AA2023-6

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

PRIVATELY OWNED
J A 3 8 2 5

September 28, 2023

Japan Transport Safety Board

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.

《Reference》

The terms used to describe the results of the analysis in "3. ANALYSIS" of this report are as follows.

i) In case of being able to determine, the term "certain" or "certainly" is used.
ii) In case of being unable to determine but being almost certain, the term "highly probable" or "most likely" is used.
iii) In case of higher possibility, the term "probable" or "more likely" is used.
iv) In a case that there is a possibility, the term "likely" or "possible" is used.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

CRASH

PRIVATELY OWNED

CESSNA 172N RAM, JA3825

MINAMIFURANO-CHO, SORACHI-GUN, HOKKAIDO

AT ABOUT 13:00, JULY 19, 2020

August 25, 2023
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member SHIMAMURA Atsushi
Member MARUI Yuichi
Member SODA Hisako
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	On July 19 (Sunday), 2020, a privately owned Cessna 172N RAM, registered JA3825 took off from Sapporo Airfield and was conduct flight training, but crashed into the mountain slope in Minamifurano-cho, Sorachi-gun, Hokkaido. The two persons onboard the aircraft suffered serious injuries. The Aircraft was destroyed but no fire broke out.
1.2 Outline of the Accident Investigation	The Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate the accident on July 19, 2020. An accredited representative of the United States of America as the State of Design and Manufacture of the aircraft involved in the accident participated in the investigation. Comments on the draft Final Report were invited from the parties relevant to the cause of the accident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of the captain and the trainee, the history of the flight is summarized below. At about 10:51 (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), a privately owned Cessna 172N RAM, registered JA3825 took off under VFR from Sapporo Airfield. Onboard the Aircraft were two people consisting of a captain and a trainee, and the captain

seated on the right pilot seat as the flight instructor and the trainee in charge of flying seated on the left pilot seat.

In the pre-flight inspection performed before the departure, there was no anomality in the Aircraft. In addition, the quantity of fuel onboard was 52 gallons, almost full capacity (Fuel-loading in terms of flight duration: 6 hours 30 minutes).

Figure 1: The Aircraft

After took off from the Airfield, the Aircraft headed forward the Kanayama Dam via waypoint KURIS. The flight altitude of the Aircraft was approximately 5,500 ft until it crossed the Yubari Mountains, and after that it was approximately 4,000 ft.

After reaching the Kanayama Dam, the Aircraft entered slow flight*1 over Lake Kanayama, and then it was performing in straight-and-level flight training in slow flight while repeating round trip flights between Ikutora (Point A in Figure 13) and Ochiai (Point B in Figure 13) in Minamifurano-cho. The Aircraft started the flight between Ikutora and Ochiai at an altitude of about 4,000 ft, but changed the flight altitude on the way to that of about 3,000 ft. In addition, from take-off until midway through the flight between Ikutora and Ochiai, the trainee was controlling the Aircraft seated in the left pilot seat. After that, in two round trip flights before the crash, the trainee moved to the rear seat in order to observe the instruments from behind while the captain was operating and to take pictures of the surrounding landscape with his smart phone in order to memorize the terrain, on the other hand, the captain, who had seated in the right pilot seat, moved to the left pilot seat in order to control the Aircraft. At this time, as to the configuration of the Aircraft, the flap setting was 10° and the airspeed was approximately 60 kt. During the flight, the map for surveying was used (see Figure 15). Besides, normal Aeronautical charts were not used.

Immediately before the accident, the Aircraft was flying at 3,000 ft (approximately 914 m) from Ikutora to Ochiai. The Aircraft was approaching the mountain located east of Ochiai and as high as the flight altitude, but the captain was delayed in noticing it. Besides, as encountering turbulence including downdraft, therefore, the Aircraft tried to return back. At this time, there were mountain peaks of equal height on both sides, and the Aircraft commenced to turn left.

About what happened after that, the captain stated as follows.

After commencing to turn, engine output was set to the maximum (full power), but the altitude rapidly descended due to downdraft, and the captain felt impossible to avoid crashing into the mountain. The captain did not remember well after that, but he tried to put the Aircraft in an almost stall

*1 "Slow flight" refers to fly the airplane at reduced airspeed in order to develop the pilot's sense of feel and ability to use the controls properly, and improve proficiency in maneuvering mainly when taking off and landing. Slow flight requires maneuvering operations different from those in normal flights, during which the airplane is flown at a low speed nearing a stall, and it leaves little leeway for the airplane to climb, therefore practicing slow flight should be conducted at an adequate height above the ground.

