AIRCRAFT ACCIDENT INVESTIGATION REPORT

CRASH

PRIVATELY OWNED

PZL-BIELSKO SZD-55-1(GLIDER, SINGLE SEATER), JA2502

NAGANOHARA TOWN, AGATSUMA COUNTY,

GUNMA PREFECTURE

AT ABOUT 13:19 JST, APRIL 9, 2023

June 13, 2025
Adopted by the Japan Transport Safety Board

Chairperson	RINOIE Kenichi
Member	TAKANO Shigeru
Member	MARUI Yuichi
Member	SODA Hisako
Member	TSUDA Hiroka
Member	MATSUI Yuko

1. PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	On Sunday, April 9, 2023, a privately owned PZL-Bielsko SZD-55-1, JA2502, took off from Nagano City gliding field in Nagano City in Nagano Prefecture for a training by winch launch. It crashed into the bank slope of a lake in the vicinity of Yokokabe, Naganohara Town, Agatsuma County, Gunma Prefecture. The pilot, who was the only person on board, sustained a fatal injury. The glider was destroyed, but there was no outbreak of fire.
1.2 Outline of the Accident Investigation	On April 10, 2023, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate this accident. An accredited representative of the Republic of Poland, as the State of Design and Manufacture of the glider involved in this accident, participated in the investigation. Comments were not invited from the person relevant to the cause of the accident because the pilot was fatally injured in this accident. Comments on the draft Final Report were invited from the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of the members of the Nagano Gliding Association (hereinafter referred to as "Association Member(s)"), to which the pilot belonged, the GPS records of the pilot's smartphone, and the video records

	of a surveillance camera at Yamba-Agatsuma Lake, the history of the flight is summarized as follows: On April 9, 2023, a privately owned PZL-Bielsko SZD-55-1, JA2502, was planned to launch from Nagano City gliding field (elevation: 338 m) in Nagano City in Nagano Prefecture by winch launch for training and return to the Gliding Field, only the pilot was on board. At about 09:30, Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), the Association's pre-flight briefing was conducted, which the pilot also attended. The Association's instructor on duty, who was responsible for the safety confirmation of the entire operation on that day, advised the pilot to pay attention to the weather conditions during the flight, as the weather forecast on the day of the accident predicted a strong northwesterly wind and wave conditions. (weather conditions in which mountain waves*1 may occur) In the mountainous areas of Nagano, the airflow is often disrupted over large areas). At about 12:00 the glider took off by winch launch from runway 04 at the Gliding Field. This was the first launch of the day for both the glider and the pilot. At about 12:30, the pilot sent a message to Association Member A in flight, saying "I am now at 2,600 m around Mt. Neko, it is going well (climbing well)". At about 12:44, the pilot asked Association Member B: "I'm around Mt. Azumaya now. Are you climbing better there?" Association Member B replied, "Now I am climbing in the thermals between Kenashi Pass and Mt. Yokote", but there was no further contact from the pilot. At about 12:56, the glider crossed the ridge at the prefectural boundary and entered the Gunma Prefecture side. At about 13:19, the glider crashed into the bank slope (elevation: 572 m) near the surface of Yamba-Agatsuma Lake, Agatsuma County, Gunma Prefecture. The accident occurred at about 13:19 on April 9, 2023, in Yokokabe, Naganohara Town, Agatsuma County, Gunma Prefecture (36° 32' 19" N, 138° 40' 35" E).

*1 "Mountain waves" are airflow waves that occur on the lee side of the mountain after strong winds have passed over the mountain.

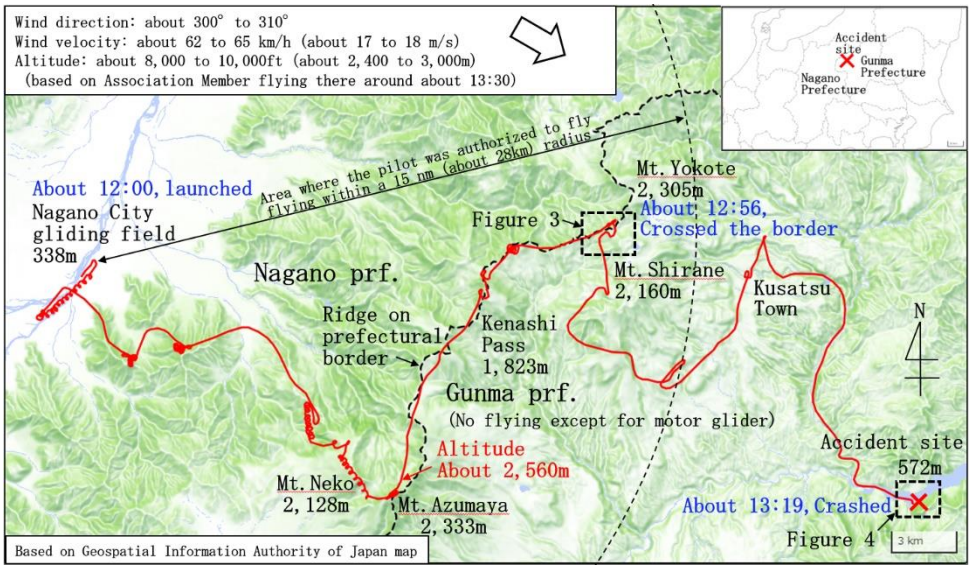


Figure 1: Estimated Flight Route
(based on the GPS records of the pilot's smartphone)

