

AA2018-4

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**KWANSEI GAKUIN UNIVERSITY
JA05KG**

June 28, 2018



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

Kazuhiro Nakahashi

Chairman

Japan Transport Safety Board

Note:

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

AIRCRAFT ACCIDENT INVESTIGATION REPORT

DAMAGE OF GLIDER DURING LANDING
DUE TO ABORT OF WINCH LAUNCHING
AT ONO GLIDING FIELD, ONO-CHO, IBI-GUN, GIFU PREFECTURE
AT ABOUT 9:21 JST, NOVEMBER 10, 2017

KWANSEI GAKUIN UNIVERSITY
SCHEMP-PHIRTH V.L. DISCUS CS (GLIDER, SINGLE-SEATER),
JA05KG

May 25, 2018

Adopted by the Japan Transport Safety Board

Chairman Kazuhiro Nakahashi

Member Toru Miyashita

Member Toshiyuki Ishikawa

Member Yuichi Marui

Member Keiji Tanaka

Member Miwa Nakanishi

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Accident	On November 10 (Friday), 2017, a Schempp-Hirth V.L. Discus CS, registered JA05KG, operated by Kwansei Gakuin University, aborted a winch launching for a familiarization flight and collided with the winch while landing, resulting in damage of the aircraft.
1.2 Outline of the Accident Investigation	<p>The Japan Transport Safety Board designated an investigator-in-charge and an investigator on November 10, 2017.</p> <p>Although this accident was notified to the Federal Republic of Germany, as the State of Design of the aircraft involved in this accident, and the Czech Republic, as the State of Manufacture of the aircraft, both States did not designate their accredited representatives.</p> <p>Comments were invited from parties relevant to the cause of the accident and the Relevant States.</p>

2. FACTUAL INFORMATION

2.1 History of the Flight

According to the statements of the pilot (hereinafter referred to as "the Pilot"), the instructor (hereinafter referred to as "the Instructor"), who is certified by the Japan Students Aviation League (hereinafter referred to as "the League"), and the winch operator (hereinafter referred to as "the Winch man"), the history of the flight is summarized below:

During a training camp sponsored by the members of the League in the Tokai and Kansai districts, the Schempp-Hirth Discus V.L. Discus CS, registered JA05KG, operated by Kwansai Gakuin University, (hereinafter referred to as "the Glider") was planned to launch from the Ono Gliding Field with the Pilot on board for a familiarization flight on November 10, 2017.

The trainees (including the Pilot) and the Instructor assembled the glider to use for the training from the early morning on the day and confirmed there was no abnormality on the Glider. After that, the Instructor got on board a multi-seater glider (ASK-21) together to confirm the competency of the Pilot and confirmed how she launched and climbed by winch launching, turned, flied the traffic pattern, and landed. Then upon discussion with the chief instructor, who was an instructor certified by the League, the Instructor judged that the Pilot was able to fly in the Glider.

The Pilot had not flown the Glider for more than eight months and therefore underwent ground-based familiarization training (i.e. image training) of the normal procedure from take-off to landing in the seat while remembering past advice and warnings before the flight. However, no confirmation was made on the emergency response procedure in case that the towline breaks. The Pilot had knowledge that the Glider, which has a higher glide ratio, reacts more sensitively to a lift produced by a change in the pitch attitude when compared to a multi-seater glider.

The Pilot considered that when a launch is begun in the normal procedure, if the nose is raised too soon or too steeply immediately after the lift-off, the airspeed will rapidly drop in case of breakage of the towline, which makes emergency response difficult. Accordingly, the Pilot tried to keep the nose in a slightly low attitude.



Photo 1: A glider immediately after a normal lift-off

Under normal conditions, after the lift-off, the nose starts to rise spontaneously while a glider is accelerating, and then a glider transitions to a climb attitude while the Pilot feels a towing power of the winch. At that

time, however, she did not feel such a sensation in her body. The Pilot thought that the towing power of the winch might be too weak to attain enough speed and checked the airspeed indicator. Then she found the airspeed was 110 to 120km/h, which exceeded the normal climbing speed of 100km/h, and therefore judged that it was not due to an abnormality in the winch. However, the Pilot hesitated to raise the nose in order to transition to the climb attitude while feeling such a sense of incongruity that she did not feel the nose starting to rise spontaneously, and therefore attempted to be released from the towline and execute landing.

