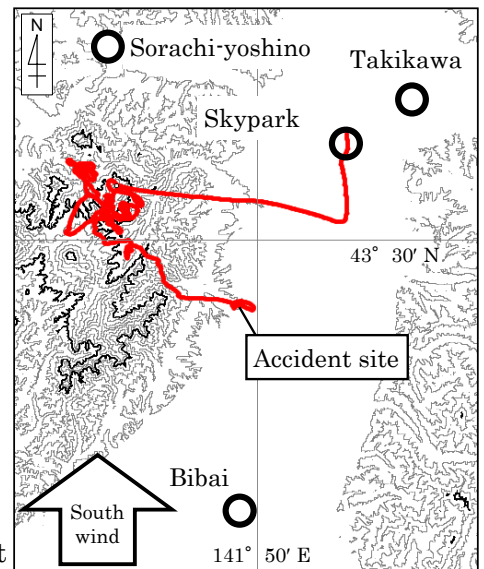


Figure 3: Surrounding Weather Observation Sites

2.8 Information on Flight Recorders

The captain brought GPS unit on the Glider and activated it. Although the main body of GPS unit was broken by the accident, the flight records of the day when the accident occurred were retained in the recording medium.

Although the Glider was equipped with a GPS flight recorder certified by Fédération Aéronautique Internationale (FAI) other than the GPS unit, no records were retained.

2.9 Information on Accident Site and Wreckage

2.9.1 Situation of Accident Site

The accident site is a grassland with about one km space in the east-west direction and at least about 60 m in the south-north direction at an elevation of about 85 m, which is located in the foot of the mountainous regions whose peak is Mt. Pinneshiri of 1,100 m above sea level. It is a slope with gradient of about 5% (3°) to the west in the longitudinal direction and uphill gradient of about 12% (7°) to the north in the lateral direction. If the Glider lands on the grassland in the uphill-gradient direction, it goes from the east to the west on the final approach. An electric fence

(electric current flows through bare metal wires in the fence) was installed near the center of the landing place, along which wheel tracks were left.

There are several grasslands and places like that allowing for the landing of the Glider in the vicinity of the grassland.

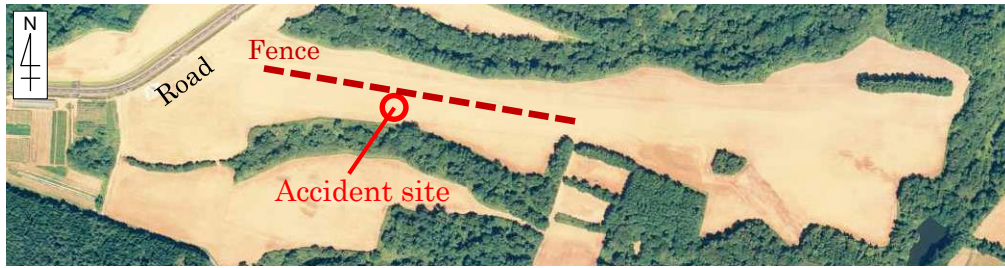


Photo 1: Topography of Grassland of the Accident Site

(Aerial photography as of September, 2009 of Geospatial Information Authority of Japan
: The condition of the ground surface is different from that when the accident occurred.)

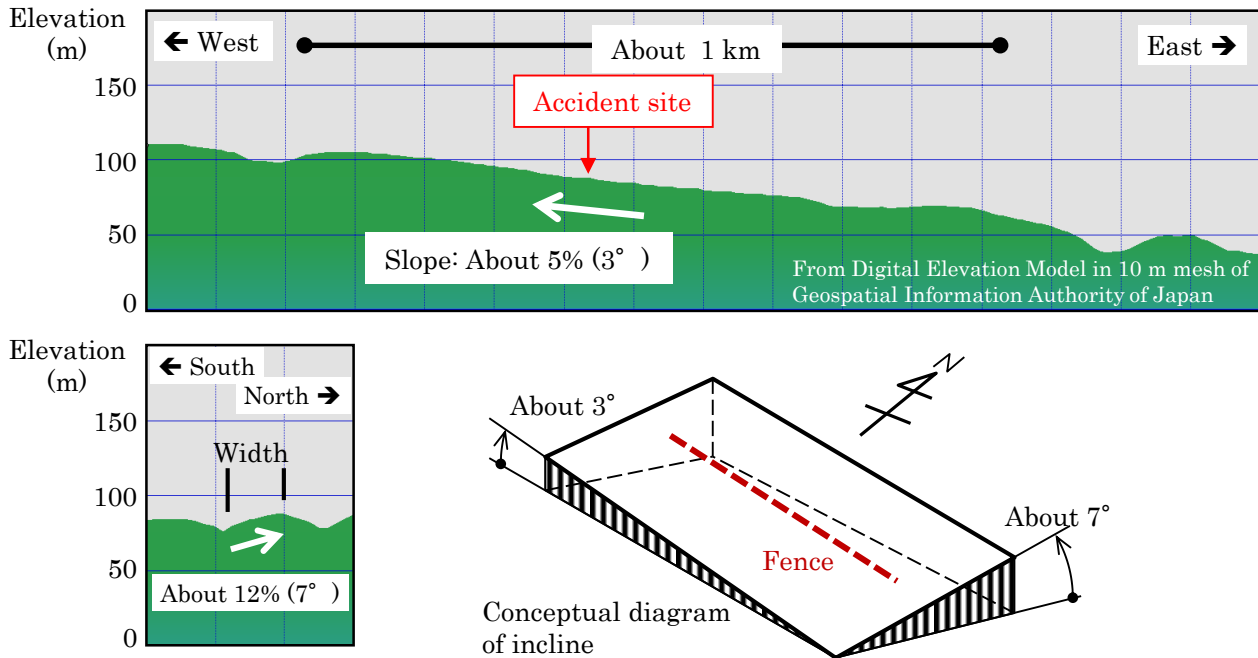


Figure 4: Surrounding Slope of the Accident Site

According to GPS unit records, the Glider approached from the south side of the accident site while turning to the left. First, there was the impact mark by the left wingtip, and the impact mark when the left wingtip was ruptured was left around its north. From that point on, there was the collision mark of the nose, and many pieces of the canopy and other things were scattered near the mark. Further from that point on, the Glider of which the nose was severely damaged and the left main wing and the fuselage were broken halted with the nose roughly headed the south.

In the south of the impact mark by the left wingtip, a tree with broken branches was found. The positions of the broken branches were not the top of the tree, and there were taller trees in the surroundings.

The distance from the tree with broken branches to the halt position of the fuselage was about 50 m in the north-northwest.