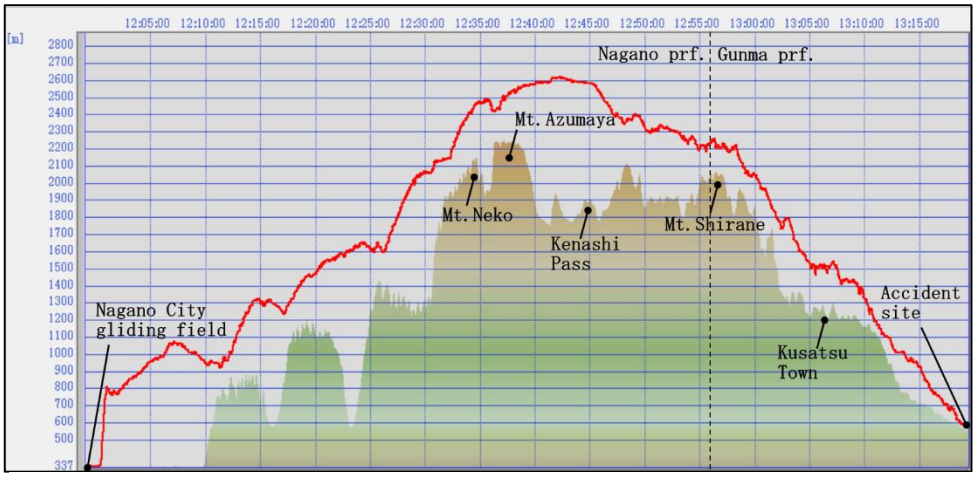


Figure 2: Estimated Flight Altitude
(based on the GPS records of the pilot's smartphone) and
Elevation Data below the Estimated Flight Route

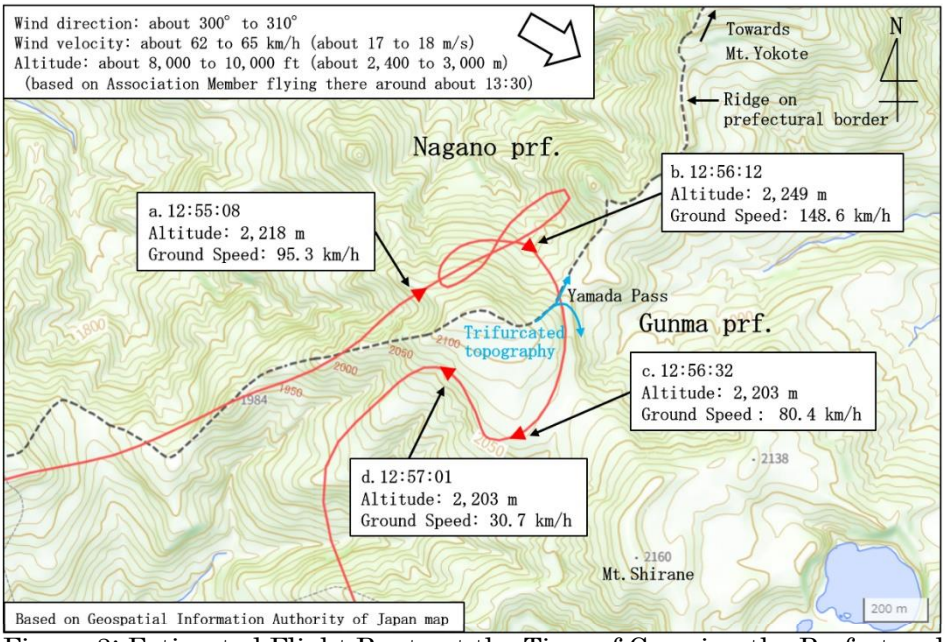


Figure 3: Estimated Flight Route at the Time of Crossing the Prefectural Boundary (based on the GPS records of the pilot's smartphone)

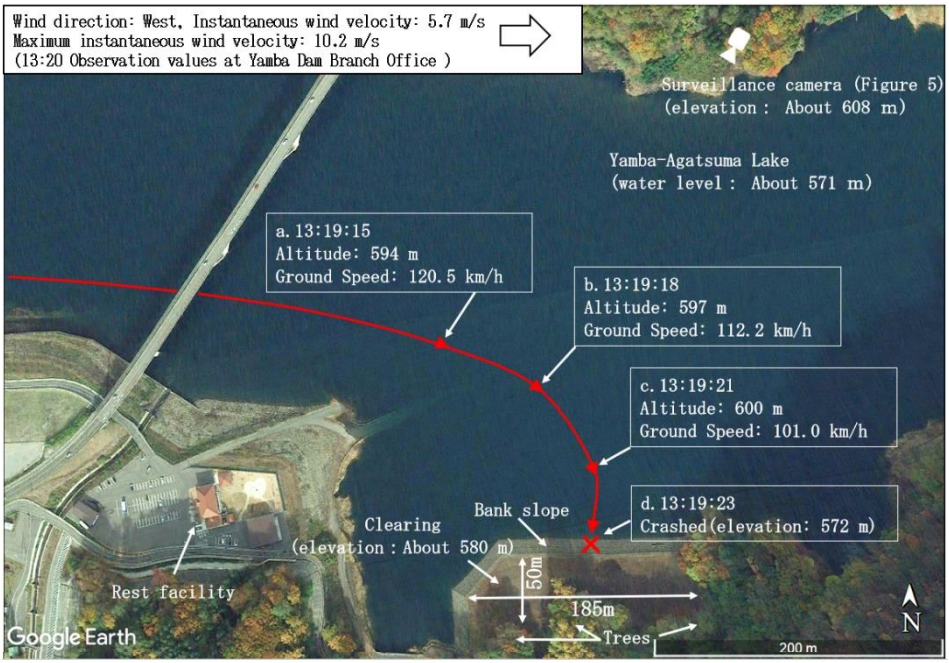


Figure 4: Estimated Flight Route near the Accident Site (based on the GPS records of the pilot's smartphone)