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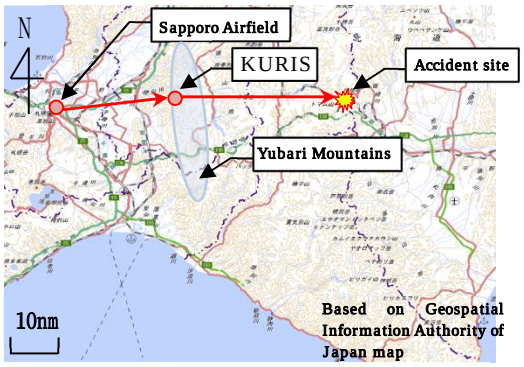
	status and tried to avoid trees by maneuvering the Aircraft between the trees. The engine output remained at full power, but in order to alleviate an impact as much as possible, the captain set the airspeed that just before touchdown in a normal landing. There came an impact, and the Aircraft had crashed into the mountain slope. After that, without operating anything, the captain evacuated from the Aircraft once, but he became anxious about a fire after the crash, thus went back inside the Aircraft and turned off all the switches. At about 13:00, the Aircraft crashed into the mountain slope. At the time of the occurrence of the accident, the captain as a flight instructor was seated in the left pilot seat, and the trainee was seated in the rear seat. After the crash, the Aircraft lay upside down on the mountain slope with about 30-degree inclination in the woods, with its nose facing the mountain side and its tail supported by trees (see Figure 1). This accident occurred on the mountain slope in Minamifurano-cho, Sorachi-gun, Hokkaido (latitude 43° 07' 13" north, and longitude 142° 42' 38" east) at about 13:00 on July 19, 2020.  Figure 2: Estimated flight route
2.2 Injuries to Persons	Onboard the Aircraft were two people consisting of the captain and the trainee, and both of them suffered serious injuries.
2.3 Damage to the Aircraft	(1) Extent of damage of the Aircraft: Destroyed (2) Damage to parts of the Aircraft a. Fuselage ・ The spinner was crushed and deformed from the front. ・ The skin between the engine mounting area and cabin had been torn off. ・ The strut supporting the left main wing was fractured at its attaching point to the fuselage and tree chips were attached. ・ The cargo compartment of the aft fuselage had buckled.  Figure 3: Spinner  Figure 4: Fuselage b. Main wings ・ The flap positions were at the Full Up for the right main wing and slightly Down for the left main wing. ・ The left main wing was damaged between flap and aileron because its trailing edge had hit trees.

	・ The left main wing tip was ripped off.  Figure 5: Left main wing  Figure 6: Upper fuselage c. Empennage ・ The horizontal stabilizer had hit trees and the elevator was in an asymmetrical position. ・ Slight damage was confirmed on the skin of the rudder.  Figure 7: Bottom of the empennage  Figure 8: Top of the empennage d. Aircraft control system ・ Master switch: OFF ・ Mixture: RICH ・ Throttle: in a state of being pushed in about 2/3 forward position ・ Fuel selectors: Both position ・ Flap lever: 10° ・ Altimeter (QNH setting): 29.88 inHg e. Engine and propeller After moving the Aircraft from the accident site, the following inspections were conducted. ・ Engine exterior: No damage, no oil leak ・ Cylinder interior: No abnormalities were found in the cylinder, there was no compression abnormality. ・ Ignition system: Operated normally ・ Lubrication system: No metal chips were found. ・ Fuel system・Carburetor: Foreign material was not found in the filter. ・ Vacuum system: Operated normally ・ Propellers: One of two propellers was bent backward. f. Others The Emergency Locator Transmitter (ELT), a manually operated type, was on board in a box in the cargo compartment and was not operating. Luggage was scattered in the cargo compartment after the crash.
2.4 Personnel	(1) Captain (Flight Instructor) Age: 66