The Pilot felt uneasy when pulling the release handle since she had no experience in releasing the towline at a low altitude.

She established a gliding attitude to execute landing and checked the airspeed, which showed about 120km/h. At that time, the Glider went slightly toward the right, heading to a slightly elevated play ground, hence the Pilot changed the course to the left in confusion, trying to land at the area between the winch and trees along the riverbank, which seemed to have a longer length. The Pilot received instructions telling her to calm down via radio, but could not hear anything else. At this time, the Pilot did not hit upon an idea to open the air brakes*¹, but controlled the pitch attitude to land without opening them, which resulted in overcontrol and the Glider started pitching up and down just like porpoising*². The Glider touched the ground during the second pitching motion and touched down hard at the third movement. The Pilot remembers nothing after that. When she next woke she found herself hanging by the shoulder harness from the upside-down Glider.

The Instructor, who stayed near the launch starting point, confirmed that the Glider lifted off normally at about 9:21 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock). After that, the instructor, however, found that it did not transition smoothly to a normal climb attitude but kept the nose low, therefore instructed via radio to raise the nose further. Nevertheless, the situation did not change, and furthermore, the towline loosened, hence the Instructor instructed to release it. At that time, its altitude appeared to be about 30 m Above Ground Level (hereinafter referred to as "AGL"). The Glider appeared to be released from the towline, but to incline to the right without opening the air brakes despite the fast speed, and then conversely to make a left bank angle of about 35 degrees. If this situation continued, the landing distance would be longer and, moreover, if the Pilot tried landing in such a situation, she would overcontrol and would be hard to control the Glider. After instructing her to calm down, the Instructor instructed her for

*¹ "Air brakes" are plates stowed in the wings, which extend upward and their extension gradually increases as the control lever is moved in the direction of extension. When extended, the air brakes increase the air resistance on the aircraft while reducing lift, thus decreasing the glide ratio. The "dive brake" is equal to the airbrake of the Aircraft. In this report, the term "air brake," which is used in the Airworthiness standards, is used.

*² "Porpoising" refers to a situation where an aircraft repeats a cycle of touchdown and re-lifting, just like a porpoise jumping up and down on the sea surface, caused by inadequate corrective action taken by the pilot in the case the aircraft touches down with a higher descent rate and a lower nose attitude than normal and bounces.

several times to open the air brakes. However, the Pilot did not appear to open the air brakes, judging from how the Glider flew.

The Winch man saw the Glider climbing little with a very shallow pitch attitude after the lift-off. Soon the Glider appeared to overtake the towline. Upon seeing the Glider releasing the towline with nose-down, the Winch man applied the brakes of the winch and stopped retrieving the tow line. After that, the Winch man saw the Glider approaching toward the winch while pitching up and down, therefore withdrew behind the winch. The Glider once appeared to touch down about 20 m short of the winch, and then a bang was heard. The Winch man found the Glider rolled over with its right main wing broken and stopped upside-down at a point about 50 m across the winch.

Several people gathered at the crash site, lifted the Glider together, and pulled the Pilot out of it.

