

AA2021-2

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**PRIVATELY OWNED
J A 2 5 0 0**

February 18, 2021

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.

TAKEDA Nobuo
Chairperson
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

AIRCRAFT DAMAGE WHEN LANDING PRIVATELY OWNED GLASER-DIRKS DG-500M (MOTOR GLIDER, TWO-SEATER), JA2500 IWAMI AIRPORT AT AROUND 14:46 JST, APRIL 29, 2019

January 22, 2021

Adopted by the Japan Transport Safety Board

Chairperson TAKEDA Nobuo
Member MIYASHITA Toru
Member KAKISHIMA Yoshiko
Member MARUI Yuichi
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE INVESTIGATION

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| 1.1 Summary of the Accident | On Monday, April 29, 2019, a privately owned Glaser-Dirks DG-500M, registered JA2500, attempted to land with its main landing gear remained retracting in gliding condition because the engine was not restarted in flight with a total of two people on board including a pilot and a passenger. Then it hit the ground surface and suffered damage to the airframe. |
| 1.2 Outline of the Accident Investigation | <p>On April 29, 2019, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator on April 29, 2019, to investigate this accident.</p> <p>An accredited representative of the Federal Republic of Germany, as the State of Design and Manufacture of the aircraft involved in the accident, participated in the investigation.</p> <p>Comments were invited from parties relevant to the cause of the accident and the Relevant State.</p> |

2. FACTUAL INFORMATION

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| <p>2.1 History of the Flight</p> | <p>According to the statements of the pilot and the passenger, and records of the cameras to monitor the airport facilities, the history of the flight is summarized as follows.</p> <p>At around 14:25 Japan Standard Time (JST, UTC+9 hours, unless otherwise stated, all times are indicated in JST on a 24-hour clock) on April 29, 2019, a privately owned Glaser-Dirks DG-500M, registered JA2500, with the pilot in the front seat and the passenger in the rear seat, took off using the engine from Runway 29 at Iwami Airport.</p> <p>After taking off, the Aircraft made a left turn to fly to the northeast, then made a 180° turn at an altitude of about 3,000 ft before UOMACHI.</p> <p>When the Aircraft was approaching about 8 km northeast of the Airport, the pilot stopped the engine at an altitude of about 2,500 ft and retracted the engine and propeller into the fuselage to give the passenger experience of gliding flight.</p> <p>When the Aircraft was circling several times over Masuda City, the pilot felt strongly a southerly wind blowing, and thus decided to return to the Airport while starting the engine. After extending the engine and the main landing gear at an altitude of about 1,700 ft and at a speed of about 90 km/h setting the flaps at FLAP+10°, the pilot tried to start the engine twice following procedures in the flight manual. However, the propeller moved twice, about 15° firstly and about 30° secondly, in the rotation direction and stopped leaning about 45° in total. The pilot tried to start the engine again, however, the propeller was not moved, and the engine did not start.</p> <p>While the Aircraft was continuing gliding toward the Airport, the altitude was lowered, therefore the pilot attempted the third engine restart at an altitude of about 1,050 ft about 4 km from the Airport, however, the propeller was not moved in the same way as the second engine restart. The pilot gave up starting the engine thinking that it</p> |
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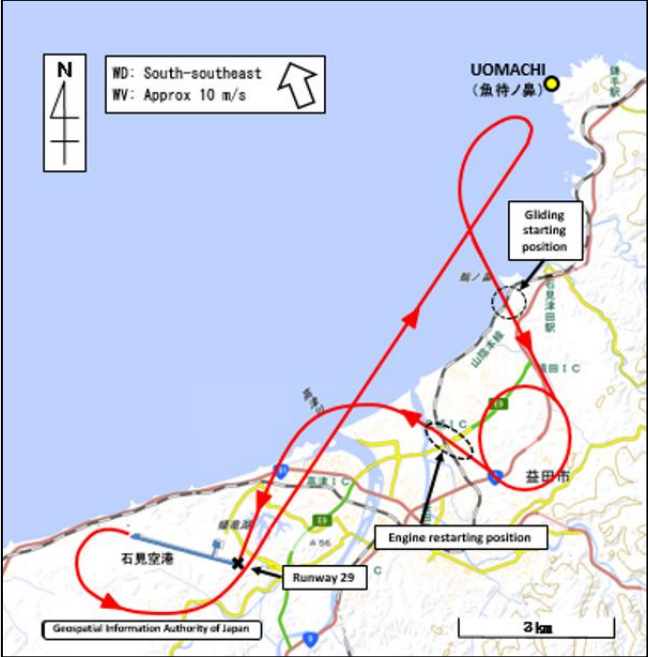


Figure 1: Estimated flight route

would not be able to return to the Airport if the engine would fail to start when trying one more start.

