

JTSTB Digests

JTSTB (Japan Transport Safety Board)

(Issued in February 2017)

Digest of Aircraft Accident Analyses For prevention of Accidents Involving Private Small Aircraft and Gliders

1. Preface	1
2. Statistics on Accident Occurrence	2
3. Case Studies of Accidents (four cases)	4
4. Interviews	16
5. Conclusion (For prevention of accidents involving private small aircraft and gliders)	20

1. Preface

Out of 176 aircraft accidents that occurred between 2006 and 2015 and were placed under investigations by the former Aircraft and Railway Accidents Investigation Commission and the Japan Transport Safety Board, 65 cases (approx. 40%)(*1) were accidents involving small aircraft operated for non-business purposes, and owned and flown by individuals, or operated by groups of aircraft lovers, etc. (hereinafter in this issue referred to as "private small aircraft") and gliders.(*2)

The number of accidents involving private small aircraft and gliders has been rising, though it has shown temporary decreases occasionally (see Fig. 1).

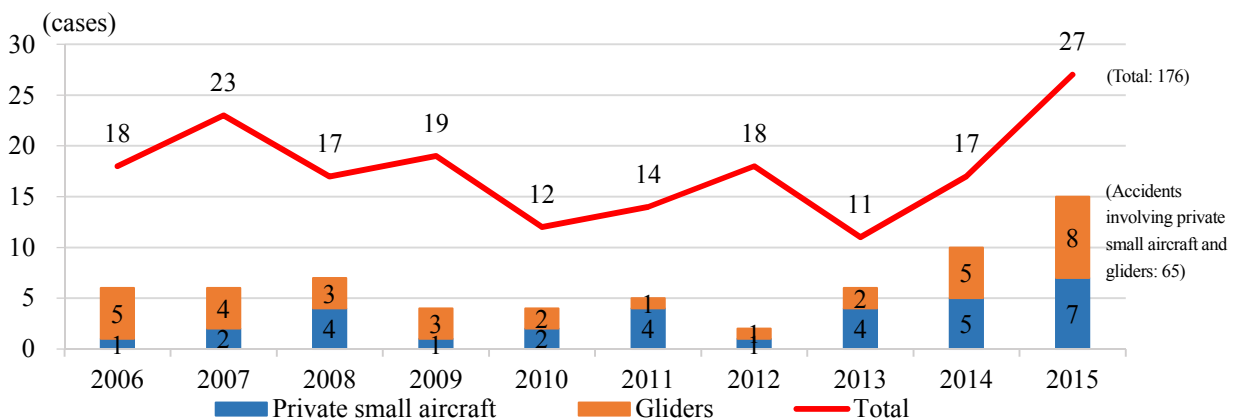


Fig. 1 Changes in the number of aircraft accidents between 2006 and 2015

In light of such circumstances, for the purpose of preventing the reoccurrence of similar aircraft accidents and mitigating damage, this report compiles the tendency of accidents involving private small aircraft and gliders, which was revealed through investigations, and introduces some investigated cases.

We also had interviews with the Japan Flying Association (JFA) and Aircraft Owners and Pilots Association (AOPA-Japan), which hold many private pilots as their members and have been working to prevent aircraft accidents, concerning their related activities and challenges.

(*1) Analysis targets are the aircraft accidents as follows (aircraft serious incidents are excluded):

Types: Small aircraft (aircraft whose maximum take-off weight is not exceeding 5,700 kilograms; excluding ultralight planes) and gliders

Ownership: Owned and managed by individuals or by aero clubs, etc. under individuals' names

Flight purposes: Non-business purposes

(*2) Gliders in this issue include motor gliders equipped with power units.

2. Statistics on Accident Occurrence

Out of the 65 accidents involving private small aircraft and gliders (31 small aircraft accidents and 34 glider accidents), investigation reports have been publicized for 59 accidents (27 small aircraft accidents and 32 glider accidents).

The following are statistical data for these accidents.

* Fig. 2 to Fig. 7 cover the 59 accidents for which investigation reports have already been publicized. However, as a case of in-flight collision of gliders is included, the number of the involved aircraft is 60 and that of pilots is 60.

Pilots' age

Pilots in their 50s and 60s both numbered 17, while eight were in their 20s, seven in their 40s, and six in their 70s (see Fig. 2).

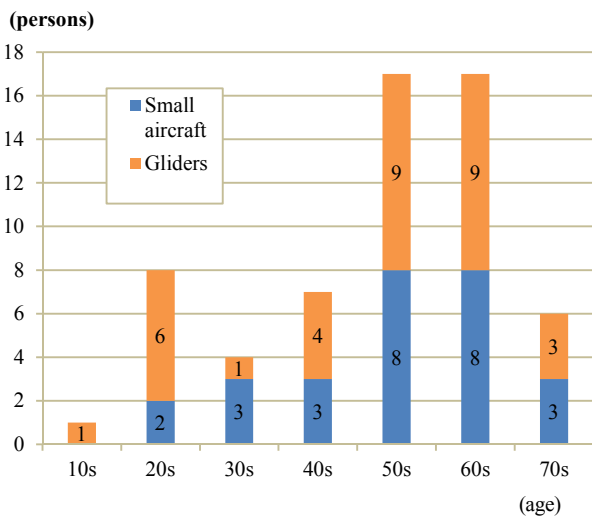


Fig. 2 Pilots' age

Pilots' flight time

The total flight time was 301 to 1000 hours for 22 pilots, 1001 to 3000 hours for 11 pilots, and 101 to 300 hours for ten pilots (see Fig. 3).

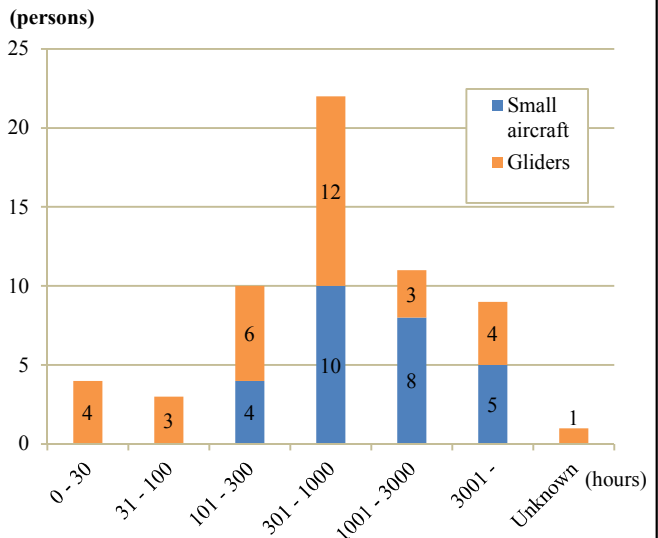


Fig. 3 Pilots' flight time

Flight purposes

Flight purpose at the time of accident occurred was for training or for familiarization for 31 aircraft and for leisure for 18 aircraft. These two purposes accounted for nearly 80% (see Fig. 4).