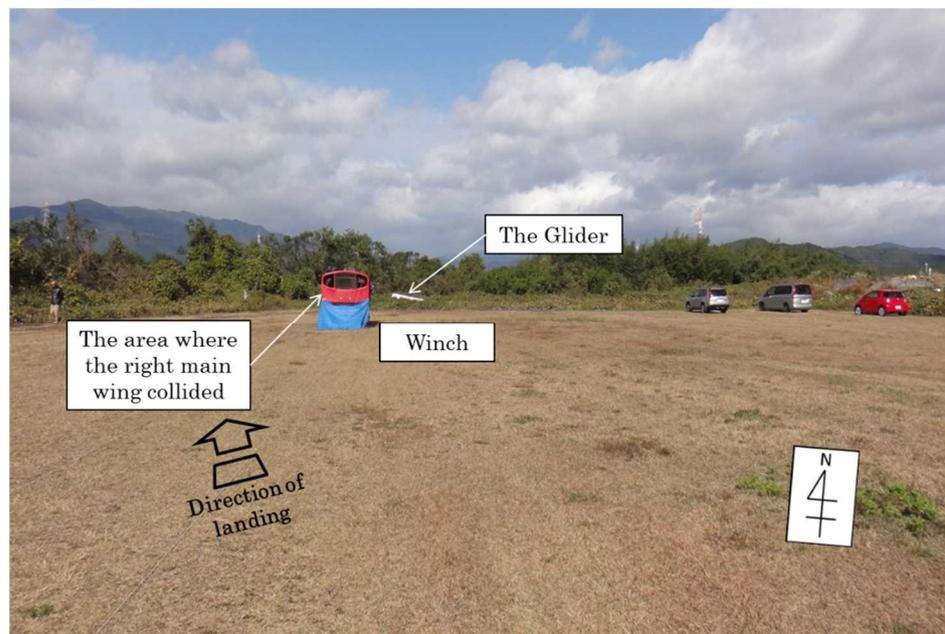
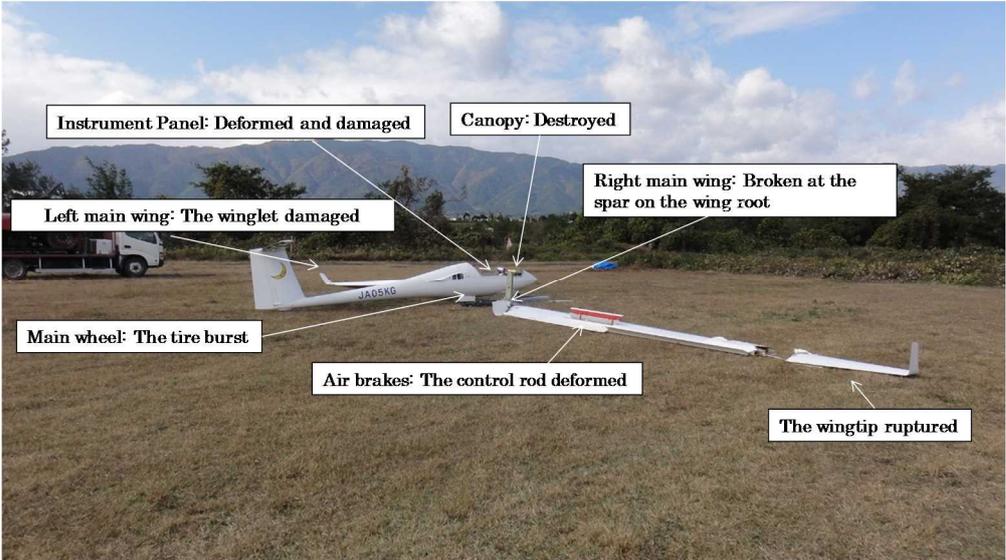


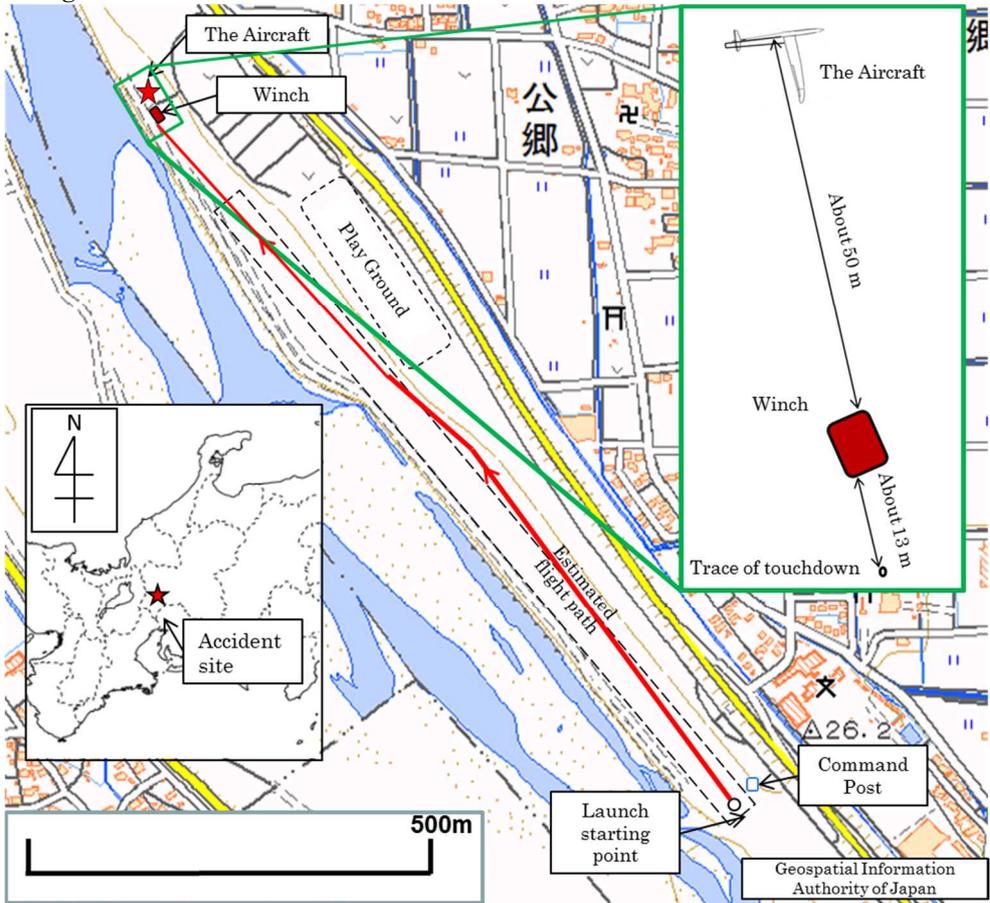
Photo 2: The winch and The Glider (The vehicles on the right side parked at the time of the accident investigation.)