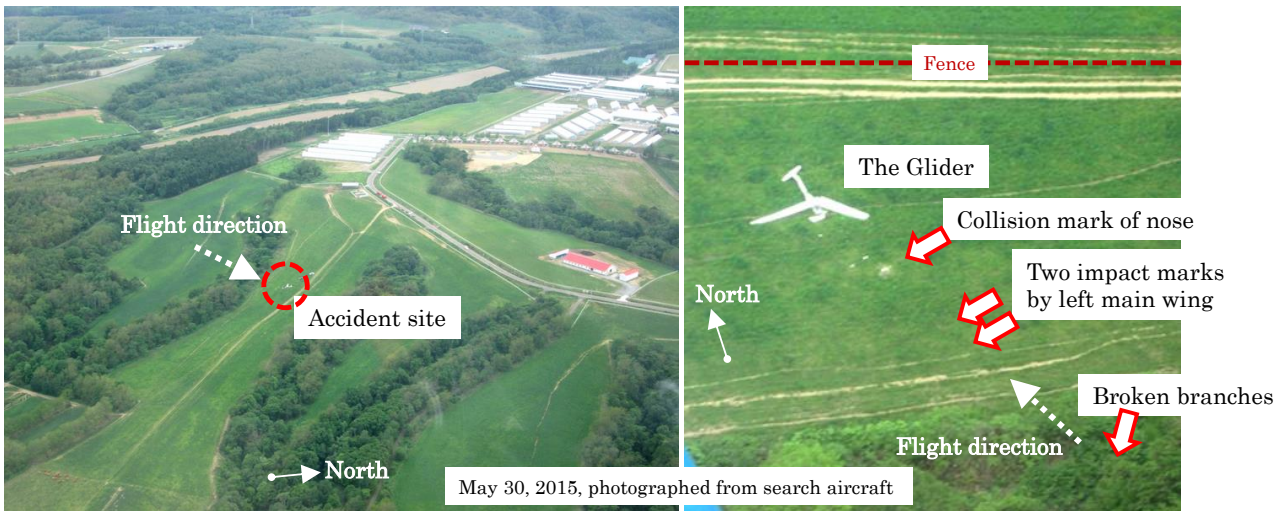


Photo 2: Aerial View of the Accident Site

2.9.2 Detailed Situation of Damage

The left wingtip of the Glider was ruptured, and around the connection part between the wing and the fuselage was also broken and twisted. The fuselage was broken in the rear of the engine. No damages were found in the right main wing, the vertical stabilizer, and the horizontal stabilizer. While the airbrake of the damaged left main wing was fully extended, the airbrake of the undamaged right main wing was completely retracted.

The cockpit was severely damaged, and the airspeed indicator, variometer, and altimeter on the instrument panel were fallen off. The airbrake lever was in the forward-leaning position (Closed), and was damaged to be bent. The operation of three controls (ailerons, elevator, and rudder) by control stick and rudder pedals were uncontrollable due to the severe damage of the cockpit. The retractable main landing gears were damaged in the retracted position.

The engine and propeller of the Glider were not completely retracted and the propeller blade tips stood out with the engine door opened. The propeller blades were not damaged. The rod of electrical spindle drive for extending/retracting the engine was extended (extending position), and the upper end of the installation part was ruptured. The two arresting cables (wires) for supporting the engine in order not to fall forward were ruptured. The front side of the engine retraction opening was damaged due to the hit of steel-tube pylon supporting the engine. (See Appendix 5: Engine Extended/Retracted)

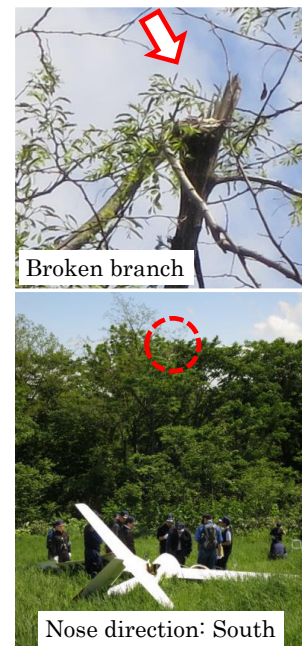


Photo 3: Situation of Tree

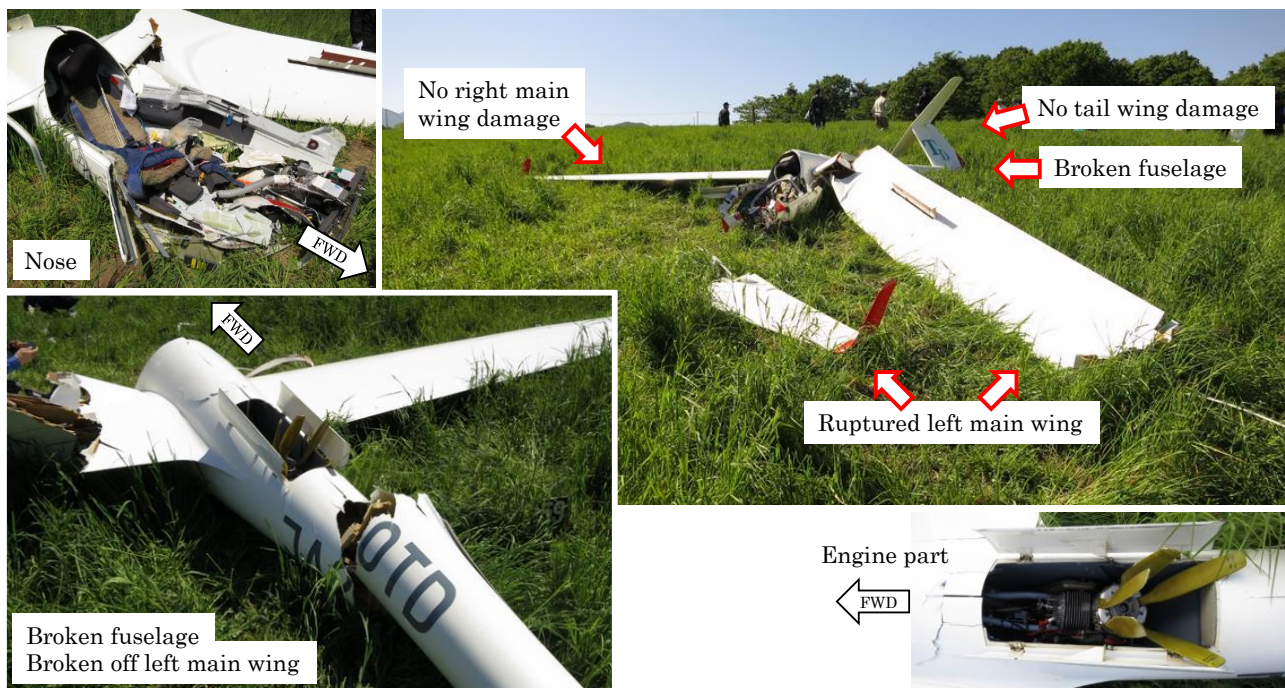


Photo 4: Detailed Damage Description

The electrodes of two ignition plugs indicated proper combustion condition during the latest engine operation. The fuel left in the fuel tank was 0.25 liters, which was less than non-usable fuel (0.5 liters). In addition, no signs of fuel leak were found. The fuel remaining quantity of the Glider can be confirmed by a fuel indicator on the instrument panel or the indicator of the transparent line, but it is difficult to confirm the latter during flight due to its rear position of the pilot seat.

The condition of engine operation switch or others were as follows:

Engine control unit on the instrument panel

- Master switch: ON
- Ignition switch: ON
- Extend/Retract switch: Extended

Right side in the cockpit

- Fuel shut-off valve: Closed

2.10 Medical Information

The cause for the fatal injury of the captain was multiple traumas.

The autopsy results revealed neither alcohol nor drugs. According to his family, the captain did not have specific diseases and a habit of drinking alcohol or smoking.