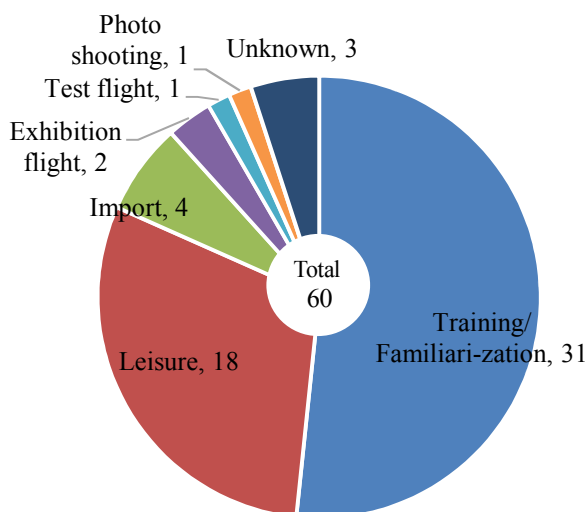


Fig. 4 Flight purposes

Casualties

Out of 131 people on board (the 60 aircraft), 48 were killed or injured. Out of those 48, 12 were killed, 20 were severely injured, and 15 were slightly injured, while 83 were unharmed(*) (see Fig. 5).

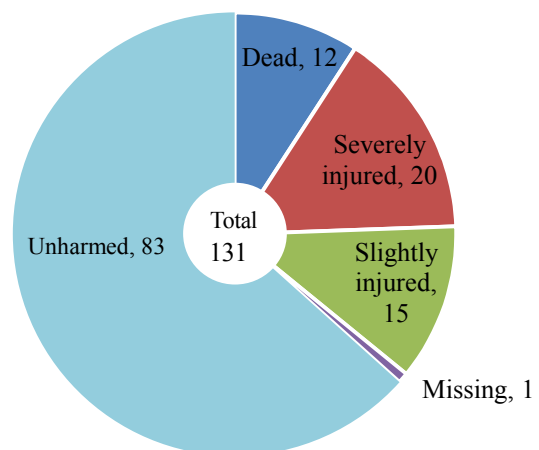


Fig. 5 Casualties among those on board

* A part from the people on board one ground worker killed in an accident

Accidents involving private small aircraft and gliders were mostly caused by human factors

When categorizing causes of accidents stated in investigation reports into human factors, environmental factors and others, 40 accidents were caused by human factors (17 for private small aircraft and 23 for gliders) and 13 by human and environmental factors combined (six for private small aircraft and seven for gliders). All the 59 accidents, except for two private small aircraft accidents, were somewhat related to human factors (see Fig. 6 and Fig. 7).

Human factors mostly occurred while flying, but some occurred before takeoff or otherwise during non-flight times.

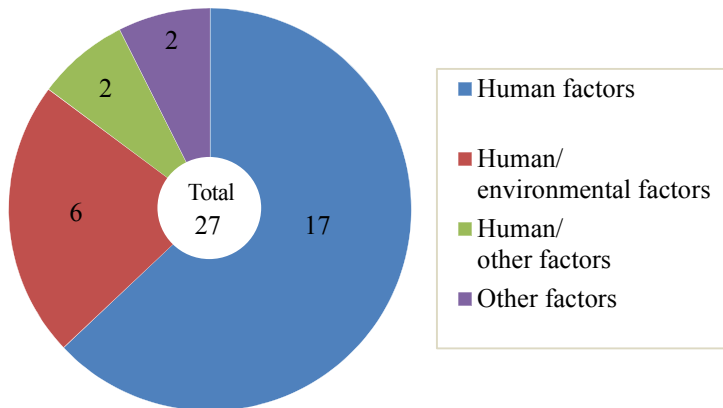


Fig. 6 Private small aircraft accidents by causal factors

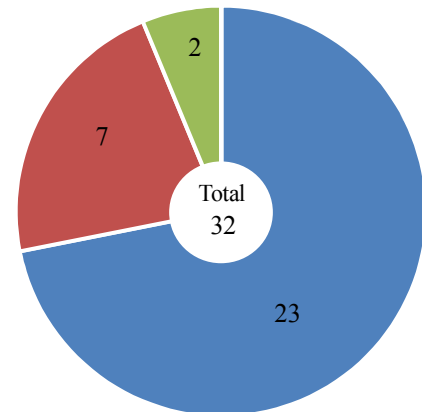


Fig. 7 Glider accidents by causal factors

<Major causes of private small aircraft accidents>

Examples of human factors

- Insufficient nose-up
- Failure to extend the landing gear **Case 4**
- Inappropriate go-around operations
- Overconfidence due to affluent experience
- Failure to properly maintain knowledge and skills
- Engine shut-down due to fuel exhaustion **Case 2**
- Omission of maintenance work prior to flight
- Lack of knowledge on the landform of mountainous areas

Examples of environmental factors

- Turbulence, tail wind
- Flights in cloud, poor visibility

Examples of other factors

- Trouble in the generator during flight
- Fuel exhaustion as a result of the check valve becoming stuck in the closed position due to aging of the valve or the existence of foreign substances
- Cracks in the connecting pipe being affected by corrosive action
- A skydiver's failure to follow basic procedures

<Major causes of glider accidents>

Examples of human factors

- Insufficient nose-up
- Lack of required altitude upon landing and during flight **Cases 1 and 3**
- Inappropriate air brake operation
- Lack of attention to power lines
- Underestimation of the influence of strong cross wind
- Insufficient prior check of weather information
- Flying too close to a mountainside
- Misjudgment on when to return
- Failure to start a motor glider's engine due to fuel exhaustion **Case 1**
- A defect in a motor glider's engine causing an excessively banked turn and a stall
- Inappropriate training and instructions **Case 3**
- Insufficient briefing before the flight
- The towing personnel's suspension of winch towing causing a stall before starting to lower the nose