When the pilot tried to retract the engine and the propeller, he could not retract them into the fuselage because the propeller did not move to the retractable position. In order to reduce drag, the pilot tilted the engine backward by using the manual extension/retraction switch to the extent that the propeller would not touch the fuselage and retracted the main landing gear located in the lower fuselage by using the main landing gear handle.

The pilot approached from the base leg on the north side of the Airport in order to land on Runway 29 that was closer, but the south wind was strong and the altitude was lowered gradually, therefore, he felt that he might not be able to reach the Airport. After gaining the airspeed with the nose slightly down, the pilot pitched the nose up to fly as if to clear the guard rail installed along the airport servicing road and entered the Airport.

The pilot was going to land the Aircraft on the grass area on the south side avoiding the runway because the main landing gear remained in the retracted position, however, he made the Aircraft a turn to the right because he was afraid it might depart from the aerodrome after passing over the grass area. At that time, the right wing tip of the Aircraft made contact with the ground

surface firstly, then it hit the ground surface as being rather a falling while spinning to the right and stopped. The pilot hardly felt the impact, however, he found the aft fuselage was fractured after getting out of the cockpit.



Figure 2: Appearance of the extended engine

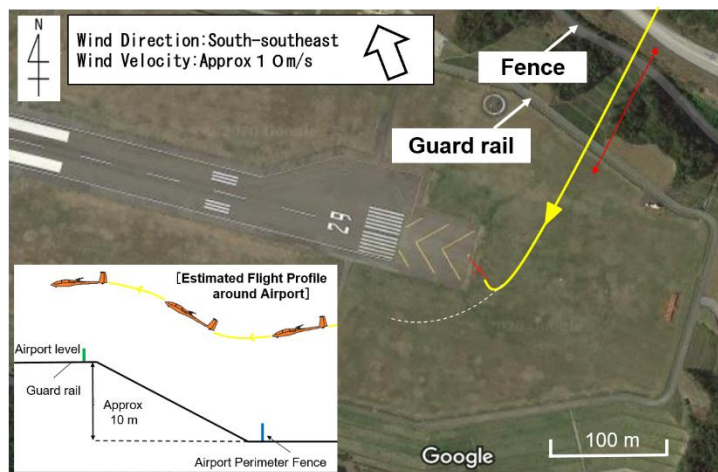


Figure 3: Estimated flight track

| | This accident occurred at around 14:46 on April 29, 2019, in the grass area near Runway 29 threshold at Iwami Airport (Latitude 34°40' 25" N, Longitude 131°48' 05" E). | | | | | | | | | | | | | | | | | | | |
|--------------------------------|---|--|-------------|--|------|----------------------------------|--|-------------|-------|--------------------------|----------|---------|-------|--------------------------|----------|---------|-------|--------------------------|----------|---------|
| 2.2 Injuries to Persons | None | | | | | | | | | | | | | | | | | | | |
| 2.3 Damage to the Aircraft | Extent of damage: Substantially damaged -Aft fuselage: Fractured, Lower fuselage: Scratched -Engine coolant leakage | | | | | | | | | | | | | | | | | | | |
| 2.4 Personnel Information | Pilot: Male, age 63 Private pilot certificate (High class glider) September 10, 1977 (Motor glider) July 26, 2016 Pilot competence assessment Expiry of practicable period for flight September 16, 2020 Flight instructor certificate (Glider) March 28, 1979 Class 2 aviation medical certificate Validity date: August 26, 2019 Total flight time 1,298 hours 10 minutes Flight time in the last 30 days 1 hour 30 minutes Total flight time on the same type of aircraft 102 hours 1 minute Flight time in the last 30 days 1 hour 30 minutes | | | | | | | | | | | | | | | | | | | |
| 2.5 Aircraft Information | (1) Aircraft type: Glaser-Dirks DG-500M Serial number: 5E41M19 Date of manufacture: December 13, 1991 Certificate of airworthiness No. 2018-11-26 Validity: October 24, 2019 Total flight time 418 hours 50 minutes Flight time since last periodical check (Annual check conducted on October 23, 2018) 8 hours 8 minutes (2) Engine type: Rotax 535C Serial number: 3461562 Date of manufacture: September 21, 1990 Total time in service 108 hours 53 minutes (3) When the accident occurred, the weight and the center of gravity of the aircraft were within the allowable ranges. | | | | | | | | | | | | | | | | | | | |
| 2.6 Meteorological Information | The weather observations at the Iwami Aeronautical Weather Observatory (within the Airport) at the time of the accident were as follows: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Time</th> <th style="text-align: left;">Wind direction/ Wind velocity</th> <th style="text-align: left;">Maximum instantaneous wind velocity</th> <th style="text-align: left;">Temperature</th> </tr> </thead> <tbody> <tr> <td>14:30</td> <td>South-Southeast/11.1 m/s</td> <td>15.9 m/s</td> <td>17.8 °C</td> </tr> <tr> <td>14:40</td> <td>South-Southeast/ 9.8 m/s</td> <td>14.9 m/s</td> <td>17.6 °C</td> </tr> <tr> <td>14:50</td> <td>South-Southeast/10.1 m/s</td> <td>15.9 m/s</td> <td>17.3 °C</td> </tr> </tbody> </table> | | | | Time | Wind direction/ Wind velocity | Maximum instantaneous wind velocity | Temperature | 14:30 | South-Southeast/11.1 m/s | 15.9 m/s | 17.8 °C | 14:40 | South-Southeast/ 9.8 m/s | 14.9 m/s | 17.6 °C | 14:50 | South-Southeast/10.1 m/s | 15.9 m/s | 17.3 °C |
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| 2.7 Additional Information | (1) Accident site At the Airport, monitoring TV cameras were installed, which recorded the image when the Aircraft cleared the guard rail installed on the airport servicing road and stopped on the grass area after entering the Airport at a low | | | | | | | | | | | | | | | | | | | |