2.11 Information on Fire and Rescue

The aircraft was destroyed but there was no outbreak of fire.

At 16:02, Sunagawa District Wide Area Firefighting Union headquarters was informed by phone that a glider made an off-field landing, the wing was broken, and there might be an injured person, from Skysport Association of Takikawa, which do activities of gliders mainly in Skypark.

At 16:29, an ambulance and two fire trucks arrived at the accident site. The captain was found in a state of cardiopulmonary arrest and carried into Sunagawa City Medical Center.

The captain fastened his seatbelt when rescued in the accident site.

2.12 Additional Information

2.12.1 Flight Records

(1) Ground speed

The GPS unit had recorded the time, latitude, longitude and altitude along with ground speed estimated from these values by the second. "Ground speed" described in this report refers to the values.

(2) Climb/descent rates

On the day when the accident occurred, six gliders (including motor glider) other than the Glider launched from Skypark for flight, five of which flew above mountainous regions, in the same period as well as the Glider. According to GPS records of these five gliders and the records of GPS unit of the Glider, any of the six gliders approaching the north of Mt. Pinneshiri (lee side) descended at high descent rate.

(See Appendix 4: Gliders Flying during the Same Period)

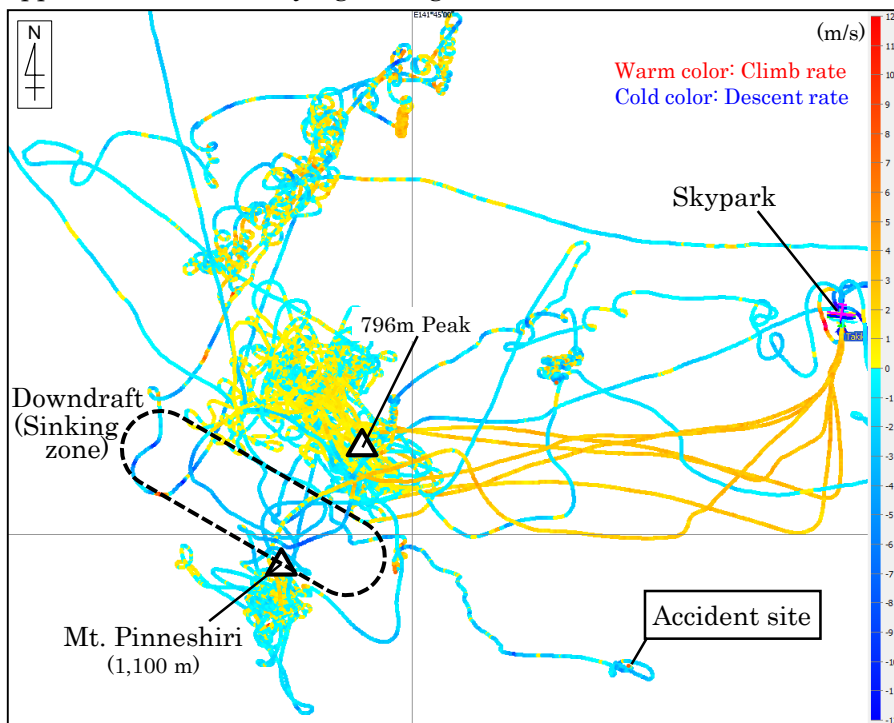


Figure 5: Climb/descent Rates of Gliders Flying near Mt. Pinneshiri

2.12.2 Landing Place near the Accident Site

Skysport Association of Takikawa creates detailed materials compiling information on main off-field landing sites *1 (name, latitude, longitude, altitude, landing direction, usable length, incline, surface features, aerial photos, and other things) in Hokkaido as "Off-field Landing Sites" (2015), and opens it to the public.

In the vicinity of the accident site, the places along Ishikari River such as "Nakajima" (about four km southeast of the accident site), "Sunagawa" (about six km northeast of the accident site), "Confluence point" (about 8.5 km northeast of the accident site) are determined as off-field landing sites; however, the accident site was not included.

Captain's belongings that have been left in the Glider included a copy of a map of 1:200,000 describing these off-field landing sites.

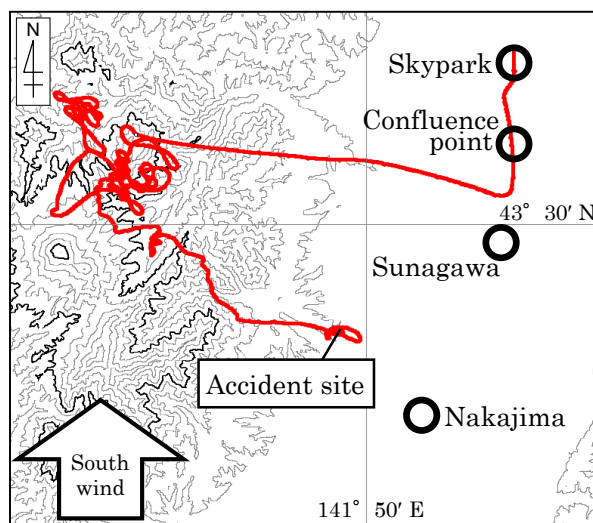


Figure 6: Surrounding Off-field landing Sites

2.12.3 Flight Manual

The flight manual of the Glider has the following description:

(Excerpts):

Chapter 2 LIMITATIONS

2-4-1-3 Fuel tank capacity

	<i>Fixed tank only</i>
<i>Capacity</i>	<i>14.0 Liters</i>
<i>Usable fuel</i>	<i>13.5 Liters</i>
<i>Non-usable fuel</i>	<i>0.5 Liters</i>

2-4-2 Fuel and Oil (lubrication)

(a) Fuel *Two-stroke mixture
leaded-gasoline, RON 96*

(b) Oil (lubrication) [*Castrol Super TT*]
Fuel/oil mixture, mixing proportion 30:1

Chapter 4 NORMAL OPERATION

4-6 Daily Inspection

(1) g) *Check fuel quantity*

h) *Check fuel line and tank vent line*

4-9-2 Take-off and climb

*1 "Off-field landing sites" in this report means landing sites except for the destination and does not mean "Temporary Operation Site" permitted under the proviso of Article 79, Civil Aeronautics Act. Article 79 of Civil Aeronautics Act is not applicable to gliders, and thus the permission by the Minister of Land, Infrastructure, Transport and Tourism is unnecessary for landing and takeoff in places other than airports and so on.

The "Discus bT" is a powered sailplane, not capable of self-launching, which, like a glider, must be launched by winch or aero-tow (with its power plant retracted). -

WARNING: *Take-offs on own power should not be tried!*

4-10-1-3 Wing level stall

On reaching a stalled condition with the c/g at aft position, the "Discus bT" may drop a wing.

(Omitted)

The loss of height, from the moment it drops a wing to the point at which a normal level flight attitude is regained, is about 20 to 30 m.

4-10-1-4 Turning flight stalls

When stalled during a coordinated 45° banked turn, the "Discus bT" with stick fully back either continues to fly in a stalled condition or drops a wing.

The loss of height, from the moment it drops a wing to the point at which a normal level flight attitude is regained, is about 20 to 30 m.

There is no uncontrollable tendency for the aircraft to enter a spin.

(Omitted)

In the case of aft c/g positions, application of full rudder when the aircraft is stalled will produce a spin.