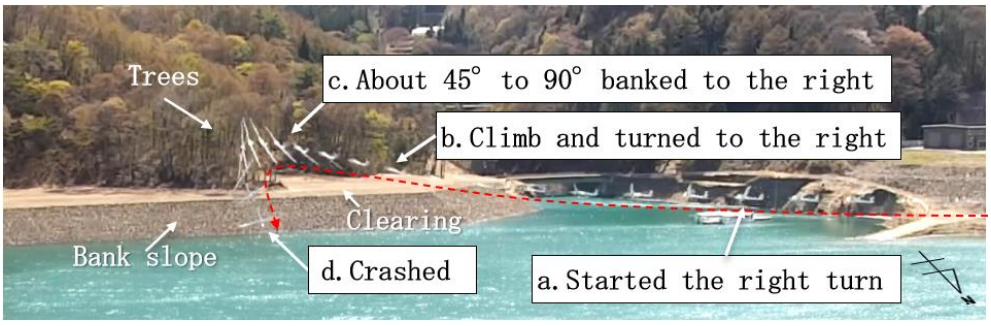
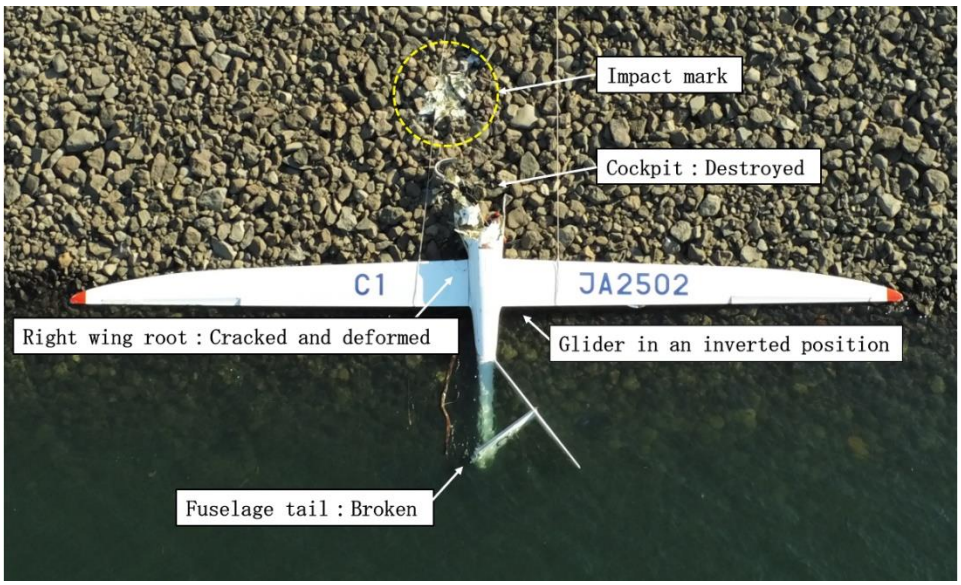
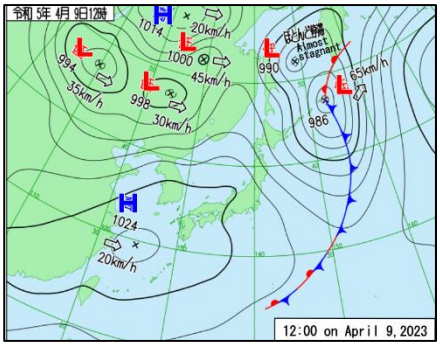
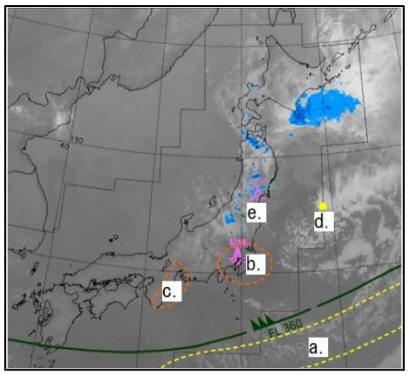
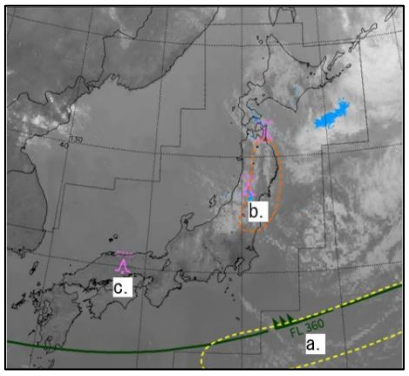


Figure 5: Continuous Synthesized Photo from Surveillance Camera Video Taken at the Time of the Crash (at 0.4 second intervals).
(a. to d. in this Figure correspond to those in Figure 4)