Information	Commercial Pilot Certificate (Airplane) December 5,1972 Pilot Competency Assessment/Confirmation Expiration date of piloting capable period: April 9, 2022 Flight instructor certificate January 22, 1991 Instrument flight certificate June 2, 1994 Class 1 aviation medical certificate Validity: April 20, 2021 Total flight time (Airplane) 13,702 hours 09 minutes Total flight time on the type of aircraft 11,407 hours 56 minutes (2) Trainee Age: 52 Flight training certificate (Airplane) Validity: From August 30, 2019 to August 29, 2020 Total flight time (Airplane) 473 hours 05 minutes Total flight time on the type of aircraft 468 hours 30 minutes
2.5 Aircraft Information	(1) Aircraft Aircraft type: Cessna 172N RAM Serial number: 17271480 Date of manufacture: May 30, 1978 Certificate of airworthiness: None Approval pursuant to the provisions of the proviso of paragraph 1, Article 11, Civil Aeronautics Act: No. 2020-0016 Validity: From May 25 to August 24, 2020 Category of airworthiness Airplane, Normal N, Utility U or Special aircraft X Total flight time: 9,979 hours 48 minutes When the accident occurred, the weight and the center of gravity of the Aircraft were each within the allowable range. (2) Engines Engine type: Lycoming O-320-D2G Serial number: L-10422-32E Date of manufacture: July 21, 2010 Total flight time: 1,144 hours 15 minutes (3) Flight Data The Aircraft was not equipped with any flight data recorders, which also were not brought in onboard. (4) Surveying instruments The Aircraft was not equipped with any surveying instruments, which also were not brought in onboard.
2.6 Meteorological Information	(1) General weather outlook A weather outlook issued for the Hokkaido region by the New Chitose Aviation Weather Station at 05:00 on the day of the accident was as follows: It will be under a pressure trough through the night on July 19, bringing rain in some area in the Pacific side. In addition, low cloud cover will spread due to humid air current and temperature drops, brining FG (fog) or BR (mist) in some places.

(2) Weather values observed at regional weather station

During the time period relevant to the accident, the observation values at Ikutora, Shintoku and Shimukappu, which are located around the accident site, were as follows.

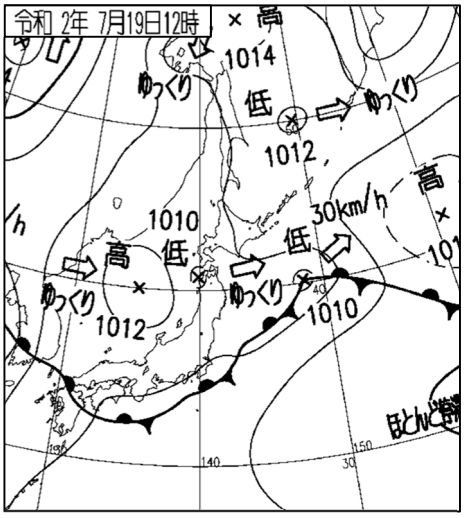


Figure 9: Weather maps

The observation values at 13:00, it was a wind of 2.5 m/s from east at Ikutora located about 13 km west-northwest of the accident site, it was a wind of 1.2 m/s from north-northeast at Shintoku located about 11 km east-southeast of the site, and it was a wind of 3.7 m/s from west at Shimukappu located about 30km southwest of the site.

Table 1: Ikutora

Time	Precipitation (mm)	Temperature (℃)	WD・WV (m/s)				Sunshine duration (min)
			Average	WD	Maximum instantaneous WV	WD	
12:00	0	28.3	2.5	SE	5.1	S	10
13:00	0	28.8	2.5	E	4.9	E	10
14:00	0	28.2	4.4	ENE	6.8	ENE	10

Table 2: Shintoku

Time	Precipitation (mm)	Temperature (℃)	WD・WV (m/s)				Sunshine duration (min.)
			Average	WD	Maximum instantaneous WV	WD	
12:00	0	21.7	1.2	SE	3.6	SSE	6
13:00	0	23.2	1.2	NNE	2.6	N	10
14:00	0	24.2	1.4	SE	3.1	SSE	9

Table 3: Shimukappu

Time	Precipitation (mm)	Temperature (℃)	WD・WV (m/s)				Sunshine duration (min.)
			Average	WD	Maximum instantaneous WV	WD	
12:00	0	27	2.9	WSW	5.2	W	10
13:00	0	26.9	3.7	W	6	W	10
14:00	0	28	2.3	SW	4.9	SW	10

(3) Wind profiler

The values observed by a wind profiler at Obihiro during the time period relevant to the accident are shown in Figure 10, with a wind of 10 kt from east to southeast at an altitude of 3,000 ft between 13:00 and 14:00, and there was no major fluctuation. (See Figure 10)

(4) Statements of the Aircraft's captain and the trainee

The captain stated that the weather conditions around the accident site at the time of the accident, the wind was blowing from east due to Okhotsk high, with humid air, and thick low clouds covered the Tokachi Plain on the east side of Karikachi Pass.