4-10-2 Flight (incl. in-flight engine stop/start procedures)

4-10-2-1 Power plant extended - Power plant operation

The power plant should only be extended and started where there is a suitable landing terrain within gliding range (with power plant extended, L/D is only about 19:1). Below 300 m (1000 ft) AGL, starting procedures are to be avoided so as to have a safe height left for planning the approach pattern should the engine fail to run.

(Omitted)

First open the fuel shut-off valve and extend power plant at a speed of about 85 to 95 km/h. Then switch the ignition "ON", depress stick-mounted fuel pump button and hold. Next pull-back the "DECO" handle (to open the decompression valves) and hold propeller starts rotating.

For the case that not all the blades have unfolded, wag rudder repeatedly to assist them in unfolding. Once all prop blades have reached their proper position, accelerate to a speed of about 120 to 130 km/h (65-70 kt, 75-81 mph). On reaching this speed release "DECO" handle suddenly engine will fire.

Let revs build up, release fuel pump button and enter the climb.

The loss of height, from the moment of extending the engine until it runs, is approx. 50 to 60 m.

If the prop stops spinning after the "DECO" handle was released, pull it back again, depress fuel pump button and repeat the starting procedure at a slightly higher speed.

(Omitted)

The best rate of climb is achieved at a speed of 90 km/h.

4-10-2-2 Stopping the engine

To stop the engine, reduce the speed to about 85 to 95 km/h and close the fuel shut-off valve.

When RPMs drop due to the lack of fuel, switch the ignition "OFF". To stop the propeller, proceed as follows:

Hold down retraction switch, watch rear-view mirror and release switch after about 3 seconds just before the prop hub disappears behind the fuselage back (prop blades will still be clear from the engine doors) - Prop will stop spinning fairly quickly.

Thereafter (with prop stopped) the power plant is fully retracted regardless of the position of the propeller blades. When power plant contacts its padded stop block, a slight "bump" is perceptible.

4-10-3 Approach

4-10-3-2 Power plant extended

On approach it should be taken into account that the performance has deteriorated due to the extended stopped engine.

With an all-up mass of 370 kg the minimum sink rate, for instance, is 1.3 m/s (256 fpm) and L/D is only 19:1.

(Omitted)

The reduced performance nevertheless is sufficient to carry out approaches with the same technique as in the "clean" sailplane configuration.

WARNING: Be cautious when extending the airbrakes. Due to the additional drag or the extended power plant, more attention must be paid to maintain the required approach speed.

4-10-4 Landing

4-10-4-1 Power plant retracted or not installed

If possible, the "Discus bT" should touch down at minimum speed and with its skid (wheel) first.

(Omitted)

To avoid an unnecessarily long ground run (off-field landings), make sure that the "Discus bT" always touches down at its minimum speed.

(Omitted)

For off-field landings the undercarriage should always be extended as the pilot then is much more protected from vertical landing impact.

4-10-4-2 Power plant extended

Landing the "Discus bT" with its power plant extended is performed in the same manner as with the power plant being retracted (ignition to be switched "OFF").

Chapter 5 PERFORMANCE

5-2-2 Stall speeds

The following stall speeds (IAS) were determined in straight and level flight for various all-up masses:

(Excerpts of the case of 370 kg which is closest to 390 kg, the estimated weight of the Glider from the table of gross weight of 330 kg, 370 kg, 450 kg and 525 kg)

<i>C/G position</i>	<i>aft</i>	
<i>Stall speeds</i>	<i>Power plant retracted/removed</i>	
	<i>km/h</i>	<i>kt</i>
	<i>Airbrakes retracted</i>	63 34
<i>Airbrakes extended</i>	71 38	
<i>Stall speeds</i>	<i>Power plant EXTENDED, IGNITION "OFF"</i>	
	<i>km/h</i>	<i>kt</i>
	<i>Airbrakes retracted</i>	65 35
<i>Airbrakes extended</i>	75 40	
<i>Stall speeds</i>	<i>Power plant EXTENDED, IGNITION "ON"</i>	
	<i>km/h</i>	<i>kt</i>
	<i>Airbrakes retracted</i>	61 33
<i>Airbrakes extended</i>	73 39	

(Omitted)

The stall characteristics of the "Discus bT" can be described as being innocuous.

The loss of height from the point of stall until regaining a normal level flight attitude is about 20 to 30 m (66-98 ft).

5-3-1 Demonstrated crosswind performance

The maximum crosswind velocity, at which take-offs and landings have been demonstrated, is 20 km/h (11 kt).

5-3-2 Flight Polar

(Omitted)

<i>All-up mass</i>	<i>350 kg</i>	<i>370 kg</i>
<i>POWER PLANT RETRACTED/REMOVED</i>		
<i>Minimum rate of sink at 78 km/h (42 kt, 48 mph)</i>	<i>0.61 m/s</i> <i>(120 fpm)</i>	-
<i>Best L/D at 100 km/h (54 kt, 62 mph) approx.</i>	43	-
<i>POWER PLANT EXTENDED / ENGINE OFF</i> <i>(ignition off)</i>		
<i>Minimum rate of sink at about 80 km/h (43 kt, 50 mph) approx.</i>	-	<i>1.25 m/s</i> <i>(246 fpm)</i>
<i>Best L/D at about 90 km/h (49 kt, 56 mph) approx.</i>	-	19
<i>POWER PLANT EXTENDED / FULL POWER</i> <i>(ignition on)</i>		
<i>Maximum rate of climb at about 90 km/h (49 kt, 56 mph) approx.</i>		<i>1.20 m/s</i> <i>(236 fpm)</i>

5-3-3-2 Range (all-up mass 370 kg)

Cruising speed, approx. 135 km/h (73 kt)

Fuel consumption approx. 9.5 Ltr/h

(The rest is omitted)

Chapter 7 SYSTEM

7-3 Instrument Panel

Note: With low fuel contents the pilot should always read off the fuel level from the transparent line (in the region of his upper arm on the right hand side). In case of doubt this direct indication is to be preferred.

7-7 Power plant

The engine with its propeller is suspended in the fork of the steel tube pylon by means of three (3) engine shock mounts (vibration isolators) - the two arresting cables are attached the pylon.

An electrical spindle drive, anchored at the fuselage center frame and assisted by a gas strut, swings the pylon up and down.

The doors of the engine compartment are automatically opened and closed by rods while the power plant extends/retracts.

(Omitted)

The only other controls necessary for the power plant are the fuel shut-off valve and the decompression handle.

3. ANALYSIS

3.1 Qualification of Personnel

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

3.2 Airworthiness Certificate

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

3.3 Relations to Metrological Conditions

Based on the description of 2.7, it is probable that the south wind with slight westward drift blew in the surroundings of Skypark where the Glider launched and the plains in its south. As described in 2.9.1, the accident site is a place at an elevation of less than 100 m, which is located in the foot of mountainous regions. Based on the fact and the surrounding geographical features, it is probable that the south wind mainly blew there as well. Based on the description of 2.12.1 (2), it is highly probable that the south wind caused a downdraft zone (sinking zone) in the north of Mt. Pinneshiri.

In addition, based on the statement of 2.1.2 (1) and the description of 2.7, though mountainous regions where the Glider flied were covered with clouds, some places got sunshine through the rifts in the clouds; therefore, it is probable that the updraft existed.