altitude (about 10 m above ground level).

On the grass area, a contact mark of about 5.4 m length was left in a 240° direction. The Aircraft stopped with its left main wing and tail onto the overrun area short of Runway 29 threshold.

(2) Aircraft Condition

The fuselage was broken behind the engine compartment door, however, the flight control system in the empennage remained connected. There was no damage in the wings, but the soil was stuck to the auxiliary wheel at the right wing tip.

When restarting the engine was tried during the Aircraft examination after the accident, it was found that the operating condition of the primer valve of the fuel system, which is actuated only on engine start, was unstable, but there was no failure in other systems including the starter system.

Besides, there was no leakage of oil and fuel, but coolant leaked out through the radiator line, accumulating in the bottom of the engine compartment.

(3) Maintenance of the Aircraft

After being stored without flying for about four years, the Aircraft obtained the certificate of airworthiness in October, 2018. During the airworthiness inspection, there were two cases where it was difficult to start the engine on the ground, but any maintenance actions had not been taken for it.

(4) Starter System

The engine is started by a starter motor which a battery powers. This starter system is equipped with a DEI (digital engine indicator), which has a function to indicate the engine data.

Besides, if the propeller is not stopped in the retractable position in flight, the position of the propeller can be corrected by operating the starter system.

In the flight manual of the Aircraft, it is stated that when the starter motor does not work, limit switch does not work, or defective DEI or defective starter motor.

(5) Engine Start Procedure in Flight

In section 4-5-6-2 of Chapter 4: Normal Procedures in the flight manual of the Aircraft, the engine start procedure in flight is summarized below.

Extension: Fly at 90 km/h (49 kt) with flaps set at 10° . Main-



Figure 4: Accident site



Figure 5: Auxiliary wheel at the right wing tip

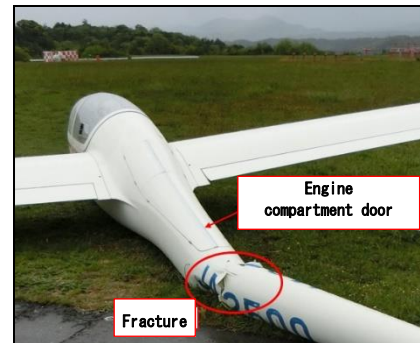


Figure 6: Fracture appearance of the fuselage

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| | <p>switch on. Switch on DEI to “Avionik+engine”. Check if the red handle of the manual extension-retraction switch on the right side console of the front cockpit is switched to the down position.</p> <p>Check if the primer switch is in the “automatic” position. Switch on ignition and press the starter button. The engine will extend by itself and the starter motor will start the engine as soon as the power plant is extended.</p> <p>Restarting the engine should only be done over landable terrain and not below 500 m (1,650 ft) above ground. Should a flight be conducted over a wide expanse of unlandable terrain, the engine should then be restarted at 1,000 m (3,300 ft) above ground.</p> <p>With the engine extended but not running the rate of sink at 90 km/h (49 kt) increases to 1.5 m/sec. (300 ft/min.). This is a glide angle of 17.</p> <p>In a normal restarting situation, the loss of altitude from starting the extension procedure until the engine is running is only about 20 m (70 ft).</p> <p>(6) Starting the Engine with the Starter Not Working (In flight)</p> <p>In section 3-11 of Chapter 3 in the flight manual, there are the following descriptions.</p> <p><i>Extend the engine by switching on the ignition, when engine is extended increase speed as quickly as possible to approx. 170 km/h (92 kts) until the engine starts. Then flare out with max. 2g. From the beginning of the dive to the lowest point of the procedure you need appr. 150 m (500 ft). Therefore, you should not start this procedure below 400 m (1320 ft) above ground. Otherwise a safe outlanding is preferable.</i></p> <p>(7) Landing with the Engine Extended and Stopped</p> <p>In section 4-5-7-3 of Chapter 4 in the flight manual, there are the following descriptions.</p> <p><i>Wing flap setting L (+15°).</i></p> <p><i>Due to the high drag from the extended engine, the approach should be made using as little airbrake as possible.</i></p> <p><i>Fully extended airbrakes may result in a heavy and uncomfortable landing.</i></p> <p><i>If possible avoid landing with the engine extended and stopped.</i></p> |
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3. ANALYSIS