Examples of environmental factors

- Turbulence, strong cross wind
- Influence of wind gradient

Examples of other factors

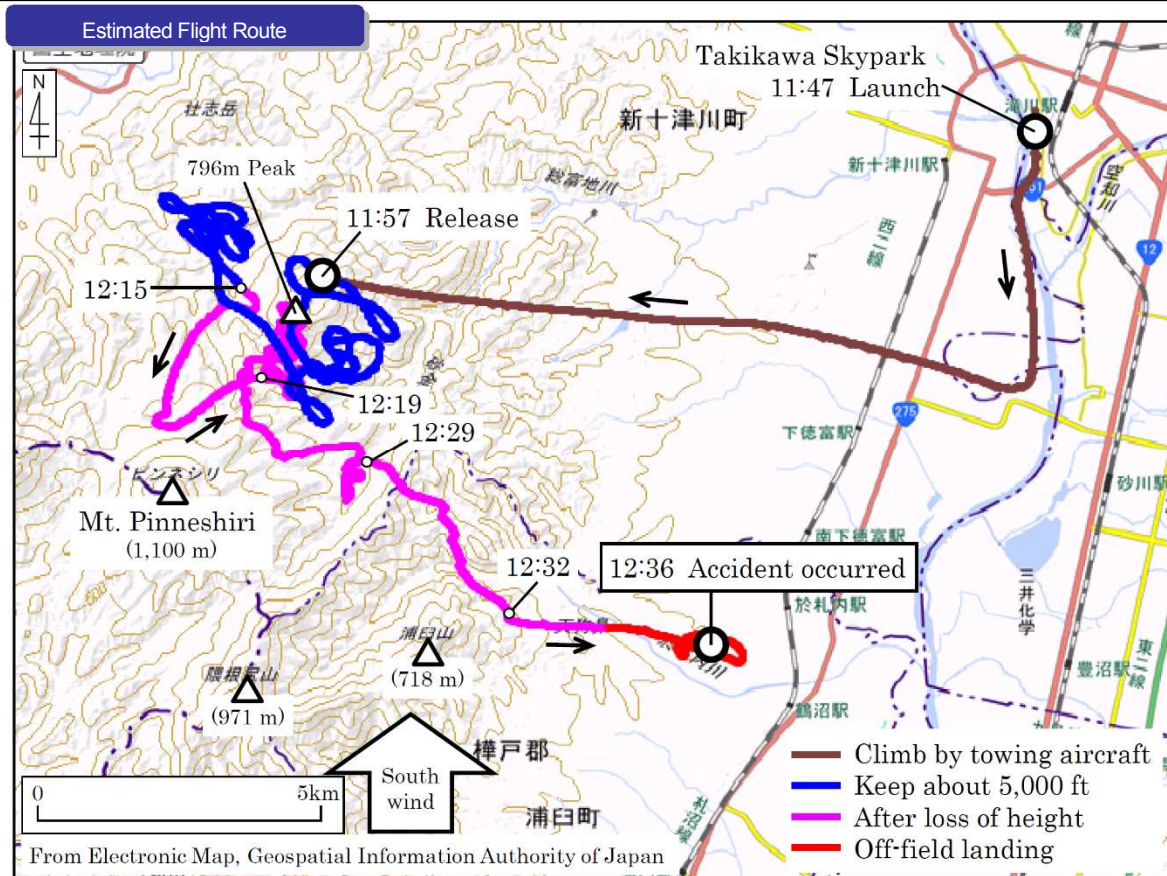
- Break of the towline safety gear

3. Case Studies of Accidents

Case 1 Due to unexpected circumstances (Unable to maintain altitude due to a downdraft and failure to start the engine)

After being released from the towing aircraft, the motor Glider greatly lost height due to failure to start the engine, and finally crashed. (Captain: Age 44, Total flight time: 1,195 hours)

Summary: On Saturday May 30, 2015, a privately owned Schempp-Hirth Discus bT, 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.



Developments Leading to the Accident

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.

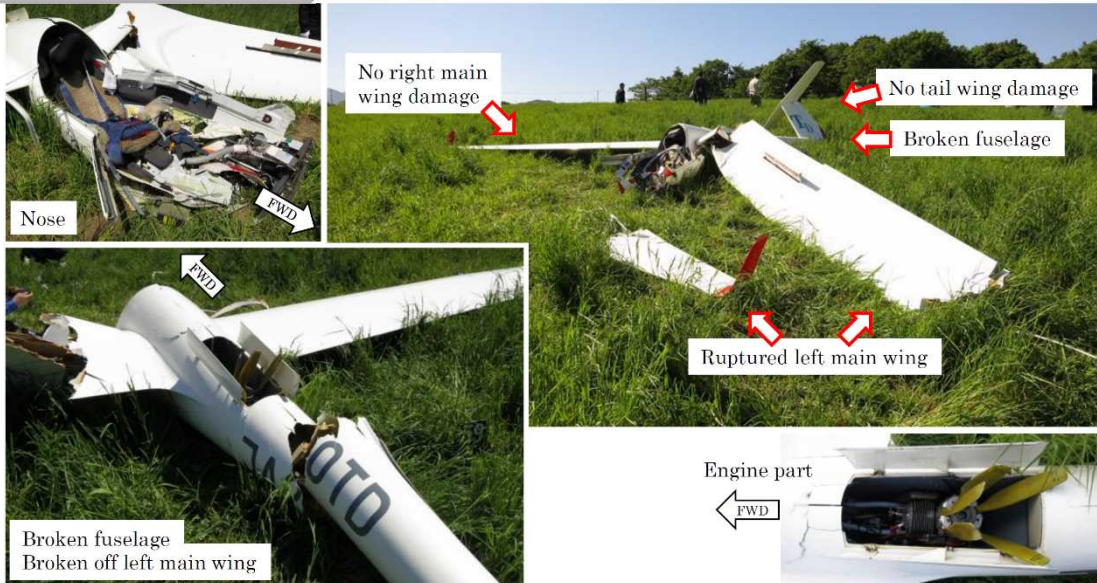
12:32 or later

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

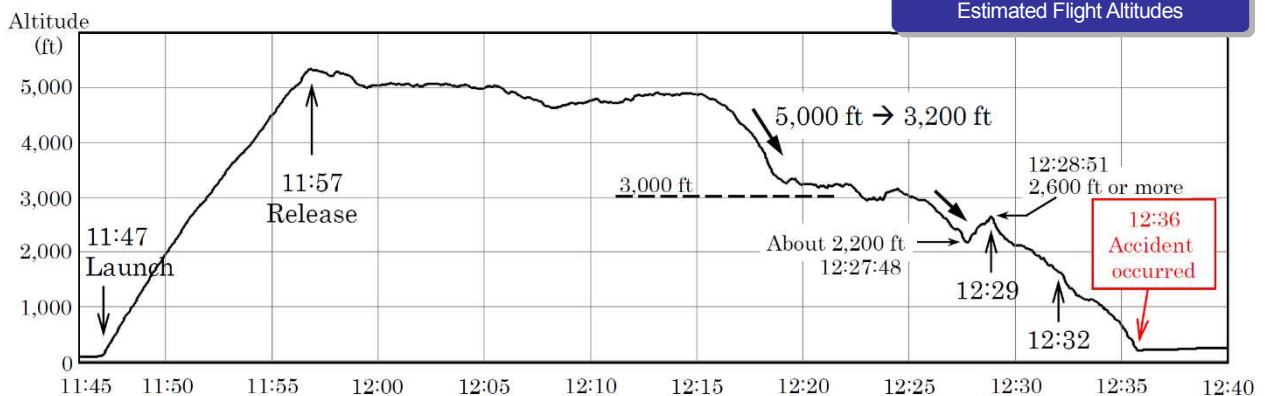
The Glider crashed during the left turning at low altitude.

Detailed Damage Description



Analysis of Causal Factors of the Accident

Situations Leading to the Accident



o Fuel Confirmation before Launching

On May 24, 2015, the captain refueled five liters to the Glider together with the head of the Glider owners, and 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.

It is somewhat likely that the captain launched the Glider without confirming the fuel quantity in the fuel tank.

There were no problems for the flight of the Glider even without the engine.

o Flight after Release

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.

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.

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.

o Attempting to Start Engine

According to the records of the GPS unit and the values calculated from the records (such as climb/descent rates and 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.

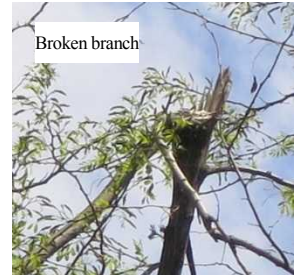


The fuel quantity in the fuel tank was less than the non-usable fuel; therefore, it is highly probable that the engine did not start due to the fuel exhaustion.

o Off-field landing

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.

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.



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.

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:

Confirmation of landing place

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.

Keeping airspeed

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.

Ensuring final approach course and keeping descent angle

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.

○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.