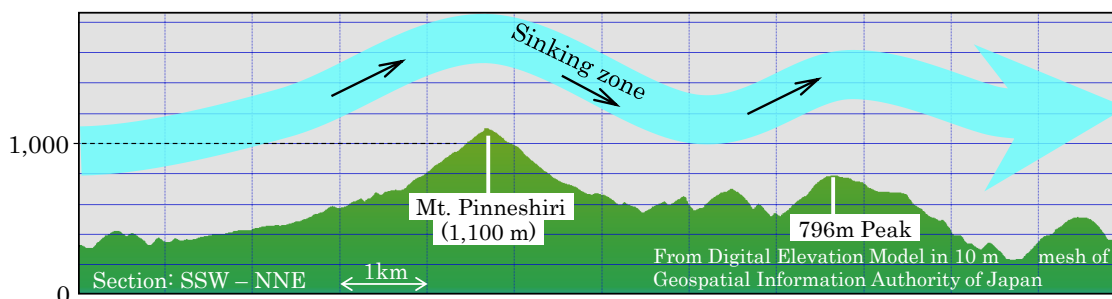


Figure 7: Air Current of Mountainous Regions (Conceptual figure)

3.4 Situations Leading to the Accident

3.4.1 Fuel Confirmation before Launching

According to the statement of 2.1.2 (2), on May 24, 2015, the captain refueled five liters to the Glider together with the head of the Glider owners, and as described in 2.5.2, the following engine operating time was about 20 minutes; therefore, it is somewhat likely that he thought in calculation that there was a margin to the quantity of fuel (described later in 3.5).

As the flight manual (4-6) described in 2.12.3, fuel quantity and other things needed to be confirmed in the daily inspections for the Glider. In addition to the above fact, there were no problems for the flight of the Glider even without the engine; therefore, it is somewhat likely that the captain launched the Glider without confirming the fuel quantity in the fuel tank.

3.4.2 Flight after Release

As described in 2.1, at 11:47, the Glider launched by aerotow from Skypark, was released

from the towing aircraft above mountainous regions 10 minutes later, and flew mainly at an altitude of 5,000 ft for about 18 minutes.

As described in 2.1.1, the Glider went south towards Mt. Pinneshiri from around 12:15 and turned to the left on the way to get away from it, during which it largely descended to an altitude of about 3,200 ft. As described in 2.12.1 (2), other gliders which flew above the same mountainous regions in the same time period as well as the Glider also lost the height at high descent rate near the almost same place; therefore, it is highly probable that the large descent was caused by entry into the downdraft zone (sinking zone) which occurred in the north of Mt. Pinneshiri.

The Glider began to fly in the southeast from the mountainous regions from around 12:25. It is somewhat likely that the captain made the Glider get away from the mountainous regions in order to avoid further loss of height and headed it for the plains under the assumption that the altitude would be regained by using the engine. As shown in the above figure on Appendix 1, before 12:28, the Glider once descended to an altitude at about 2,200 ft and it did not cross the ridge line (the nearest elevation of about 550 m or 1,800 ft) yet; therefore, it is somewhat likely that the captain felt impatient and was strongly anxious to start the engine as soon as possible for regaining the altitude.

Afterward, the Glider climbed to an altitude of 2,600 ft or more at high climb rate (about 2.5 m/s according to the calculation from the records of GPS unit). According to the flight manual (5-3-2) described in 2.12.3, the maximum rate of climb by engine is about 1.2 m/s, which is too high if the climb is only made by engine, and according to the records of GPS unit, no signs of extending the engine and trying to start it were found; therefore, it is somewhat likely that this climb was caused by updraft. The Glider acquired enough altitude by this climb to cross the ridge line, and went towards the plains.

3.4.3 Attempting to Start Engine

As shown in the Appendix 2, around 12:30-31, the Glider once decelerated the ground speed to 90 km/h or less, and then, around 12:31-32, it accelerated the ground speed to 120 km/h and, around 12:32-33, the ground speed to more than 150 km/h. As described in 3.3, it is probable that the south wind mainly blew around that time, and based on the Appendix 1, it is probable that the airspeed was higher than the ground speed.

In addition to these, the flight manual (4-10-2-1) described in 2.12.3 prescribed that the engine should be started with the airspeed accelerated to about 120 to 130 km/h after the engine was extended at the airspeed of about 85 to 95 km/h; therefore, it is somewhat likely that the captain once decelerated the airspeed to perform operations for extending the engine, failed to start the engine with the first acceleration, and tried to start the engine with more acceleration for a second time.

According to the records of GPS unit, the Glider was at an altitude of about 2,100 ft before deceleration and fell down to an altitude of about 1,200 ft after the second acceleration.

According to the records of GPS unit and the values calculated from the records, such as climb/descent rates, flight direction, no signs that the Glider climbed by engine power were found on the day when the accident occurred; therefore, it is probable that the engine did not start. As described in 2.5.2, since the captain used the engine a day before the accident, it is probable that there was no specific failures in the engine at that time. As described in 2.9.2, the fuel quantity in the fuel tank was less than the non-usable fuel; therefore, it is highly probable that the engine did not start due to the fuel starvation.

As described in 2.9.2, though the remaining fuel in the fuel tank can be confirmed by the fuel indicator on the instrument panel, it is somewhat likely that the captain tried to start the engine twice with the fuel starvation; therefore, it is somewhat likely that he did not perceive the indication of the fuel indicator on the instrument panel or temporarily forgot it.

The height of the Glider was lost without being able to start the engine; therefore, it is somewhat likely that the captain strongly felt impatient again.

3.4.4 Flight with Engine Extended

As described in 2.9.2, the switch position of engine control unit indicated that the engine was extended. Meanwhile, the fuel shut-off valve was in the closed position; however, it is probable that this is because the display panel moved from the opened position to the closed position when the cockpit was strongly broken to separate the right side in the cockpit. Based on the broken conditions of engine and relevant components described in 2.9.2, it is highly probable that the Glider crashed with the engine extended, the impact of which made the engine once fell down forward, and then it almost got into the retraction position.

According to the flight manual (*4-10-3-2*, *5-2-2*, and *5-3-2*) described in 2.12.3, the flight performance has deteriorated with the extended stopped engine, and thus it is desirable that the engine should be retracted if the engine did not start. According to the flight manual (*4-10-2-2*) described in 2.12.3; however, the engine retraction requires some time for the confirmation with rear-view mirror or the operation, which delays the selection of landing places. As described in 3.4.3, the Glider lost the height to about 1,200 ft (about 370 m) (the elevation of surrounding geography is about 100 to 200 m); therefore, it is probable that the captain put the selection of landing places a higher priority than the engine retraction.

3.4.5 Selection of Landing Place

As described in 2.12.2, the captain brought a map describing predetermined off-field landing sites into the Glider. It is desirable that the suitable place should be selected from among these off-field landing sites; however, it is somewhat likely that the captain failed to start the engine twice, and it is somewhat likely that the captain tried to make landing anywhere on grasslands or other suitable places in his sight, considering he has no time to open and confirm the map under the situation of no sufficient altitude.

The flight route after the right turning around 12:34 shown in the lower figure on Appendix 1 indicates that there were several options for the landing place but the captain could not make any decision on landing for some reason and continued to fly while searching for a suitable place.