Photo 3: The Glider after the accident

This accident occurred at grassland about 200 m northwest of the runway departure end of the Ono Gliding Field, Ono-cho, Ibi-gun, Gifu Prefecture (Latitude 35°27'18"N, Longitude 136°35'49"E) at about 9:21 on

	November 10, 2017. (Refer to Figure 1: Accident Site Layout)	
2.2 Injuries to Persons	None	
2.3 Damage to Aircraft	<p>Extent of the damage on the Glider: Destroyed</p> <p>(1) Nose Instrument Panel: Deformed and damaged Canopy: Destroyed</p> <p>(2) Fuselage Main wheel: The tire burst Right main wing: Broken at the spar on the wing root and ruptured at about 1.5 m from the wingtip Air brakes: The control rod deformed Left main wing: The winglet damaged</p>	
		
	Photo 4: Damage of the Glider	
2.4 Personnel Information	<p>The Pilot: Female, Age 22</p> <p>Private pilot certificate (Glider) August 25, 2016</p> <p>Specific pilot competence certificate</p> <p>Expiration date of piloting capable period August 25, 2018</p> <p>Type rating for High-class glider</p> <p>Class 2 aviation medical certificate Validity: September 26, 2021</p> <p>Total flight hours (Number of launches) 28 hrs. 16 min. (196 launches, including 64 solo flights)</p> <p>Flight time in the last 30 days 1 hr. 41 min. (13 launches, including 3 solo flights)</p> <p>Total flight time on the type of aircraft (Number of launches) 29 min. (6 launches)</p> <p>The last flight February 27, 2017</p>	
2.5 Aircraft Information	<p>(1) Type: Schempp-Hirth Discus V.L. Discus CS</p> <p>Serial Number: 280CS</p> <p>Date of Manufacture: December 14, 2000</p>	

	<p>Certificate of airworthiness Validity Total flight time</p> <p style="text-align: right;">No. 2017-35-11 May 7, 2018 1,403 hrs. 41 min.</p> <p>(2) At the time of the accident, both the weight and the position of the center of gravity of the Glider were within the allowable ranges.</p>
<p>2.6 Meteorological Information</p>	<p>The weather of the gliding field at the time of the accident (according to an oral statement of the Instructor)</p> <p>Wind calm, Visibility more than 10km, 5/8 Altostratus height unknown</p>
<p>2.7 Accident Site</p>	<p>The right main wing of the Glider collided with the right front area of the winch at about 1.2m high, which stood at about 150 m outside of the end of the runway 33 (length: about 1,000 m, width: about 60 m) of the gliding field, and then stopped upside-down with its nose facing the east at grassland about 50 m northwest of the crash site. The right main wing was bent at the root toward the direction of the fuselage and got caught under the body of the Glider.</p> <p>The tip of the towline fell down at almost the halfway point of the runway. At the point of 13 m before the winch, a trace of touchdown was left which suggests the main wheel scooped out the soil. While there was almost no room for the Glider, whose width is about 15 m, to pass through at the left (west) of the winch, the width of the grassland at the right (east) side was enough.</p>  <p style="text-align: center;">Figure 1: Accident Site Layout</p>
<p>2.8 Additional</p>	<p>(1) The launch Procedures and Pilot Induced Oscillations</p>