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 investigation report of this case is published on the Board's website (issued on June 30, 2016).

http://www.mlit.go.jp/jtsb/eng-air_report/JA20TD.pdf

Similar accidents (Lack of height)

Date of occurrence	Operator	Category	Pilot's age	Total flight time	Summary of the accident
					Probable causes
March 15, 2013	Private	Glider	58	5,811	<p>The Glider took off from Memanbetsu Airport for a recreational flight to Shikabe Airfield in Shikabe, Kayabe-gun, Hokkaido, and the aircraft went missing during the flight. The Glider was destroyed but there was no outbreak of fire.</p> <p>It is highly probable that this accident occurred when the Glider, flying over the Hidaka Mountains, encountered a downdraft that was blowing down from the ridgeline of the mountains, which made the Glider descend below the altitude needed to safely pass over the ridgeline, and crash into a slope on the mountain; consequently, the aircraft was destroyed, and the pilot and the passenger suffered fatal injuries.</p> <p>It is probable that the reasons that the Aircraft descended below the altitude were that while the Glider decreased its ground speed against the downdraft, the pilot judged that the Glider would be able to maintain the altitude to safely pass over the ridgeline and the Glider began to approach Kyunosawa Valley, where the accident occurred, at an altitude with almost no margin. Along with this, the downdraft became stronger than the pilot had expected and the pilot could not stop descent with the climb performance of the Glider.</p>
March 5, 2014	Private	Small aircraft	76	1,074	<p>The Aircraft took off from Nagoya Airfield and collided with a tower for high voltage power transmission lines. The Aircraft was destroyed and scattered; accordingly, post-crash fire broke out.</p> <p>It is highly probable that the Aircraft collided with the Tower for high voltage power transmission lines set up on the ridge of the hilly area because it flew below the minimum safety altitude while it flew from the Nagoya Airfield towards the Omaezaki area under the visual flight rules.</p> <p>It is somewhat likely that the Aircraft tried to have visual contact with the ground surface by flying below the minimum safety altitude because the visibility was very poor, and cloud was in a low state due to the weather conditions that day.</p>
May 1, 2015	Group	Glider	73	4,711	<p>The Glider took off from Hida Airpark in Takayama City, Gifu, for leisure flight and crashed into a slope ahead when approaching Mt. Norikura.</p> <p>In this accident, it is highly probable that the Glider fell to the altitude preventing the turnaround and could not climb along the gradient when it approached the mountain slope while climbing, so that the Glider collided with the slope.</p> <p>It is probable that it is because the Glider approached the mountain slope too close and did not fly at an altitude sufficient to avoid the downdraft that it fell to the altitude preventing the turnaround.</p>

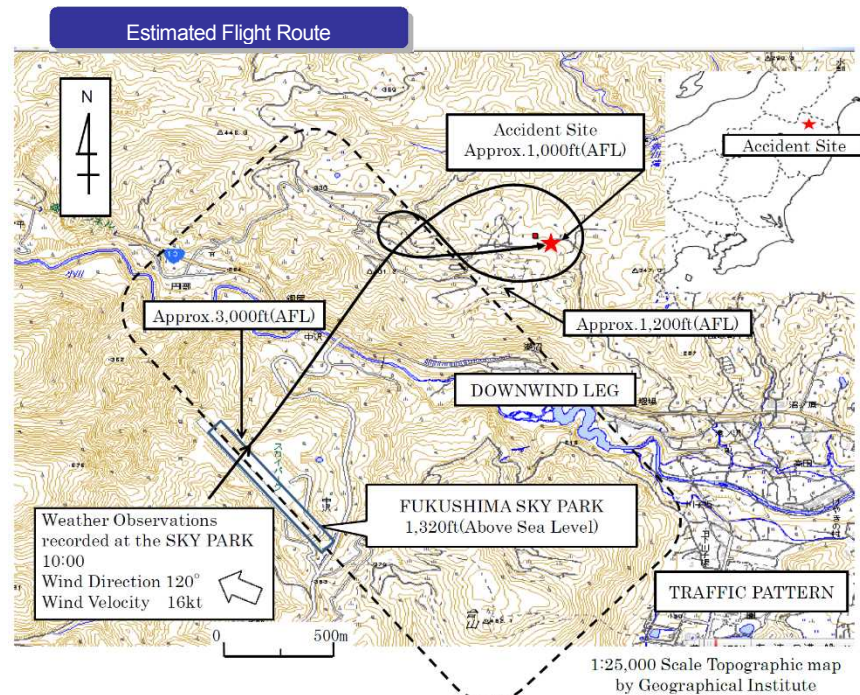
Case 2 Due to fuel exhaustion and insufficient flight planning (Fuel exhaustion)

When returning from a familiarization flight, the Small Aircraft made a forced landing due to fuel exhaustion and was damaged. (Captain: Age 26, Total flight time: 357 hours; Another pilot on board: Age 46, Total flight time: 1,070 hours)

Summary: On Monday May 12, 2014, a privately owned Extra EA300/L, took off from Fukushima Sky Park Temporary Airfield for a familiarization flight. While returning to the Airfield after finishing the familiarization flight, the Aircraft failed to increase the engine power and made a forced landing on a bamboo grass field in Nakanochinai, Iizaka-cho at around 10:16.

The captain got slightly injured and another pilot on board got seriously injured.

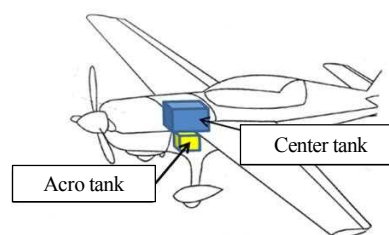
The Aircraft was destroyed but there was no outbreak of fire.



Detailed Damage Description



Fuel Tank



Developments Leading to the Accident

Around 09:42

An aircraft with a center tank and an acro tank having been fully fueled, took off from Fukushima Sky Park Temporary Air Field (hereinafter referred to as "the Sky Park") for familiarization flight with the captain sitting in the rear seat and piloting the aircraft, and the pilot sitting in the front seat.

The pilot performed a series of acrobatic maneuvers called a "sequence." Thereafter, taking over the piloting from the pilot, the captain performed the same sequence. Taking over the piloting from the captain again, the pilot performed the third sequence of the day.

After completing the last sequence, the pilot closed the throttle and headed for the Sky Park while descending.

The captain opened the throttle to increase the engine power for level flight at the downwind leg, but the engine didn't respond.

The captain repeated opening/closing of the throttle several times but the engine power didn't increase. The captain didn't check the fuel quantity indicator at that time.

The captain decided to make a forced landing in a peach orchard, which he found by chance in the mountain area.

Around 10:15

The captain reported to Fukushima Flight Service that they were in a situation of emergency.

Around 10:16

The aircraft flew to the peach orchard while turning left and approached there almost wing level altitude at approximately 3 m above ground level. Having the middle of its left wing collide against an iron pole which stood at the border of a peach orchard and a bamboo grass field, the aircraft made forced landing on a bamboo grass field and came to stop upside down.

Analysis of Causal Factors of the Accident

Remaining fuel

It is highly probable that the aircraft consumed more fuel than that of the captain and the pilot estimated during the three times of sequences.

Since the flight time elapsed more than 30 minutes after takeoff and very little remaining fuel was detected from the acro tank, it is also highly probable that the fuel quantity indicator had read “zero” when the aircraft entered the downwind leg.

The remaining fuel in level flight cannot be used safely when indicator reads “zero”, it is highly probable that the fuel was almost exhausted at that time, thus the aircraft couldn't get the sufficient engine power to return back to the Sky Park.

Endurance and the fuel consumption rate

Endurance under the Pilot's Operating Handbook

The endurance for the full tank (a center tank and an acro tank) is supposed as follows: Approximately 30 minutes with maximum power, approximately 35 minutes with 75% Power, approximately 48 minutes with 65% Power.

Some indeterminate variables such as engine and propeller, air turbulence and others may account for variations as high as 10% or more in range and endurance.

Captains' awareness

The captain estimated the endurance at approximately 33 minutes but he had perceived that there was sufficient time to fly because the maximum power would not always used during the acrobatic flight.

Pilot's awareness

The pilot estimated the endurance at 35 minutes based on his experience.

- It is probable that both of them didn't grasp the fuel consumption rate based on the past fuel consumption results.
- It is highly probable that both of them continued flying without apprehension about fuel exhaustion in spite of that they had flown more than 30 minutes after takeoff.