2.2 Injuries to Persons	The pilot was fatally injured.
2.3 Damage	(1) Extent of Damage: Destroyed (2) Damage to the Glider Components (see Figure 6) ・ Cockpit: Destroyed ・ Right wing root: Cracked and deformed ・ Fuselage tail: Broken  Figure 6: Damage of the Glider
2.4 Personnel Information	Pilot, Age 68 Private pilot certificate (High Class Glider) June 4, 1975 Pilot competence assessment/confirmation Expiration date of piloting capable period: May 14, 2024 Class 2 aviation medical certificate Validity: November 11, 2023 Total flight time 641 hours 06 minutes Total flight time on the type of glider 64 hours 31 minutes Flight time in the last 30 days 2 hours 51minutes
2.5 Glider Information	Type of the Glider: PZL-Bielsko SZD-55-1 Serial Number: 551192033 Date of Manufacture: March 10, 1992 Certificate of Airworthiness: No.2021-57-20 Validity: December 24, 2023 When the accident occurred, the weight of the glider was 307.8 kg, and the position of the center of gravity was 386.5 mm, both were estimated to have been within the allowable range.

2.6 Meteorological Information	(1) General Weather Conditions According to the SPAS, Analysis Chart for Japan announced by the Japan Meteorological Agency at 12:00 on April 9, 2023, the main island of Japan was covered by high pressure, but there was a rather large pressure gradient between the high pressure moving eastwards from the Continent and the low pressure sea around the Kuril Islands.  Figure 7: Extract from SPAS at 12:00, April 9 (2) Significant Weather Analysis Charts The Significant Weather Analysis Chart as of 09:00 on April 9, 2023 indicated mountain waves (FL 20 to 180 (altitude of about 600 to 5,500 m), weakening) in the Kanto Plain . (Area within the orange dotted line of b. in Figure 8) The Significant Weather Analysis Chart for 12:00 indicated no mountain waves in the Kanto Plain.  Figure 8: Significant Weather Analysis Chart as of 09:00, April 9  Figure 9: Significant Weather Analysis Chart as of 12:00, April 9 (3) Narrow Area Significant Weather Prognostic Chart The Narrow Area Significant Weather Prognostic Chart as of 09:00 on April 9, 2023, predicted that a turbulence of MODERATE intensity (FL 40 to 90 (altitude of about 1,200 to 2,700 m)) was expected near the border between Nagano and Gunma prefectures. The Narrow Area Significant Weather Prognostic Chart for 13:00 predicted no turbulence and others near the prefectural border.

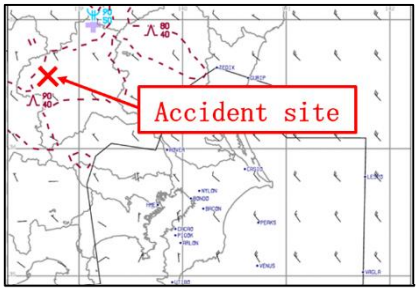


Figure 10: Narrow Area Significant Weather Prognostic Chart(extracted from SIGWX Analysis Chart at 09:00, April 9, and added)

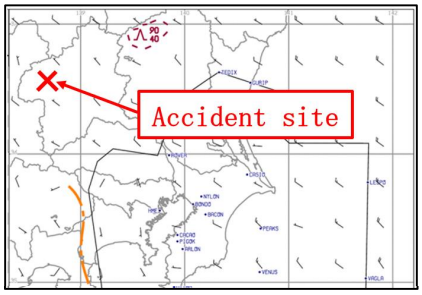


Figure 11: Narrow Area Significant Weather Prognostic Chart(extracted from SIGWX Analysis Chart at 13:00, April 9, and added)

(4) Wind Direction and Velocity near the Ridge on the Prefectural Border (based on the statements of Association Members)

About 13:30

Altitude: about 8,000 to 10,000 ft (about 2,400 to 3,000 m)

Wind direction: about 300° to 310°

Wind velocity: about 62 to 65 km/h (about 17 to 18 m/s)

(5) Observation Values at Nagano City gliding field

According to the operation controller, the weather conditions at Nagano City Glider were as follows:

12:00 Wind direction: 040°, Wind velocity: 6 to 8 m/s. Weather: fine

(6) Observation Values at the Regional Weather Station

During the time relevant to the accident, the observation values at Kusatsu Regional Weather Station, located about 12 km northwest of the accident site, were as follows:

13:00 Wind direction: north, Wind velocity: 4.2 m/s

Temperature: 4.2°C

Precipitation: 0.0 mm

During the time relevant to the accident, the observation values at Nagano Regional Weather Station, located about 45 km west-northwest of the accident site, were as follows:

13:00 Wind direction: east-northeast, Wind velocity: 5.2 m/s

Temperature: 12.9°C

Precipitation: 0.0 mm

Atmosphere (sea level): 1016.2 hPa

(7) Observation Values at Yamba Dam Branch Office

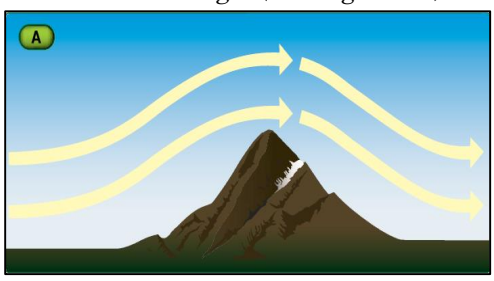
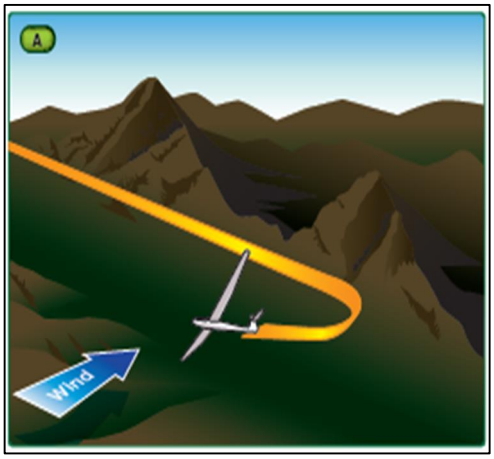
During the time relevant to the accident, the observation values at Yamba Dam Branch Office, located about 4 km east-northeast of the accident site, were as follows:

13:20 Wind direction: west, Instantaneous wind velocity: 5.7 m/s

Maximum instantaneous wind : 10.2 m/s

Temperature: 10.6°C

Precipitation: 0.0 mm

2.7 Additional Information	(1) Wind Conditions near the Ridge on the Prefectural Border At the same time as the glider was flying, four gliders belonging to the association were flying. Three of four were performing ridge soaring, which uses the updrafts produced by the lift of the air as it encounters the upwind slope of mountains in the airspace over near the prefectural border between Nagano and Gunma Prefectures. In addition, one of the four was performing wave soaring, which uses mountain waves. In the airspace on the day of the accident, a strong wind (at 17 to 18 m/s) was blowing from the northwest (300° to 310°), which influenced the wind conditions in the vicinity, both updrafts and downdrafts were strong, and the updrafts and downdrafts changed within a narrow area of several hundred meters. There were no clouds in the vicinity. (2)) Ridge Soaring Using Slope Lift The U.S. Department of Transportation Federal Aviation Administration Flight Standard Service, FAA-H-8083-13A "GLIDER FLYING HANDBOOK" (hereinafter referred to as the "FAA Handbook"), pp. 9-14 to 9-20, contains the following statements regarding ridge soaring using slope lift produced in mountains. *Slope or ridge soaring refers to using updrafts produced by the mechanical lifting of air as it encounters the upwind slope of a hill, ridge, or mountain. Slope soaring requires two ingredients: elevated terrain and wind.* (Omitted) *Just as the flow is deflected upward on the windward side of a ridge, it is deflected downward on the lee side of a ridge.* (see Figure 12) *This downdraft can be alarmingly strong—up to 2,000 fpm or more near a steep ridge with strong winds. Even in moderate winds, the downdraft near a ridge can be strong enough to make penetration of the upwind side of the ridge impossible.*  Figure 12: Airflow along the Ridge (3) Ridge Soaring (Slope Soaring) Rules The FAA Handbook includes the following on p. 10-12. *Make all turns away from the ridge.* (see Figure 13) *A turn toward the ridge is dangerous, even if gliding seemingly well away from the ridge. The groundspeed on the downwind portion of the turn is difficult to judge properly, and striking the ridge is a serious threat. Even if above the ridge, it is easy to finish*  Figure 13: Ridge rules

the turn downwind which may take the glider over the ridge crest; this puts the glider into heavy sink.

(4) Off-Field Landing Procedures *2

The FAA Handbook states the following on p. 8-18.

Causes of off-field landings while soaring in the vicinity of the launching airport, include rapid weather deterioration, a significant change in wind direction, unanticipated amounts of sinking air, disorientation, lack of situational awareness, tow failures, and other emergencies requiring an off-field landing. In these situations, it usually is safer to make a precautionary off-field landing than it is to attempt a low, straight-in approach to the airport.

(Omitted)

These basic ingredients for a successful off-field landing can be summarized as follows:

- *Recognizing the possibility of imminent off-field landing.*
- *Selecting a suitable area, then a suitable landing field within that area.*
- *Planning the approach with wind, obstacles, and local terrain in mind.*
- *Executing the approach, land, and then stopping the glider as soon as possible.*
- *Attempting to contact ground crew and notifying them of off-field landing location.*

(Omitted)

Decision heights are altitudes at which pilots take critical steps in the off-field landing process. If the terrain below is suitable for landing, select a general area no lower than 2,000 feet above ground level (AGL). Select the intended landing field no lower than 1,500 feet AGL. At 1,000 feet AGL, commit to flying the approach and landing off field. If the terrain below is not acceptable for an off-field landing, the best course of action is to move immediately toward more suitable terrain.

(Omitted)

The recommended approach procedure is to fly the following legs in the pattern:

- *Crosswind leg on the downwind side of the field*
- *Upwind leg*
- *Crosswind leg on the upwind side of the field*
- *Downwind leg*
- *Base leg*
- *Final approach*

This approach procedure provides the

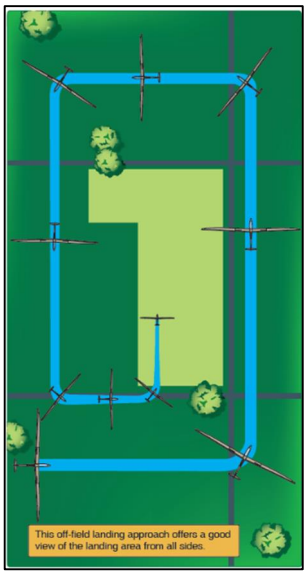


Figure 14: Off-field Landing Approach

*2 "Off-field landing" means landing at the sites other than the destination. Pursuant to the Article 79, Civil Aeronautics Act, gliders do not require permission from the Minister of Land, Infrastructure, Transport and Tourism is unnecessary for landing and takeoff in places other than airports and so on.

opportunity to see the intended landing area from all sides. Use every opportunity while flying this approach to inspect the landing area and look for obstacles or other hazards. (see Figure 14)

(5) Spins

The FAA Handbook includes the following on pp. 3-17 to 3-18.