It is somewhat likely that the captain felt gradually impatient, lost some options for the selection of landing places or suitable approach course as the height was lost, and was put into difficult situation for safety landing.

As described in 2.9.1, it is probable that the captain realized that the place where he finally decided to make landing was grassland with the sufficient space and the direction in which the Glider would experience crosswind on the final approach. It is probable that the captain attempted to approach in the direction of the rising slope to mountain in order to shorten the landing distance; however, it is probable that it was difficult in the air to judge to what extent the surface was inclined and that it was also difficult to distinguish the fence of bare metal wires present near the center of grasslands, which would be obstacles in landing.

3.4.6 Off-field landing

As described in 2.9.1, the grassland where the captain finally attempted to make landing was a slope; therefore, it is somewhat likely that it was difficult for the captain to visually judge the altitude. As described in 3.4.4, the engine of the Glider remained extended; therefore, it is probable that the glide performance was decreased, the loss of height was large, and no sufficient altitude was left; and consequently, it was difficult for the captain to keep the airspeed necessary to continue the flight.

It is probable that, around 12:35:40, the Glider turned to the left at low altitude and attempted to land without ensuring the straight final approach course. As described in 2.9.1, there were taller trees surrounding the tree with broken branches. Based on the thickness of broken branches, the distance between the tree and the impact marks, and other facts, it is probable that the Glider greatly lost the height during the left turning, which made the left main wing collide with the tree.

It is somewhat likely that the large loss of the height of the Glider was because it was nosed up while turning to the left under the situation of no sufficient altitude, which decreased the airspeed, or because lack of coordinated turn control during the turning made it slid down to the left.

Besides, as described in 3.3, it is probable that the south wind mainly blew around the accident site, which would be a tail wind for the Glider during the left turning for landing. It is somewhat likely that the captain noticed the fence or stakes around the landing place during the left turning and attempted to increase a left bank angle and reduce the turning radius to land in the front of them without being drifted, which made further loss of height.

3.5 Fuel

According to the statement of 2.1.2 (2), it is highly probable that the captain refuelled the Glider with five liters together with the owner's head on May 24, 2015.

As described in 2.5.2, the engine operating time of the Glider from that time was five minutes on May 24 and 15 minutes on May 29 (or it may be about 20 minutes according to the records of GPS unit), whose total time was 20 minutes (or about 25 minutes). In addition, as described in 3.4.3, it is probable that the engine did not start on the day when the accident occurred. As described in 2.9.2, no signs of fuel leak from the fuel tank of the Glider were found in the accident site.

As described in 2.6.4, the fuel consumption of the engine at cruising speed is about 9.5 liters per hour, and it is possible, in calculation, to fly for about 30 minutes only by five liters supplied on May 24. The refueling quantity had not been recorded in the Glider, and thus it was impossible to confirm the fuel consumption in actual operation from the previous records.

In light of above mentioned facts, it is also somewhat likely that the fuel consumption per hour was more than expected; however, the cause of little fuel left in the fuel tank of the Glider could not be determined.

3.6 Decisions on Return or Landing

As described in 3.4.3, the altitude of the Glider before the try of engine start was 2,000 ft or more; therefore, it is somewhat likely that the captain tried the first engine start to regain the height, considering the performance (maximum glide ratio: about 43:1), weather conditions (tail wind for the return to Skypark), and his flight experiences (2.5.1).

As described in 3.4.3, it is probable that the engine of the Glider did not start; however, it is

somewhat likely that the captain tried the engine start again. As shown in Appendix 1, it is probable that the change of directions to the east is because the Glider lost the height; therefore, the captain tried to head eastern valleys, and it is also somewhat likely that the captain visually confirmed several grasslands and other places surrounding the accident site and considered them as places which allow for landing even if the second engine start failed.

Once the Glider crossed the ridge line for the plains, the captain needed to decide whether he should return to Skypark instead of trying the engine start, or extend the engine according to the flight manual 4-10-2-1 (*The power plant should only be extended and started where there is a suitable landing terrain within gliding range (with power plant extended, L/D is only about 19:1)*) as described in 2.12.3, after moving to the predetermined off-field landing sites.

3.7 Ensuring Sufficient Altitude

The Glider is a motor glider; therefore, it is somewhat likely that the captain was not strongly aware of ensuring sufficient altitude, considering that it was possible to keep the altitude or climb by engine if necessary. However, if there are no other choices but to make off-field landing in the place other than predetermined places, it is necessary to ensure sufficient altitude due to the following reasons:

(1) Confirmation of landing place

As described in 3.4.5, it is probable that the captain made the decision to land in the grassland which is the accident site under the situation of no sufficient altitude.

If the pilot tries off-field landing in an unfamiliar place without background knowledge, it is necessary to closely confirm the space, wind, approach direction, slope or heave, conditions on the surface, obstacles and other things, from the air. In addition, if the place is not suitable, another place must be selected again.

(2) Keeping airspeed

As described in 3.4.6, it is probable that it became difficult for the captain to keep the necessary airspeed due to no sufficient altitude.

In the case of a glider without power plant, basically, the altitude is decreased for accelerating the airspeed and low altitude may be not enough to regain the airspeed.

(3) Ensuring final approach course and keeping descent angle

As described in 3.4.6, it is probable that the captain attempted to land without ensuring the straight final approach course.

It is necessary to ensure the straight final approach course and keep the adequate descent angle in consideration of wind in order to make off-field landing safely.

3.8 Operation of Sustainer-Type Motor Glider

The specific attentions need to be paid in the operation of sustainer-type motor glider as follows:

(1) Loss of altitude during engine start

The sustainer-type motor glider without an engine starter loses the altitude when the engine is started because it needs to be ignited after the airspeed is accelerated to make the propeller sufficiently rotate by wind pressure.

(2) Performance deterioration with the extended engine

With the engine extended, the drag is increased; therefore, the glide ratio is largely decreased, the stall speed is increased, and acceleration becomes difficult.

(3) Failures of engine start or retraction

Always assuming the cases that the engine cannot be started or that it cannot be retracted and remains extended, and the engine shall be extended only in places allowing for safety landing even in such cases.

3.9 For Safety Flight

The Glider pilots need to objectively judge safety margin to be ensured considering such as environments, performances, experiences while always refining knowledge or skills to foresee the change of situations during flight.

4. PROBABLE CAUSES

In this accident, it is probable that the Glider crashed because it greatly lost the height during left turning at low altitude when the captain attempted off-field landing in the grassland without ensuring the straight final approach course.

It is somewhat likely that the large loss of the height during left turning at low altitude was because the glider was nose up while turning to the left under the situation of no sufficient altitude, which decreased the airspeed, or because lack of coordinated turn control during the turning made it slid down to the left.