- The captain should have estimated the endurance using all the available effective information and made the flight plan with sufficient time at least more than 10% of endurance, much more when challenging the new acrobatic maneuver.
- He should have confirmed the remaining fuel by checking the fuel quantity indicator and landed earlier to the Sky Park before the fuel quantity indicator read "ZERO."

Probable causes: It is highly probable that this accident occurred because the aircraft consumed more fuel than the expectation of the captain and the pilot during the sequence, and the Aircraft's fuel was almost exhausted when entering the downwind leg, which made it impossible for the Aircraft to get sufficient engine power to fly back to the Sky Park. As a result, the Aircraft had no choice but to make a forced landing and became damaged. It is probable that the reason of the aircraft consumed more fuel than the expectation and it was almost exhausted was that both of the captain and the pilot didn't grasp the fuel consumption rate based on the past fuel consumption results appropriately and they didn't make the flight plan with sufficient time.

The investigation report of this case is published on the Board's website (issued on July 30, 2015).
http://www.mlit.go.jp/jtsb/eng-air_report/JA111L.pdf

Similar accident: Insufficient preparation (Fuel exhaustion, poor maintenance, etc.)

Date of occurrence	Operator	Category	Pilot's age	Total flight time	Summary of the accident
					Probable causes
July 24, 2011	Private	Small Aircraft	67	1,036	<p>When the Aircraft was taxiing on an apron for flying from Tajima Airfield to Nagoya Airfield, its left main landing gear (L/H MLG) was retracted and the left wing contacted with the ground surface and sustained damage.</p> <p>It is considered highly probable that this accident occurred because the captain and the owner started taxiing the Aircraft without its landing gears down locked, causing the mutual load balance between the landing gear actuators to be loosened and as a result, the L/H MLG to be retracted and the left main wing contacted with the ground surface and sustain damage.</p> <p>As to the fact that the taxiing was started without the landing gears down locked, it is considered that the captain and the owner had not taken the proper measures for maintenance while being aware that the landing gear system did not work properly in the flight just before the accident, and that they had not properly understood the meaning of the situation even though the landing gear position indicator lights were showing the landing gear out of the down lock position in a subsequent pre-flight check.</p>
September 23, 2013	Private	Small Aircraft	47	350	<p>After taking off from Otone Landing Airfield for a sightseeing flight, the engine of the Aircraft, which was flying at an attitude of 1,500ft, suddenly stopped and the Aircraft made a forced landing on a harvested rice field.</p> <p>It is highly probable that this accident occurred due to the check valve mounted between the left fuel tank and the sump tank of the aircraft becoming stuck in the closed position, resulting in the consumption of fuel only from the right fuel tank, leading to an engine stop due to interruption of the fuel supply by depletion of the fuel in the right fuel tank, compelling the making of the emergency landing, and resulting in damage to the aircraft during said emergency landing.</p> <p>It is somewhat likely that the left check valve became stuck in the closed position due to both age-related degradation of the left check valve and the presence of foreign substances, but this could not be determined.</p> <p>It is somewhat likely that misinterpretation of the asymmetrical consumption of the fuel during the preflight check as a temporary and ordinary phenomenon contributed to the accident.</p>
May 30, 2015	Private	Glider	66	659	<p>The Glider was launched from Kirigamine Gliding Field by winch launching for familiarization flight. During launching, the towline broke, and then the Glider to crash.</p> <p>It is probable that the fuses on the towline of the glider broke during launching and the captain tried to perform a turning landing; however, it crashed due to a significantly descent of altitude at low altitude.</p> <p>Regarding the break of fuses, it is highly probable that the low intensity fuses were mounted incorrectly.</p> <p>Regarding the significantly descent of altitude while the glider was circling, it is somewhat likely that the side slip was occurred due to operational unbalance caused by the circling under the insufficient altitude. Moreover, it is somewhat likely that the down draft contributed to the accident.</p>

Case 3 Due to miss judgment of altitude, etc. (Flight training at a low altitude)

Training was continued below the required altitude, causing the Glider to make a hard landing and become damaged. (Instructor (captain): Age 75, Total flight time: 1,279 hours; Trainee: Age 59, Total flight time: 305 hours)

Summary: A Scheibe SF34B, owned by Association A, was damaged during a landing practice on Runway 14 at Nirasaki Gliding Field in Tatsuoka-machi, Nirasaki City, Yamanashi.

Developments Leading to the Accident

The Glider was launched, being aerotowed, from Runway 14 at Nirasaki Gliding Field for flight training with the trainee on the front seat and the instructor (captain) on the rear seat.

Although the trainee tried to fly towards the piste of the Gliding Field at the altitude of about 500 m, the instructor pointed out the start point for approach to the vicinity of piste, and the Glider turned to the left there to adjust the start point and flew towards the piste.

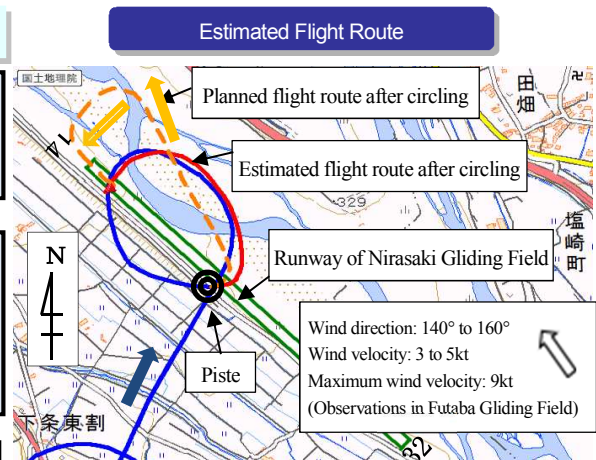
The person in charge of the piste said by radio communication, "Watch your low altitude."

The instructor replied to this, saying "Roger. We make a short approach to runway 14 by left turn from over the field."

Although the trainee felt the difficulty in judging the altitude, he did not voluntarily ask any advice to the instructor. Afterward, when he flew towards the left base of the Runway, he encountered downdraft and felt the loss of altitude.

During circling over the runway, the instructor felt the altitude was lower than usual but did not confirm it by altimeter.

The Glider continued to turn to the left, it could not directly face the Runway and the left main wing tip was brought in contact with the ground in front of the Runway. After bouncing once, the Glider slightly veered the nose to the right, crossed the Runway while skidding sideways, and stopped with the nose directed to the west.



- Extent of damage: Substantially damaged
- Fuselage: Severe distortion, Paint peeling and others
 - Left main wing: Wing Tip breakage, Cracks and others
 - Tail wheel: Recessed into the fuselage

Analysis of Causal Factors of the Accident

Condition of weather

On that day, it is somewhat likely that there was sufficient sunshine, updrafts occurred over the western land of Kamanashi-gawa river, the downdraft occurred over Kamanashi-gawa river.

Situation of the touchdown

After the left main wing tip was brought in contact with the ground in front of the Runway, the tail wheel and main wheel touched down on the ground towards the center line.

- It is probable that sink rate was large in the touchdown of the fuselage.
- It is probable that the front wheel touched down to the ground, veering the nose slightly to the right after the fuselage bounced in its reaction, the Glider crossed the Runway while skidding sideways with the front wheel and main wheel, and it was stopped in the western edge of the Runway with the nose directed to the west.

o The pilots' judgment and control

Instructor


Although the instructor set the altitude of first passing the vicinity of piste at an altitude lower than usual, he did not confirm the altitude by his altimeter when passing the vicinity of piste.