If the aircraft is not stalled, it cannot spin. A spin can be defined as an aggravated stall that results in the glider descending in a helical, or corkscrew, path. A spin is a complex, uncoordinated flight maneuver in which the wings are unequally stalled. Upon entering a spin, the wing that is more completely stalled drops before the other, and the nose of the aircraft yaws in the direction of the low wing.

(Omitted)

The cause of a spin is stalled airflow over one wing before airflow stalling over the other wing. This is a result of uncoordinated flight with unequal airflows over the wings.

Spins occur in uncoordinated slow flight and high rate turns (overbanking for airspeed). The lack of coordination is normally caused by too much or not enough rudder control for the amount of aileron being used. If the stall recovery is not promptly initiated, the glider is likely to enter a full stall that may develop into a spin. Spins that occur as the result of uncoordinated flight usually rotate in the direction of the rudder being applied, regardless of the raised wing. When entering a slipping turn, holding opposite aileron and rudder, the resultant spin usually occurs in the direction opposite of the aileron already applied. In a skidding turn in which both aileron and rudder are applied in the same direction, rotation is also in the direction of rudder application. Glider pilots should always be aware of the type of wing forms on their aircraft and the stall characteristics of that wing in various maneuvers.

(6) Pilot's Experience and Skills

The pilot met the requirement of "30 hours of flying time over the mountains in Nagano", which was the "standard for flying within a 15 nm radius of the gliding field" in the "standard for the flight area to be followed by all members" specified by the Association, therefore, the pilot was recognized by the instructor as having necessary experience and skills to fly. (See dotted line in Figure 1)

(7) Track Record of the Flight near Mt. Yokote and Yamada Pass

According to the flight track recorded on the GPS of the pilot's smartphone, of the 244 flight track records from August 27, 2017, to April 9, 2023, seven flight track records of near Mt. Yokote were recorded on the smartphone, but there were no flight track records near Yamada Pass when the glider entered the Gunma Prefecture side, except for the one at the time of the accident.

(8) Stall and Stall Characteristics of the Glider

a. The Flight Manual Issue 4, Rev. 3 for this aircraft type states the following. (Excerpt)

Flight conditions	All-up mass	
	265 kg	500 kg
	Light pilot without ballast	Heavy pilot with ballast
Stalling in straight flight	63 km/h	84 km/h
Stalling in circling with 45° bank	75 km/h	101 km/h

The stalled glider drops down symmetrically or with the tendency or with the tendency to drop the wing. The recovery after pushing the stick follows without the troubles and fail less. The height loss is about 40 m in straight flight and 80 m in circling.

b. Estimated Stall Speed of the Glider

Stall speed is proportional to the square root of the ratio of the glider's weight. Therefore, using the following formula, the stall speed of the glider in straight flight at the weight of the glider (307.8 kg) at the time of the accident is estimated to have been approximately 67.90 km/h.

$V_{s2} = V_{s1} \times \sqrt{W_2/W_1}$

W_1: 265 kg (from 2.7 (8) a.)

W_2: 307.8 kg

V_{s1}: 63 km/h (stall speed corresponding to W_1)

V_{s2} : Stall speed corresponding to W_2

(9) Estimated Stall Speed in a banked turn

The stall speed in a banked turn was estimated using the following formula.

$V_s{}^{TURN} = V_s \times \sqrt{n}$

$n = 1/\cos\theta$

$V_s{}^{TURN}$: Stall speed in a banked turn

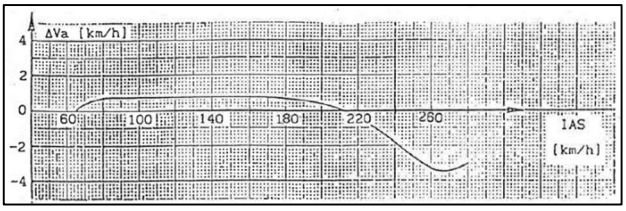
V_s: Stall speed in a straight flight

n: Load factor

θ: Bank angle

(10) Airspeed Indicator Calibration Curve

The Flight Manual Issue 4, Rev. 3 for this aircraft type states the following. (Excerpt)



CAS*3, IAS*4 and the airspeed indicator calibration value (ΔVa) have the following relationship.

CAS = IAS+ ΔVa

*3 "CAS" stands for Calibrated Air Speed, meaning the airspeed indicated on the instrument, being obtained after the position error and instrument error of the airspeed system have been calibrated.

*4 "IAS" stands for Indicated Air Speed, meaning the airspeed displayed on the instrument in the cockpit after the difference between all the pressures at the end of the pitot tube and the static pressure has been computed.