Information

Regarding the launch procedures of gliders including winch launching and The Pilot Induced Oscillation (hereinafter referred to as PIO*³), U.S. Department of Transportation FEDERAL AVIATION ADMINISTRATION Flight Standard Service “GLIDER FLYING HANDBOOK” 2013, pp.7-16, 7-17, 8-2, 8-6 contain the followings: (Abstract)

(i) Establishing a climb attitude

a. (Figure 2, position A) The glider pilot should track the runway centerline and monitor the airspeed. When the glider accelerates and attains lift-off speed, the glider pilot eases the glider off the ground. After the initial lift-off, the pilot should raise the nose to the proper pitch attitude, watching for an increase in airspeed. If the nose is raised too soon or too steeply, the pitch attitude is excessive while the glider is still at low altitude. If the launching mechanism loses power or other troubles happen, release and recovery will become difficult.

Conversely, if the nose is raised too slowly, the glider may gain excessive airspeed and may exceed the maximum ground launch tow speed. The shallow climb will result in the glider not attaining planned release altitude. If this situation occurs, the pilot should pull the release and land straight ahead, avoiding any obstacles and equipment.

b. (Figure 2, position B) The pilot should ease the nose up gradually. While monitoring the airspeed to ensure that it is adequate for launch but does not exceed the maximum permitted ground launch tow airspeed.

c. (Figure 2, position C) When optimum pitch attitude for climb is attained, the glider should be approximately 200 feet AGL. The pilot must monitor the airspeed during this phase of the climb-out to ensure the airspeed is adequate to provide a safe margin above stall speed but below the maximum ground launch airspeed.

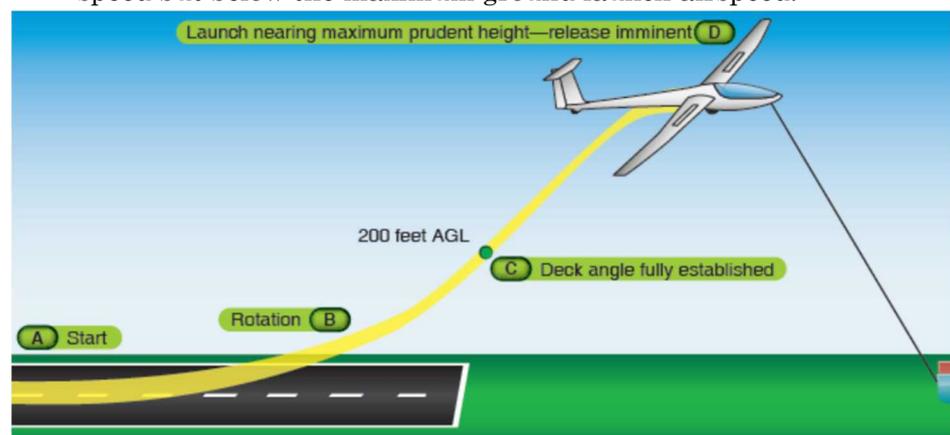


Figure 2: Ground launch takeoff profile

(ii) Pilot-Induced Pitch Oscillations During Landing

The instability of a glider’s attitude that arises when the pilot fails to recognize the lag time inherent in controlling the glider is known as a pilot-induced oscillation (PIO.) Although PIOs can occur at any time,

*³ “PIO” refers to an unstable situation where periodic oscillation of an aircraft induced by repeated overcontrol by the pilot does not be resolved.

these situations arise most commonly during primary training.

A pilot can cause a PIOs by overcontrolling the elevator during the flare, causing the glider to balloon well above the landing surface even as airspeed is decreasing. If the pilot reacts by pushing the stick well forward, the glider will quickly dive for the ground with a fairly rapid rate of descent. If the pilot pulls the control stick back to arrest this descent while still in possession of considerable airspeed, the glider balloons again and the PIO cycle continues.*4

(2) Instructions about response in case of releasing the towline at a low altitude

The theoretical manuals provided by the League include the following instructions about response in case of releasing the towline at 50 m or less AGL. (Abstract)

The pilot should smoothly establish a gliding attitude and release the towline. After confirming that an adequate approach speed is obtained, use the air brakes and land straight ahead.