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| 3.1 Involvement of Weather | Yes |
| 3.2 Involvement of Pilot | Yes |
| 3.3 Involvement of Aircraft | Yes |
| 3.4 Analysis of Findings | (1) Flight after Attempting to Restart the Engine In consideration of the south wind, the pilot attempted to start the engine |

two times at an altitude of about 1,700 ft according to the procedures in Chapter 4: Normal Procedures in the flight manual, however, the engine was not restarted. When the third restart was attempted, the altitude was about 1,050 ft. Because the altitude loss is approximately 70 ft when restarting the engine, it is probable that the altitude was at or below an altitude of 1,650 ft where the engine restart is restricted, after attempting the second engine restart.

After attempting the third engine restart, the pilot gave up starting the engine, thinking that it would not be able to return to the Airport if the engine failed to start when attempting one more restart. However, it is probable that after failing to start the engine on the first attempt, the pilot should give up restarting it, then should return to the Airport minimizing the loss of the altitude or consider making a safe forced landing nearby.

It is highly probable that because the gliding performance was worse by drag caused by the engine and the propeller which were unable to stow and the south-south-easterly wind observed at the Airport which was a headwind against the Aircraft, the Aircraft lost much altitude while going to the Airport.

(2) Situation on Hitting the Ground Surface

It is probable that because the pilot felt it was unlikely to reach the runway while approaching the Airport, after increasing the airspeed by pitching down the nose before the Airport, he made an approach to the Airport while pitching up the nose and lifting the Aircraft to clear the guard rail. In addition, it is probable that because the Aircraft pulled its nose up and floated up, its airspeed was reduced and the gained altitude above the ground level was low.

The pilot tried to avoid a landing on the runway and land on the grass area on the south side of the runway, but as he was afraid that the Aircraft would go straight and land outside of the Airport site, he tried to land on the grass area next to the runway while giving the Aircraft a right turn. However, it is probable that because the altitude loss was large, then the Aircraft's flight altitude was low when entering the Airport, the right wing tip contact the ground surface at the time of making a right turn. After that, it is probable that the Aircraft lost its balance, and fell on the grass area near the end of Runway 29 while spinning 180° clockwise, the aft fuselage was fractured.

Besides, it is highly probable that because the engine was tilted backward to the extent that hardly the propeller would touch the fuselage and the significant load was applied to the engine and radiator at the time of hitting the ground surface, cooling-liquid leaked from the radiator line.

(3) Failure in Starter System

The propeller of the Aircraft was locked at the position after rotating about 45° when the engine was restarted for the first time, and it did not rotate even in the following two times of attempt to restart. Even if the fuel is not supplied, the propeller can rotate when the starter system normally works. From this, it is highly probable that because the starter system was inoperative, the engine did not start and the engine and propeller were not

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| | <p>retracted.</p> <p>In addition, it is highly probable that the failure in the primary valve contributed to the difficulty of the engine restart on the ground, however, it is probable that it is not related to the fact that the engine did not start during the flight in this accident.</p> <p>It is also somewhat likely that the cause for the starter inoperative was any one of the following failures.</p> <ul style="list-style-type: none">• Temporary inoperative of the starter motor• DEI inoperative• Temporary inoperative of limit switch <p>However, the cause could not be identified because the starter worked normally and any problem was not reproduced, when performing the operation test on the starter at the on-site investigation.</p> |
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4. PROBABLE CAUSES

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| <p>In this accident, it is probable that because the right wing tip contacted with the ground surface when the Aircraft was making a right turn for a landing, it hit the ground surface while losing its balance and suffered damage to the airframe.</p> <p>Regarding the fact that the right wing tip contacted with the ground surface, it is probable that because the engine and the propeller which were unable to stow produced a large drag and the wind condition was a headwind, the Aircraft entered the Airport at a low altitude while losing much altitude.</p> |
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