During circling over the runway, he felt the altitude was lower than usual but did not confirm it by his altimeter. Afterward, it is highly probable that the instructor continued the flight without any his comments or advices to the trainee about the altitude until he felt that the altitude was clearly low during the flight to the start point of base turn to the Runway.

Trainee

Although the trainee confirmed that the altitude of first passing the vicinity of piste was about 450 m by his altimeter, he did not check the altimeter in the following flight.

Although the trainee felt the difficulty in judging the altitude in the training subject due to his first implementation of the training subject, he did not ask any advices to the instructor.

- 
- (i) It is highly probable that the instructor and the trainee were aware that the altitude was clearly low and made the left turn to the Runway direction earlier, however the altitude was too low to directly face the Runway, therefore the Glider brought the left main wing tip into contact with the ground in front of the Runway while it was banked to the left and then made the hard landing.
 - (ii) Regarding the fact that the Glider fell below the altitude necessary to continue the training during the training flight, it is somewhat likely that the downdraft which occurred around the Gliding Field was involved.

o Implementation method of training

Instructor

- (i) The instructor needs to sufficiently explain to the trainee the purpose of the training, flight methods, and matters to be noted before the start of training, and have him understand them.
- (ii) Besides, in the flight, the instructor needs to give necessary advices to the trainee, pay attention to the trainee's control, changes in weather and others, and place assurance of flight safety at the top priority without persisting in the implementation of the training subject if there was some doubt whether the training flight should continue.

Trainee

If the trainee felt the difficulty in judging the altitude due to his first implementation of the training subject, he owned a private pilot certificate, therefore it is necessary for him to frankly express questions and concerns while judging by himself, maintain useful communication with the instructor, and share his understanding with regard to not only training effects but assurance of flight safety.

Glider

The altitude judgment of glider is often carried out by visual estimation, therefore it is desirable that the visual estimation be verified by simultaneously using the altimeter for the altitude judgments at the start of training subjects or at the specific points on flight route, then the following flight should be planned.

Probable causes: In this accident, it is highly probable that when the Glider performed landing training which simulated the off-field landing at the Runway, the Glider could not make a stable landing attitude because the training was continued despite the altitude that was below the altitude necessary for the training, therefore the Glider brought the left main wing tip into contact with the ground in front of the Runway, then made the hard landing, and damaged the fuselage.

Regarding the fact that the training was continued below the altitude necessary for the training, it is highly probable that it was because the instructor did not perform appropriate judgment, advices, and control with assurance of flight safety as top priority while the trainee felt the difficulty in judging the altitude. Regarding the fact that the Glider fell below the altitude necessary to continue training, it is somewhat likely that the downdraft which occurred around the Gliding Field was involved.

The investigation report of this case is published on the Board's website (issued on June 30, 2016).

http://www.mlit.go.jp/jtsb/eng-air_report/JA2446.pdf

Similar accident (Forceful flight under bad conditions, etc.)

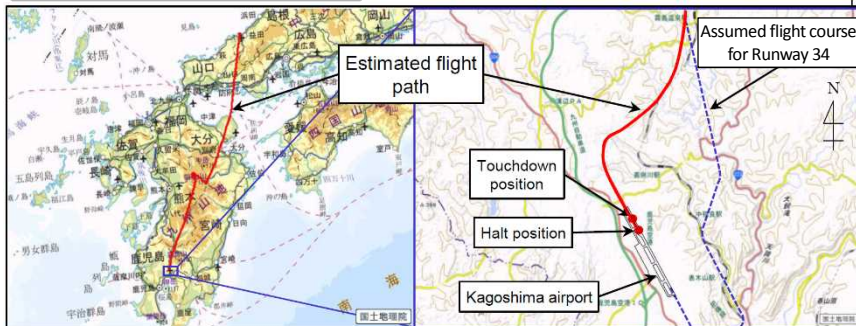
Date of occurrence	Operator	Category	Pilot's age	Total flight time	Summary of the accident
					Probable causes
March 12, 2006	Group	Glider	65	2,466	<p>The Glider took off from Itakura Gliding Field for familiarization with emergency operations and skill confirmation. When approaching the runway of the Gliding Field, the fuselage touched a bush in front of the runway and the Glider landed and became stranded on the runway.</p> <p>It is highly probable that the path was too low upon the final approach to the runway, which caused the fuselage to touch a bush, resulting in damage to the Glider upon landing.</p> <p>Regarding the causes of the path becoming too low, it is somewhat likely that the pilot's failure to accurately ascertain the height of the path due to lack of experience of handling the same type of gliders and taking appropriate measures against tail wind and downdrafts, and a lack of timely advice and assistance from the instructor.</p>
September 1, 2007	Private	Small aircraft	63	1,320	<p>The Aircraft took off from Miyazaki Airport for a recreational flight. During a return flight after flying around to Nichinan, the Aircraft crashed into the sea about 1NM southeast of the Airport.</p> <p>It is highly probable that the Aircraft could not maintain visual flight while flying in a localized heavy rain, under fast-changing weather conditions, and the pilot, in an attempt to escape from the bad weather zone, made a right turn without increasing the engine power although the height was not sufficient, which caused the right main wing to touch the sea surface, triggering the crash.</p> <p>It is probable that the pilot's excessive self-confidence backed by his extensive flight experience in this region, affected his decision to make the flight under fast-changing weather conditions.</p>

Case 4 Due to pilots' assumption and carelessness (forgetting to extend the landing gear)

After a familiarization flight, the Small Aircraft made a belly-landing due to negligence in forgetting to extend the landing gear. (Captain: Age 48, Total flight time: 378 hours)

Summary: A privately owned Cessna 172RG took off from Iwami Airport for a familiarization flight, and made a belly-landing at Kagoshima Airport on Sunday, April 26, 2015. The Aircraft sustained damage.

Estimated Flight Route



Aircraft involved in the accident

Developments Leading to the Accident

The captain confirmed that there were no weather problems, and the Aircraft took off Iwami Airport at 15:39 JST (Japan Standard Time: UTC +9hrs) to return to Kagoshima Airport.

During the flight, the front visibility decreased at the altitude of about 8,500ft on the east of Mt.Asou. The captain considered the visibility was reduced by volcanic smoke because volcanic smoke of Mt.Asou was observed. The Aircraft veered to north-west and climbed. During the climb, the surface of the earth was seen, however, the field of front vision became poor and the Aircraft almost plunged into the volcanic smoke.

The Aircraft started to descend to land at Kagoshima Airport. However, the descent rate was not sufficient. Therefore, the captain extended the landing gear at about 8,500ft and the descent rate increased.

The captain planned to approach the Airport while keeping the landing gear down, but he retracted the landing gear at an altitude of about 3,500ft for increasing airspeed to land at the Aircraft earlier because there was no traffic approaching the Airport.

Before entering the base-leg, the captain monitored another aircraft requested the Kagoshima tower to land on the runway 34 and Kagoshima tower instructed to hold. The captain entered the final from left-base in a rather shortcut move in order to land on as early as possible. During this, he extended flap to 20°.

The captain thought something was wrong because the aircraft did not touch down at the usual altitude of touchdown. Immediately after that, the altitude became smaller than usual and he heard grazing sound of metal. He checked lower outside of the Aircraft and noticed that the landing gear was not extended.

After the Aircraft stopped, he reported the Kagoshima tower of landing without the gear down.

Causal Factors of the Accident

It is probable that the captain forgot the gear once extended was retracted because he felt mentally trapped because he thought the Aircraft plunged into the volcanic smoke during flight and other traffic were waiting for landing, and he did not go through downwind where usually the landing gear was extended because the period before landing got short due to the runway change.