(3) Training (normal/emergency procedures) of the Pilot

The League provides training for certification as a Private Pilot (Glider) based on the standard training items (training syllabus) as well as training for participants in inter-university competitions for those who have obtained the certificate. Emergency procedures training, such as responding to towline breakage, is given during the training course for certification as a Private Pilot both in classroom and flight training. Intensive training is given especially before the first solo flight and practical examination for the Pilot certificate.

After the Pilot finished the training prescribed by the League, she took a check ride for a pilot conducted by the Ministry of Land, Infrastructure, Transport and Tourism, Civil Aviation Bureau, in August 2016 and obtained a Private pilot certificate. After that, she underwent training for competitions, including six flight trainings with the Glider in February. Immediately before the accident, the Pilot participated in a competition held from October 31 to November 5, and flew 10 times in a multi-seater glider (ASK-21) and twice in a single-seater glider (ASK-23), which has almost the same performance as a multi-seater glider. On the day of the accident, she was planned to undergo familiarization training to the Glider, which she had not flown for more than 8 months, preparing for the next competition.

Record of the emergency (towline breakage) procedures trainings are as follows:

- (i) Classroom training: Instructions about procedures for each release altitude, including usage of air brakes

Once in August 2015 and once in August 2016

- (ii) Flight training: Instructions about how to release and land assuming tow breakage before a normal release.

4 times in August 2015 and once in August 2016

*4. "To balloon" or "ballooning" refers to a situation where the pilot overcontrol the flare, which lifts a diving glider, causing an increase in the altitude.

The release altitude was about 300 m, which is a little lower than the normal release altitude of about 500 m, hence she did not experience flight training at a low altitude.

(4) Performance of the Glider and multi-seater gliders

The Glider is a high performance single-seater glider with a far greater maximum glide ratio (hereinafter referred to as “a High Performance Single Seater”), for which the regulations of the Airworthiness standards require the glide ratio of 7:1 or less when the air brakes are open during the approach, which is the same ratio as multi-seater gliders. If a pilot attempts to land without using the air brakes, due to a great change in the lift induced by a change in the pitch attitude (the angle of attack), overcontrol generally tends to occur during flare to respond to settling of a glider before touchdown.

(i) Multi-seater glider: ASK-21

Maximum glide ratio 34:1

Recommended towing speed:
about 100 km/h

Recommended approaching
speed: about 90 km/h

Glide ratio during approach: less
than 7:1

(air brakes open)

Stalling speed: about 75 km/h

(ii) The Glider: Discus CS

Maximum glide ratio 42.5:1

Recommended towing speed:
about 100 km/h

Recommended approaching
speed: about 95 km/h

Glide ratio during approach: 5.5:1

(air brakes open)

Stalling speed: about 70 km/h



Photo 5: A multi-seater glider



Photo 6: The Aircraft

3. ANALYSIS

3.1 Involvement of Weather	None
3.2 Involvement of Pilot	Yes
3.3 Involvement of Glider	None
3.4 Analysis of Findings	<p>(1) Situation from abort to accident</p> <p>It is probable that the Glider began launching by winch launching, but could not raise the nose sufficiently in accordance with the climbing altitude and could not climb normally, therefore attempted to be released from the towline and to land at a point about 30 m AGL and about 600 m before the runway end with an about 120 km/h of airspeed.</p> <p>After that, it is probable that the Glider transitioned to a gliding attitude for landing, but a pitching motion occurred, and with such a continuous motion, it repeatedly bounced while approaching to the winch, and then its right main wing collided with the winch.</p> <p>It is probable that the Glider rolled over to the right due to the impact force produced by the crash with the winch as well as a decrease of the lift induced by the breakage and separation of the right main wingtip, and then the right main wing root was broken due to the impact of touchdown of the right main wing. After that, it is probable that the parts of the Glider, except the right main wing, were damaged due to the impact force produced when the Glider stopped upside-down.</p> <p>(2) Judgment and action taken by the Pilot</p> <p>(i) It is probable that the Pilot was mindful at a launch to avoid an excessive nose up during acceleration immediately after the lift-off and therefore tended to push the control stick.</p> <p>It is probable that since the Pilot was inexperienced in flight with the Glider, which is a High Performance Single Seater, and she did not fly recently, she controlled in such a way, which produced a greater effect to lower the nose than she thought and made the nose attitude of the Glider far lower than the normal climb attitude.</p> <p>It is probable that though the Pilot felt a sense of incongruity when the nose did not rise spontaneously as the Glider accelerated, she did not think it was caused by her own control, but judged that she would not be able to raise the nose sufficiently in accordance with the climbing altitude and attempted to be released from the towline and to land.</p> <p>(ii) Judging from the training she has taken in the past, it is probable that the Pilot had knowledge on the response and procedure after release at a low altitude. However, it is probable that since the Pilot did not experience a flight training simulating such a situation, or confirm the emergency procedure in case of towline breakage during the familiarization training in the seat conducted by the Pilot</p>