(11) IAS Estimation Procedure

The IAS was estimated using the following procedure.

a. Pressure altitude was estimated from flight altitude (based on the GPS records from the pilot's smartphone), the sea level pressure value on the day and the ambient temperature.

b. Nose direction and the true airspeed were estimated from the wind direction, wind velocity, flight route and the ground speed (based on the GPS records from the pilot's smartphone).

c. CAS was estimated from pressure altitude, ambient temperature and true airspeed.

d. IAS was estimated from CAS and airspeed indicator calibration curve (2.7 (9)).

(12) No-fly Zone for Ridge Soaring

The Association had agreed to designate the airspace on the Gunma side as a no-fly zone for gliders other than motor gliders because, at the time of the ridge soaring near the border between Nagano and Gunma prefectures, if the aircraft crossed a ridge, entered the Gunma side, which is the lee side of the ridge, and entered the lee side sink, it would be unable to return to Nagano City gliding field.

(13) Establishment of Potential Off-field Landing Sites

The Association set up potential off-field landing sites on the Nagano side in case of an emergency during the flight, but there was no potential off-field landing site on the Gunma side as it was designated as a no-fly zone.

(14) Case of an Off-field Landing on the Gunma Side after Crossing a Ridge on the Prefectural Border

According to the statements of Association Members, there have been two previous cases of off-filed landings on the Gunma side of the border ridge in the Association. Neither case resulted in an accident or other incident.

(15) Accident Site Information

Near the accident site, there was a clearing about 50 m north-south and 185 m east-west (elevation: about 580 m). The clearing was surrounded by trees about 20 m high. (Figure 4)

3.ANALYSIS

(1) Flight near the Ridge on the Prefectural Border

Regarding the flight near the ridge on the prefectural border, the JTSB concludes as follows:

It is possible that the glider gained altitude after take-off from the Gliding Field, flew northeast along the ridge on the prefectural border from the vicinity of Mt. Azumaya while performing ridge soaring, made a figure eight turn near Yamada Pass, and attempted to climb (Figure 1 and Figure 3). However, it is most likely that even after performing the figure eight turn, the glider continued to turn to the right and made a turn into the lee side of the ridge, and then as the glider was largely drifted into the lee side of the ridge, it inadvertently crossed the ridge on the prefectural border to enter the no-fly zone on the Gunma side, resulting in a loss of altitude due to the downdraft on the lee side of the ridge (b. c. in Figure 3).

The reason that the glider continued to turn right even after the figure eight turn, and turned

to the lee side of the ridge is possibly because the pilot misjudged the topography of the ridge. Factors contributing to the pilot's misjudgment of the topography of the ridge were possibly the trifurcated topography of the ridge, which made it difficult to identify the ridge at the prefectural boundary, and the pilot's insufficient experience of flying near Mt. Yokote and Yamada Pass (Figure 3 and 2.7 (7)).

The glider then made a right turn to return the windward side of the ridge and was flying with its nose to the north-west when the glider's IAS (estimated using the procedure in 2.7 (11)) was more likely to have dropped rapidly from about 108 km/h (c. in Figure 3) to about 84 km/h (d. in Figure 3). In addition, as the altitude AGL between the glider and the nearby ridge was probably about 100 to 250 m (d. in Figure 3), it is more likely that the pilot judged that the glider's airspeed and AGL were insufficient to cross the ridge, once gave up on returning to the windward side of the ridge and flew downwind with the nose to the lee side.

During ridge soaring in strong winds, it is dangerous to turn to the lee side of a ridge, as once over the ridge, the aircraft may drift into the lee downdraft and be unable to return to the windward side of the ridge. It is therefore important to make a turn away from the ridge (windward side of the ridge) to avoid drifting into the lee downdraft at the time of turning while ridge soaring.

(2) Flight before the Crash

The JTSB concludes that the glider was probably trying to gain altitude from thermals or was looking for a suitable off-field landing site, as it made four turns after entering the Gunma side (Turns a. to d. in Figure15). However, it is probable that the glider was unable to gain altitude from thermals, gradually losing altitude, and even after descending below about 300 m (about 1,000 ft AGL), the critical decision height at which pilots should decide to perform an off-field landing, the glider did not approach for the off field landing, therefore, it is more likely that the glider was unable to identify a suitable off-field landing site and was flying close to the accident site.