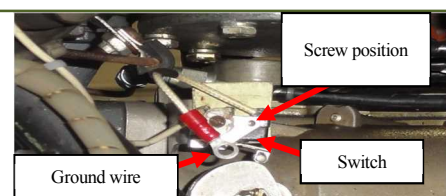
It is probable that he did not securely performed procedures based on the checklist because the captain skipped the gear down item when using the checklist for landing operation*1.

*1 The checklist is not only for secure operation but also for checking the status of the aircraft depending on flight status.

Gear warning

It is probable that the gear warning horn was not sounded even if the throttle was set to idle because the ground wire of the switch for gear warning was came off.

It is probable that the abnormal ground wire could have been noticed if the gear warning had been checked during periodic inspection. If so, it is somewhat likely that the captain noticed that the gear had not extended by the gear warning horn sound.



Video Picture

Picture of the Aircraft landing on the Airport was recorded by the video camera carried on the Aircraft. The shadow of the Aircraft immediately before landing was recorded on the picture. The shadow shows that the landing gear was not extended.



Probable causes: In this accident, it is highly probable that the Aircraft belly landed and the lower part of the Aircraft was damaged because the captain did not extend the landing gear in landing.

It is probable that the captain did not extend the gear because he forgot he retracted the gear once extended and skipped check of the gear down according to the checklist.

Meanwhile, it is somewhat likely that the relatively the captain thought the gear was extended until touch down because the gear warning horn was not sounded.

Safety Actions

- On May 1, 2015, the Japan Civil Aviation Bureau, receiving factual information (about gear warning) from the Japan Transport Safety Board, notified All Japan Air Transport and Service Association Co., Ltd. and Japan Aircraft Pilot Association of making members know the information about the viewpoint of preventing similar aircraft accidents.

The investigation report of this case is published on the Board's website (issued on March 31, 2016).
http://www.mlit.go.jp/jtsb/eng-air_report/JA3857.pdf

Similar accident (Inappropriate operation of landing gear due to carelessness)

Date of occurrence	Operator	Category	Pilot's age	Total flight time	Summary of the accident
					Probable causes
August 23, 2010	Private	Small Aircraft	57	433	<p>The Aircraft took off from Yao Airport for a familiarization flight but made a belly-landing at Kobe Airport, became stranded on the runway and sustained damage.</p> <p>It is highly probable that this accident occurred as the captain forgot to extend the landing gear upon landing, which caused the belly-landing and damage in the fuselage.</p> <p>It is highly probable that the captain considered that he had extended the landing gear. It is somewhat likely that the captain's failure to use the checklist in landing operation is one of the reasons for his wrong assumption.</p>
December 2, 2010	Private	Small Aircraft	62	1,700	<p>The Aircraft made a belly-landing on Runway 12 at Sendai Airport and became stranded.</p> <p>It is highly probable that the landing gear started to be retracted immediately after the Aircraft touched the ground on Runway 12 at Sendai Airport, due to which the fuselage was damaged.</p> <p>It is highly probable that the captain, who thought that he had failed to extend the landing gear, erroneously operated the lever, causing the gear to be retracted.</p>
October 12, 2014	Private	Small Aircraft	72	15,551	<p>The Aircraft made a belly-landing, causing the airframe to be damaged when landing on runway 17 of Chofu Airfield.</p> <p>It is highly probable that this accident occurred while the alternator of the aircraft failed during the flight and it is highly probable that the pilot did not notice this and continued flight with the power of battery only, which caused decreased battery voltage, and in spite of this, the emergency landing gear extension operation was not made and the gears were not down, causing the belly landing, with the airframe damaged.</p> <p>It is probable that an emergency landing gear extension operation was not made because the pilot thought that the gears had already been down with normal operation and the confirmation and the operation of the emergency gear extension procedure described in the Airplane Flight Manual were not appropriately executed.</p>

4. Interviews

We conducted interviews with the Japan Flying Association (JFA) and the Aircraft Owners and Pilots Association (AOPA-JAPAN), to which a number of pilots of private small aircraft and gliders belong as members, concerning their activities and challenges in preventing aircraft accidents involving private small aircraft and gliders.

(1) Japan Flying Association (JFA) (<http://ifa1953.org/>) (Only available in Japanese)

An interview with Mr. Hiroshi Okunuki, Director of the Japan Flying Association

○ Please explain the outline of the Japan Flying Association.

—The Association has engaged in activities with the aim of disseminating knowledge on aviation and promoting technological improvements, thereby contributing to the development of civil aviation and social welfare through the use of aircraft. We issue our association journals and hold lectures and training sessions.

○ In recent years, accidents involving private small aircraft owned and operated by individuals or groups of aircraft lovers are increasing. How does the JFA regard such situation?

—We consider that this is partly because the safety measures being taken by the Ministry of Land, Infrastructure, Transport and Tourism and the content of the accident investigation reports of the Japan Transport Safety Board are not fully disseminated to all the pilots.

One of the reasons is that many people obtain a license in foreign countries recently and have no sufficient “human network” in Japan for flying aircraft.

Japan has unique flying environments with many mountains and few flat plains. Information to secure safe flights in an environment with weather conditions peculiar to mountainous areas must be passed on from person to person.

However, those who obtained a license in foreign countries have no human network to provide them with such important information to fly safely in Japan. If necessary information is not sufficiently disseminated, we are concerned that similar accidents may occur repeatedly. We consider it a challenge how to prevent such situation.

○ What has the JFA been doing to disseminate information among pilots to secure safe flights in Japan?

—Five aviation-related groups including the JFA have established a system to accredit lecturers for Aviation Safety Seminars and have carried out educational activities concerning aviation safety. We think that we should further expand these activities. At the next seminar scheduled in this September, we will select some cases from the investigation reports of the Japan Transport Safety Board and have the participants consider how to react under the same situations. They will first form groups to discuss measures to be taken, then all discuss them together, and the results are to be shared among all participants.

We believe that our efforts to expand these activities and increase participants will facilitate the dissemination of the content of the accident investigation reports and the national government's safety measures, hopefully leading to a decrease of aircraft accidents.

During lectures, participants are made to think deeply about probable causes of past accidents, through which the knowledge is etched into their consciousness to help them understand how to avoid similar accidents.

Rather than having the participants simply read the investigation reports and think themselves about a statement of, for example, “The pilot encountered a downdraft and felt a descent,” have them answer questions, such as “If there is a downdraft, what should you do?” This will enable them to work out appropriate responses to unusual situations during flights. We consider it important to aim to decrease accidents in this manner.

○ What does the JFA consider recently, problematic about recent accidents involving private light aircraft?

— We are concerned about accidents upon taking-off or landing, accidents due to a stall, and the problem of the aging of pilots.

○ Are there any concerns about pilots' experience?

— We think that pilots with certain experience are more dangerous than those with less experience. What counts is the environment in which the person has accumulated experience.

If a pilot, who has encountered a dangerous situation in flight, recognizes it as danger, it would be all right, but some get the wrong idea that their skills have improved. The same experience has different meanings depending on whether the person was scolded or the person is proud of it. We are afraid that those who continue to take a chance of encountering danger and feel no fear will encounter a serious accident in the end.

○ What is important in efforts to decrease accidents involving private small aircraft and gliders?

— Considering people who are going to obtain a license from now on and fly aircraft in Japan, the fundamental principle is that education on the side of instructors is essential.

Instructors need to renew their awareness of the importance of instructing trainees from the entry level in a manner to enable them to work out procedures necessary for safe flights, not limited to teaching them flight skills.