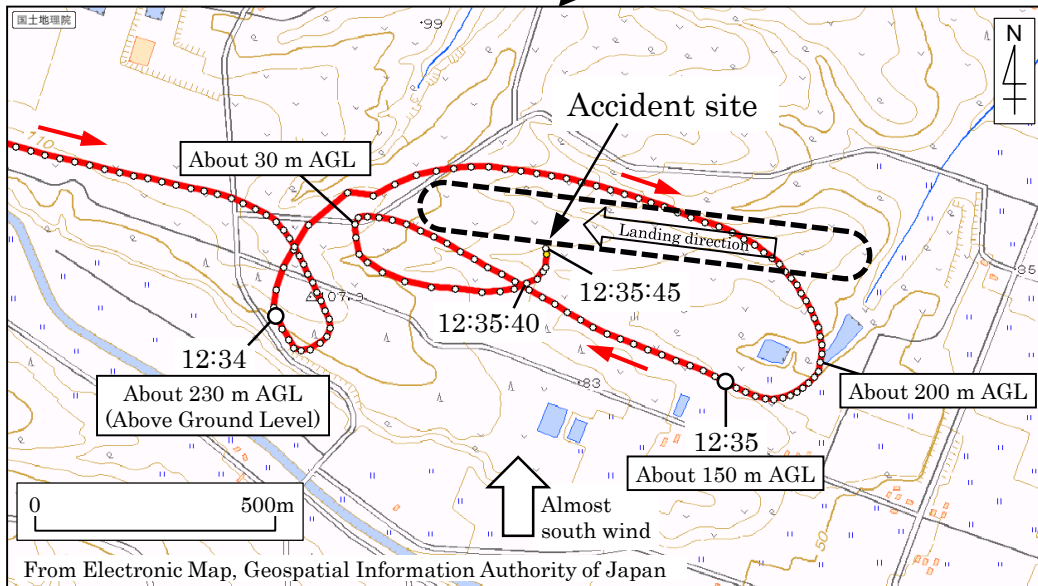
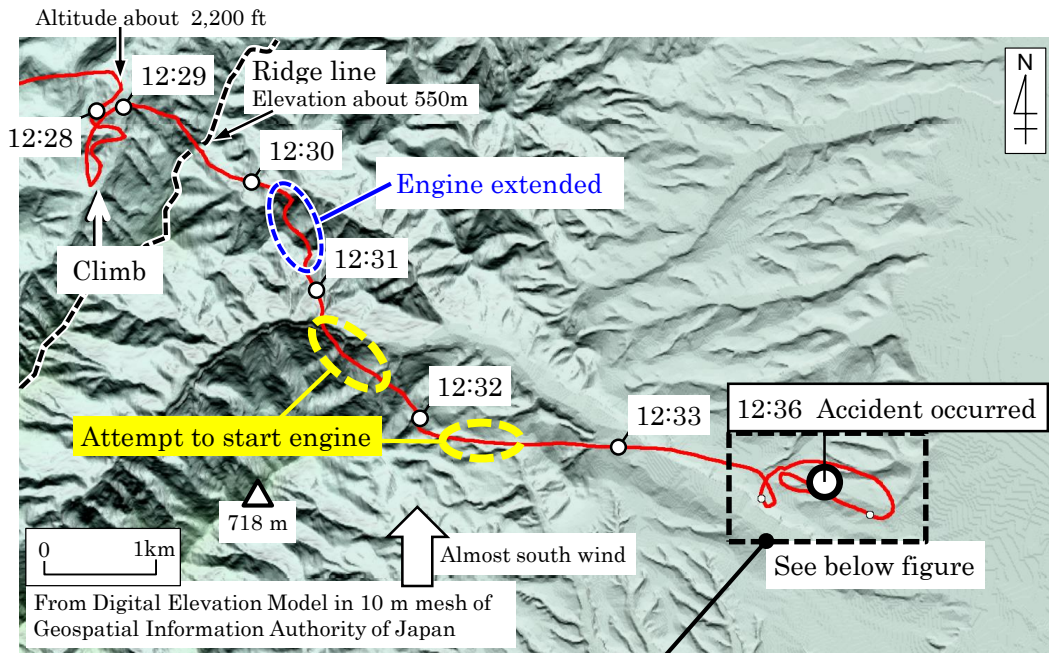
5. SAFETY ACTIONS

Safety actions taken after the accident

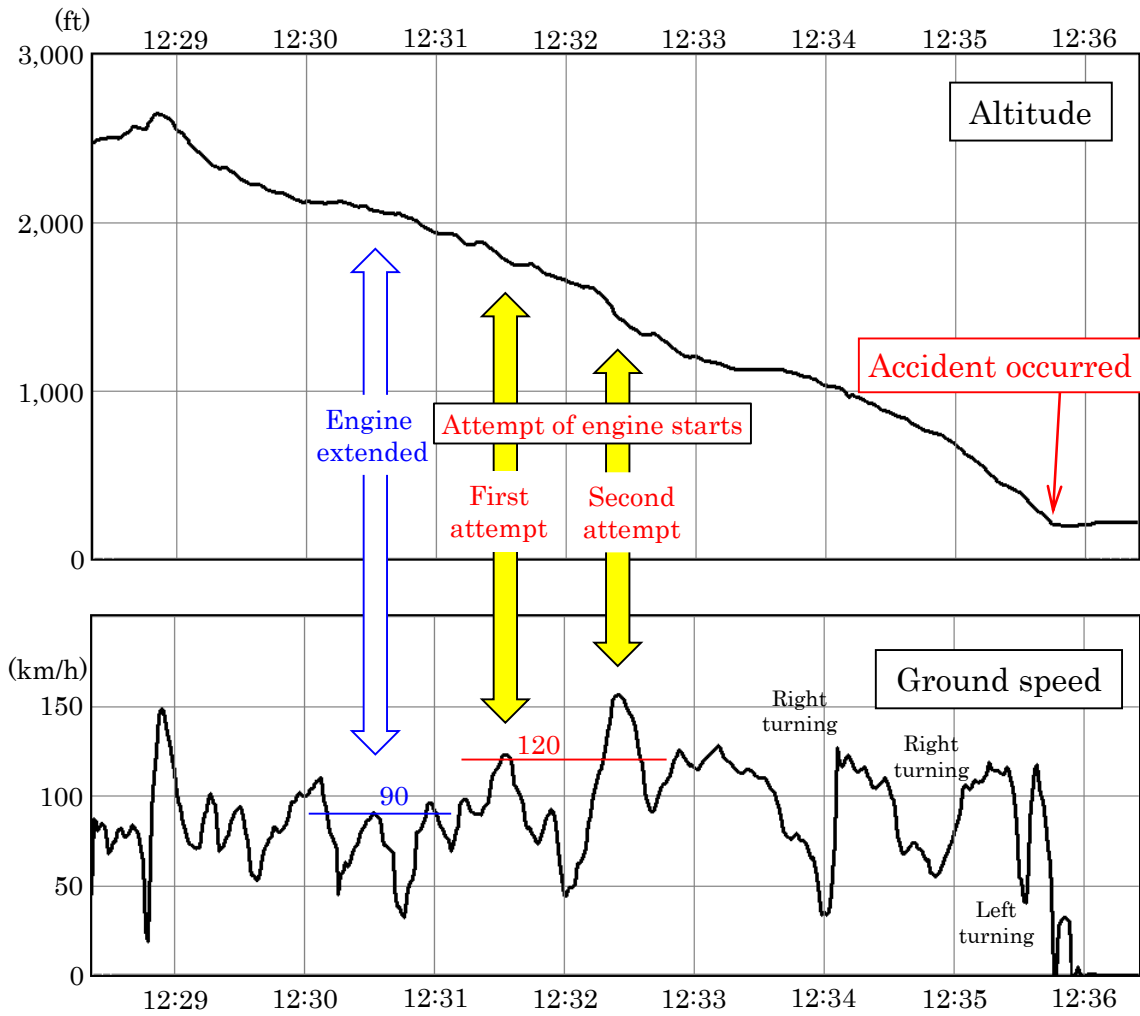
Skysport Association of Takikawa has taken the following measures in order to prevent similar occurrences:

- (1) Own analysis of accident causes
- (2) Conduct of comprehensive safety review on their owned aircraft, ground support equipment and flight operation
- (3) Consideration of measures for ensuring the safety of flight operation
 - Promulgation of compliance with various rules
 - Reconfirmation of safety education and the radio communication procedure in emergency
 - Conduct of safety measures to flight instructors and club members, and safety training for mechanics
 - Setting the opportunity to share the information
 - Conduct of countermeasures in light of the above results
- (4) Implementation of the external experts meeting
 - Skysport Association of Takikawa held for the four experts meeting invited from the outside and invited their comments related to the countermeasures by the association. Thereupon the association reflected the result to lay down measures for ensuring the safety of flight operation, whose contents was evaluated to be appropriate in the external experts meeting.