immediately before the flight, the Pilot did not hit upon any response procedure including use of the air brakes when the Glider was released at a low altitude and panicked. It is probable that, therefore, the Pilot could not make a calm judgment, and went toward the left side of the winch with a narrow clearance, not toward the right side with a large space. In addition, it is probable that in her panic, the Pilot could not hear the instructions given by the Instructor for several times to open the air brakes.

(iii) It is probable that the Pilot could not appropriately control the approaching angle and speed since she did not open the air brakes during landing after aborting the launch, and the flare and other controls by the Pilot were overcontrolled, causing PIOs and making the Glider difficult to control, which caused the right main wing to collide with the winch.

If the Pilot had landed with a normal approaching angle using the air brakes, it is somewhat likely that the Glider would have stopped before the runway end.

(3) Training by the League

In this accident, it is probable that the Pilot could not respond to an emergency since the Pilot did not experience flight training simulating release in a low altitude or confirm the emergency procedure during the familiarization training in the seat, therefore the League needs to consider the way of such training. In addition, it is probable that the cause why the Glider did not establish a normal climb attitude is associated with an absence from manipulation of a High Performance Single Seater for a certain period, therefore it is desirable to reconsider requirements to fly a High Performance Single Seater, such as latest flight experience.

(4) Prevention of similar accidents

Generally, in order to prevent accidents during the initial lift-off (at a low altitude) in a launch by winch launching, the following measures shall be considered:

(i) Prior education

It should ensure that pilots learn and acquire knowledge on the flight characteristics during winch launching, lessons from accidents, and emergency response procedures.

(ii) Flight training

Pilots should experience flight training simulating emergencies at low altitude in order that they can respond to such emergencies calmly.

(iii) Confirmation before a flight

Pilots should undergo familiarization training in the seat and reconfirm both normal and emergency procedures before flights in order that they can handle without being confused.

4. PROBABLE CAUSES

In this accident, it is probable that since the Glider became difficult to control after aborting the winch launching and landing was attempted, the right main wing collided with the winch, and then the Glider was damaged due to the impact force produced when it stopped upside-down.

It is probable that the cause why the Glider became difficult to control is that the Pilot could not appropriately control the approaching angle and speed since she did not open the air brakes, and then the flare and other controls by the Pilot were overcontrolled and it caused PIOs (Pilot-Induced Oscillations) .

5. SAFETY ACTIONS

The League decided to take following actions to prevent similar accidents.

(1) Standards to fly High Performance Single Seaters will be newly set. (The standards will be applied mutatis mutandis to other kinds of single-seater gliders.)

(i) Classroom lectures

They will make trainees understand the flight manual, characteristics of aircrafts, and accident cases of High Performance Single Seaters.

(ii) Flight training

They will make trainees undergo training simulating release at a low altitude (i.e. approaching with the air brakes closed, using the air brakes before touchdown and performing touchdown) with multi-seater gliders.

(iii) Confirming the competency immediately before a flight (for the first flight or with 90 days or more of absence from flight)

Two or more league instructors will confirm the competency of the pilot using a multi-seater glider.

(iv) Practical lecture immediately before a flight at the pilot's seat on the ground

The pilot will adjust the seat position, confirm instructions about operations of instruments and various equipment and confirm procedures in case of aborting towing and other emergencies.

(2) Classroom training on winch launching and flight training during towing (Tokai and Kansai districts): Will perform before a flight in a single-seater glider

(i) Training on safe winch launching and accident cases during towing

(ii) Flight training simulating emergencies during winch launching