It would be preferable if instructors who have thus been properly educated teach trainees and those trainees disseminate what they have learned to other pilots around them.

Additionally, it would be effective if there were a mechanism to surely disseminate information on accidents and matters to note to many people on such occasions as the Pilot Competency Assessment.

Outline of Pilot Competency Assessment

A person who has a skill certificate for piloting aircraft or supervising flight training is required to take and pass the Specified Flight Skills Examination from April 1, 2014.

- The following acts are prohibited unless the person has passed the examination conducted by a flight skills examiner accredited by the national government.
 - (i) Piloting an aircraft on board
 - (ii) Supervision of flight training of a person without a necessary pilot certificate
 - (iii) Supervision of flight training of a person who has not passed the Pilot Competency Assessment
 - (iv) Supervision of instrument flight training, etc. of a person without a necessary instrument flight certificate
- Flight skills examiners examine the following skills in the Pilot Competency Assessment.
 1. Basic flight skills for all piloting operations
 2. Flight skills in an abnormal situation or emergencies not required in an ordinary flight
 3. Knowledge necessary for flight including the latest knowledge
- This assessment is valid for two years.

See the website of the Ministry of Land, Infrastructure, Transport and Tourism for details.

(http://www.mlit.go.jp/koku/15_bf_000744.html) (Only available in Japanese)

An interview with personnel of AOPA-JAPAN

Mr. Tasuo Nomura, Safety Committee,
Mr. Masakatsu Aoki, Certified Safety Lecturer,
Mr. Hiroyuki Sakuma, Planning Committee,
Ms. Noriko Hatanaka, Secretary General

○ How does the AOPA-JAPAN regard recent accidents involving private small aircraft and gliders?

—Pilots who have caused accidents are relatively old, as the number of young people who enjoy small aircraft is decreasing in Japan.

There are not many airfields nowadays in Japan that private small aircraft can use and private pilots are decreasing due to such unfavorable environment. Young people are no longer interested in owning or leasing aircraft to enjoy piloting. At present, active private pilots are mostly those in their 50s or 60s with some time and money to spare who obtained a license in the past and are really fond of flying aircraft.

—Young pilots are generally eager to be employed by aircraft operating companies and there are only a few who enjoy piloting as a hobby. Aircraft operating companies are said to be short of pilots but only a limited number of pilots are actually employed.

—I obtained a license in a foreign country but have received training from my seniors as there are Japanese ways to fly aircraft in Japan. I am still learning from people around me to increase knowledge even after I came to be able to fly comfortably and I have adopted the rule of making prior confirmation about the weather and the features of the airport and aircraft when I fly to new places.

—We talk about our own experience of piloting private small aircraft at the Safety Seminars held by AOPA-JAPAN or on other occasions. How participants accept our talks is significant.

People who obtain a license in foreign countries have few people to ask for advice.

Those having aircraft in their 50s or 60s, who have high social status with limited people around them who give them advice, are apt to hesitate to ask questions and often lack knowledge.

In Japan, the high cost of flights makes it difficult for people in a private capacity to have sufficient flight experience.

I think if safety seminar participants have more experience before coming to listen to talks of the seniors, it would be more effective for ensuring their safe flights. Such talks may be more deeply rooted in those participants and may be recalled in emergencies.

—My impression is that there might be some cases where pilots who have caused accidents seemed to have no peer pilots. If they had had peers to have hangar talk with about air accidents or exchange opinions, they might not have encountered such accidents.

—Additionally, if new technologies and equipment effective for securing safety that are approved overseas are also approved in Japan earlier, this will facilitate accident prevention.

○ What do you think is important for piloting private small aircraft and what education should be provided?

—Aircraft operating companies have their pilots work in a team and have established their own maintenance systems, but private pilots need to do everything themselves. Therefore, we often tell veteran pilots to go back to the basics. If all pilots fly aircraft as if they were beginners, no accidents would occur.

However, accidents do occur actually. Therefore, we must provide education properly.

—During initial training, trainees learn how to pilot aircraft with non-retractable landing gear, and then they later have chances to experience handling landing gear. The operation of extending and retracting landing gear requires significant basic knowledge, but it is problematic that many trainees do not fully acquire such basic knowledge and actually pilot aircraft with retractable landing gear. They should keep in mind the necessity to receive sufficient education in advance.

Formerly there was no educational opportunity, but now we have the system of the Pilot Competency Assessment which may be an educational opportunity. Enhancing the content of the examination is a challenge for the future.

This system allows pilots to select an assessor, with the aim of encouraging them to select an excellent assessor with whom they can talk during the assessment, thereby facilitating accident prevention.

Aviation Safety Seminars

Aviation Safety Seminars are held by the Skill Maintenance Liaison Meeting jointly formed by the Japan Aircraft Pilot Association, AOPA-JAPAN, Japan Flying Association, Japan Soaring Association, and Helicopter Collective Japan for the purpose of having private pilots acquire knowledge about safety and raising their safety awareness.

At seminars, accredited skill instructors and people in the aviation industry have provided lectures on safety and skill maintenance under such themes as "Current Status of the VOICES," "Prevention of Veteran Pilots' Errors," "Hurry-up Syndromes," and "Methodologies for Maintaining Skills - Effectiveness of Accompanying Licensers on Board."



(Aviation Safety Seminars: photos provided by the Japan Flying Association)

5. Conclusion (for prevention of accidents involving private small aircraft and gliders)

This analysis revealed that among the pilots that caused the targeted accidents, 22 had flight experience for 301 to 1000 hours and 20 had 1001 or more hours of experience. By age, those in their 50s and 60s combined were 34, accounting for nearly 60% of the total.

Pilots with the total flight time of 301 to 1000 hours may have accumulated experience in familiarization flights and recreational flights after obtaining a license and may have become confident in their skills.

On the other hand, the analysis of causal factors shows the involvement of human factors, such as wrong assumptions carelessness and negligence, as well as a gap between perceptions and reality concerning skills, in many of the accidents. There was also a case where a pilot's excessive self-confidence triggered the accident.

In the interviews, some pointed out the importance of cautioning oneself against all dangerous situations instead of taking them lightly. However experienced you may be, you should refrain from dangerous and reckless flights.

Be aware that you may do something careless or make errors at any moment, be sure to conduct periodic checks and prior confirmation, and try to take action as soon as possible instead of ignoring any abnormalities or anxiety you may notice during the flight. Such attitude of each pilot will lead to preventing aircraft accidents.

Lastly, we extend our appreciation to the people from the Japan Flying Association and the AOPA-JAPAN who kindly responded to our interviews and offer our best wishes for their further success.

A Tip from the Director for Analysis, Recommendation and Opinion

This report features the increase in accidents involving private small aircraft and gliders. Accidents are often caused by pilots who have certain flight experience. The interviewees from groups of aircraft lovers all pointed out the fact that those becoming familiar with piloting are more dangerous and emphasized the significance of sharing information and experience among peers instead of becoming overconfident.

If you do not have peers, why don't you participate in safety seminars? Having friends with the same interest will increase your fun and improve flight safety at the same time.

We welcome your comments on "JTSB Digests" and requests for dispatching lecturers

Japan Transport Safety Board (JTSB)

Director for Analysis,

Recommendation and Opinion

2-1-2, Kasumigaseki, Chiyoda-ku

Tokyo, 100-8918, Japan

TEL: +81-3-5253-8824

FAX: +81-3-5253-1680

URL: <http://www.mlit.go.jp/itsb/english.html>

e-mail: hqt-itsb_analysis@ml.mlit.go.jp