Appendix 1: Estimated Flight Route

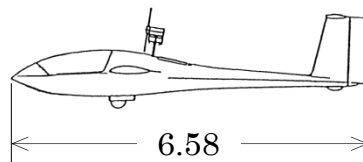
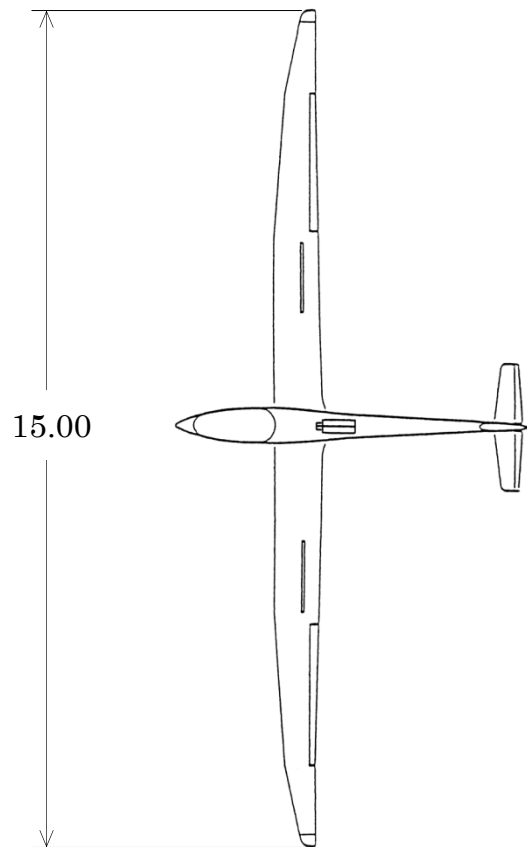
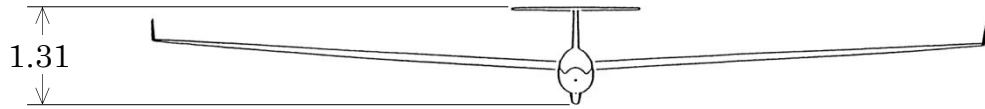


Appendix 2: Records of Altitude and Ground Speed

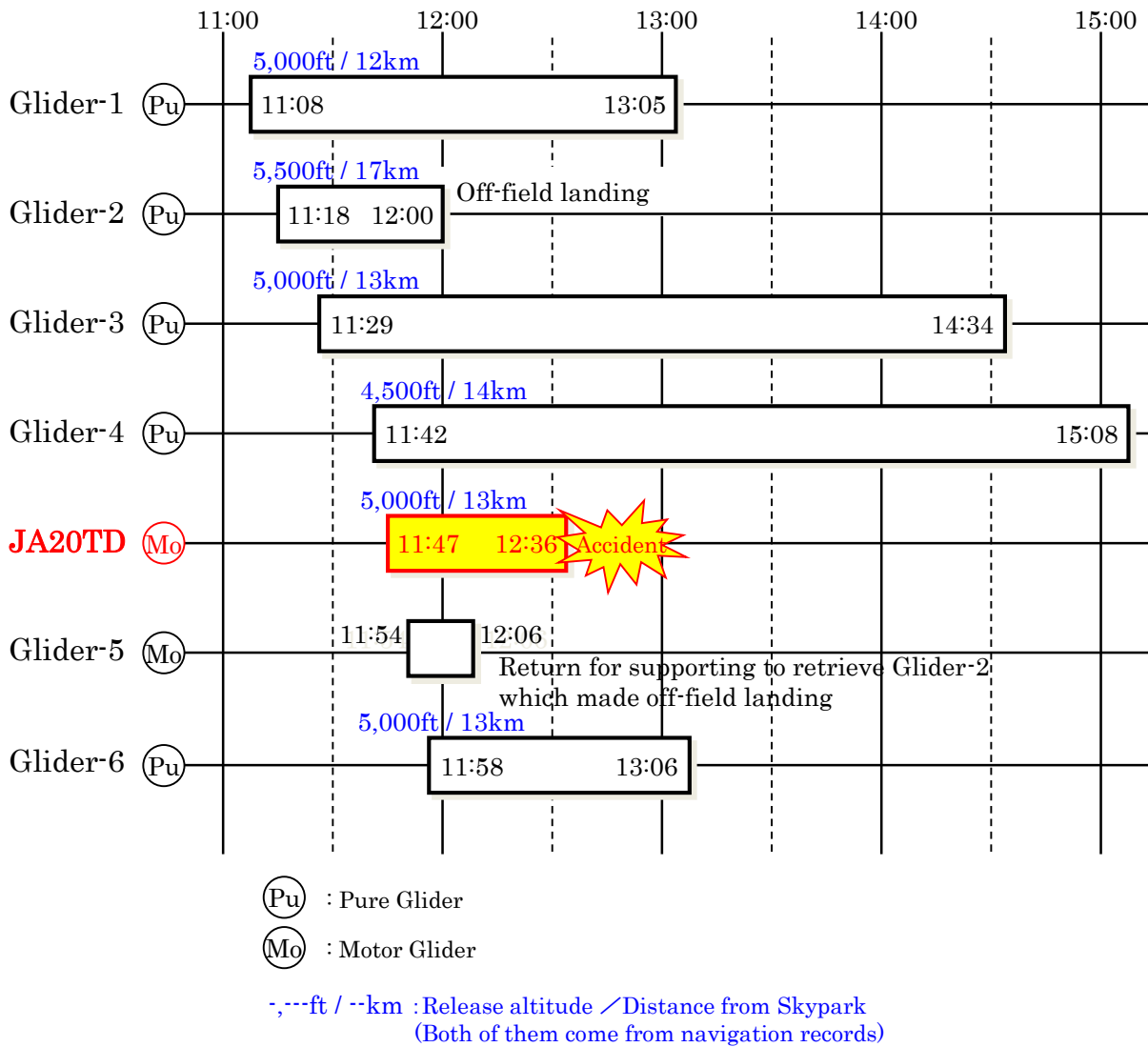


Appendix 3: Three Angle View of Schempp-Hirth Discus bT

Unit: m



Appendix 4: Gliders Flying during the Same Period



Appendix 5: Engine Extended/Retracted