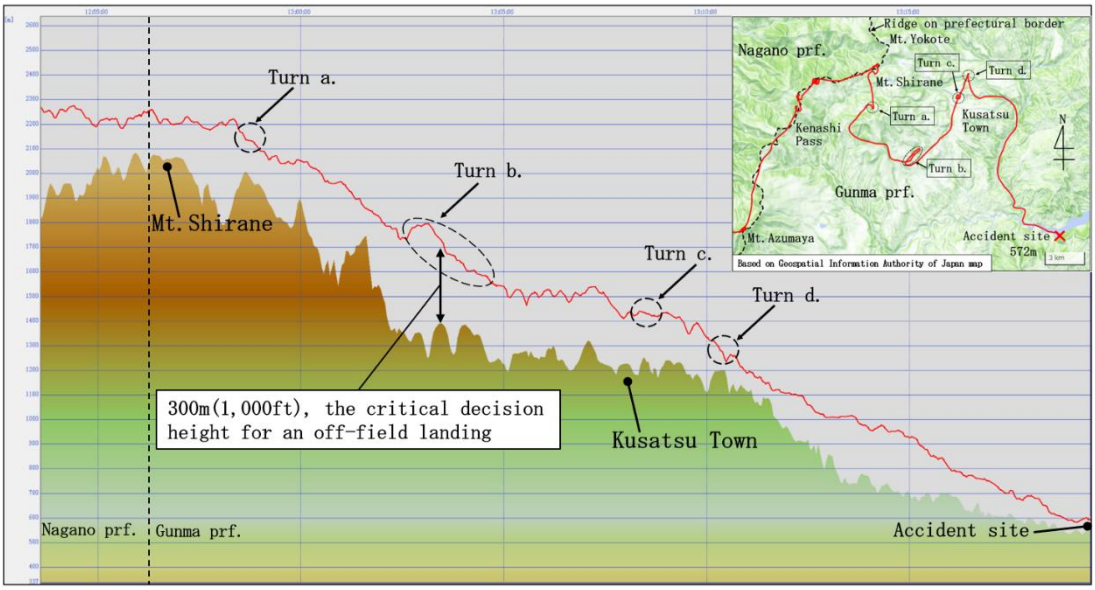


Figure 15: Flight before the Crash

(3) Situation at the Time of the Crash

The JTSB concludes that as the glider had made a turn with its nose towards a clearing near the accident site while flying close to the accident site, it is likely that the glider found the clearing and attempted an off-field landing at the clearing (Figure 4). It is possible that while the glider was making a right turn at a low altitude and attempting to land at the clearing without securing the straight final approach path, the pilot spotted the trees which could be an obstacle immediately before the off-field landing and made excessive corrections to avoid the trees, causing the glider to stall, spin, and crash from the nose into the bank slope in an inverted position with no recovery due to the low altitude.

It is probable that eight seconds before the crash, the glider's IAS was about 97 km/h (estimated using the procedure in 2.7 (11)), and its AGL (the altitude above the water surface) was about 23 m (a. in Figure 4). The glider then probably climbed slightly while continuing a right turn (b. in Figure 4).

It is more likely that about two to three seconds before the crash, the glider's IAS was about 90 km/h (estimated using the procedure in 2.7 (11)), its AGL (the altitude above the water surface) was about 29 m, and the bank angle was increasing to the right from about 45° to almost 90° (c. in Figure 5). At the weight of the glider (307.8 kg) at the time of the accident, if the bank angle exceeded about 56°, the glider likely stalled (2.7 (9)) because the stall speed of the glider exceeds about 90 km/h IAS.

The reason the glider stalled and entered a spin was probably because one of the following excessive corrections were made to avoid the trees, which could be obstacles: excessive bank angle for airspeed, or uncoordinated control with excessive right rudder usage for aileron usage.

If, during the glider flight, it becomes difficult to reach the intended landing area, it is important to decide on an off-field landing as soon as possible and execute it by following the appropriate procedure.

With regard to off-field landings at unfamiliar areas, glider pilots have no information about the size, altitude, presence of objects, surface conditions and others, which would make it difficult for them to determine the possibility of an off-field landing from the air, therefore, it is recommended that every glider pilot should identify off-field landing sites in advance, even in a no-fly zone, for unforeseen situations.

4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this accident was that it is more likely that during ridge soaring, the glider drifted into a downdraft on the lee side of a ridge, lost altitude, was unable to cross the ridge on the homeward route and therefore attempted an off-field landing, causing the glider to stall, spin, and crash without being able to recover.

The reason the glider stalled and entered a spin was probably because the excessive corrections were made immediately before the off-field landing to avoid the trees.

5. SAFETY ACTIONS

5.1 Safety Actions Required	(1) When flying gliders, it is recommended that every glider pilot should identify off-field landing sites in advance for unforeseen situations. (2) For making a turn near a ridge during ridge soaring, it is important to make a turn not toward the ridge but away from the ridge (windward side of the ridge) to avoid drifting into the leeside downdraft. (3) If, during the glider flight, it becomes difficult to reach the intended landing area, it is important to decide on an off-field landing as soon as possible and execute it by following the appropriate procedure.
5.2 Safety Actions Taken after the Accident	The Association took the following safety actions by issuing the document "Accident (JA2502) Prevention Measures". (1) The content of this accident was made known to all members of the Association. (2) The Association made it known that in the mountainous areas of Nagano, the difficulty of flying a glider increases dramatically in wave conditions in which mountain waves could occur. (3) Emergency off-field landing sites were set up on the Gunma side. (4) The following risks of flying to the Gunma side were made known. ・The Gunma side is on the lee side of the mountains, making it difficult to get back to the Nagano side. ・Sink can be particularly strong in wave conditions, which would not give pilots enough time to react. ・Potential off-field landing sites are limited on the Gunma side. (5) The following measures to avoid entering the Gunma side were made known. ・Always be aware of the ridge lines on the prefectural border and the wind direction and velocity, and stay away from it if the wind is too strong. ・Near the ridge on the prefectural border, the aircraft tends to drift downwind with a half turn, a 360° turn should not be conducted even over the mountain top. (6) The following actions to be taken at the time of entering the Gunma side were made known. ・Move north-south and return to the Nagano side from the place where the mountains are low. ・Evacuate a place where sink can be mitigated. ・Receive advice by radio from Nagano Flight Service or other aircraft in

	flight. (7) The following information was provided on emergency off-field landings. ・Confirm the off-field landing sites in Gunma Prefecture in advance. ・Select the off-field landing site as soon as possible to allow time to confirm the wind direction and approach procedure and to establish radio contact.