In addition, the trainee stated that as the Aircraft had been flying through valleys in mountainous areas, there were changes in air currents depending on the terrain.

(5) Statement of the pilot in command (PIC) who conducted the search and rescue operations.

Regarding the weather conditions around the accident site during the time period relevant to the accident, the PIC, who conducted the search and rescue operations for the persons onboard the Aircraft on the day of the accident, stated as follows.

Around the accident site during the flight to the accident site in order to conduct the search and rescue operations and during the rescue operations over the Aircraft, the weather conditions was stable without any turbulence, there was no downdraft.

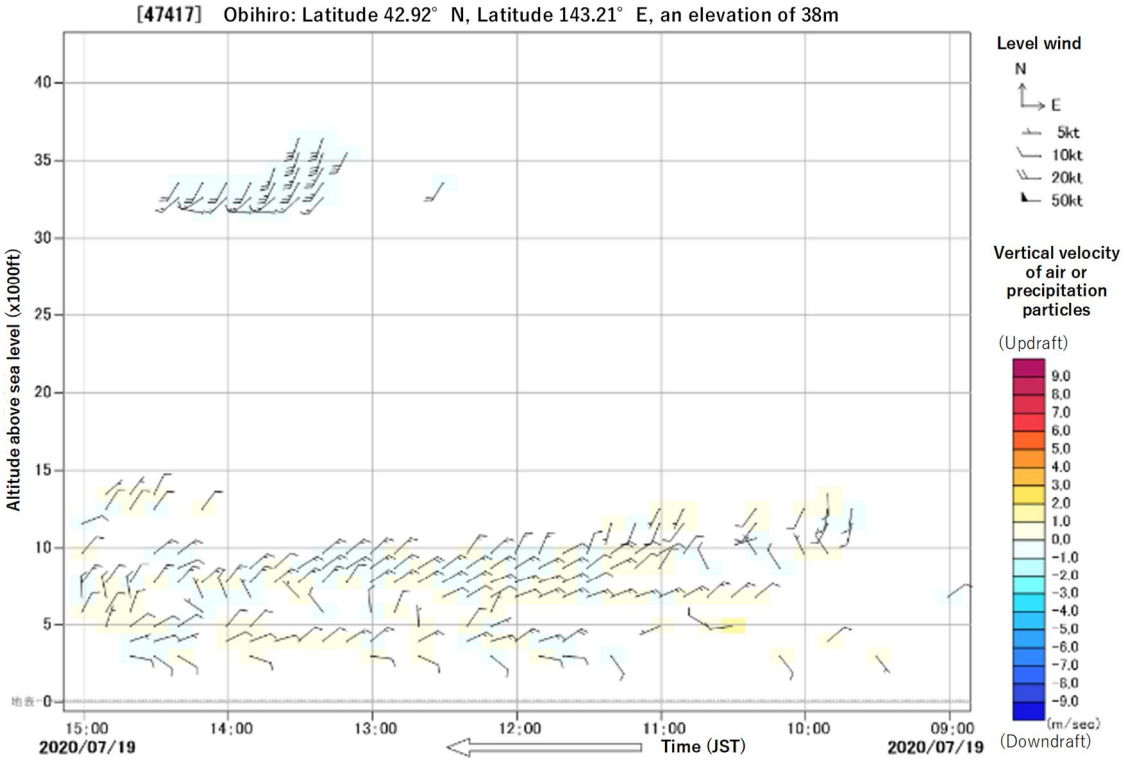


Figure 10: Wind Profiler (Obihiro)

2.7 Additional Information	(1) Aircraft fault In the investigation of the aircraft, engines and propellers at the site and after moving the Aircraft, no faults seemed to have already occurred before the crash were confirmed. (2) Information on the accident site (see Figure 11 and Figure 12) The accident site was located on the slope with about 30-degree inclination in the woods at an elevation of about 780 m on the west side of Mt. Karikachi. In the accident site, the Aircraft lay upside down with its nose facing the mountain side and its tail being supported by trees (see Figure 11 ⑨).

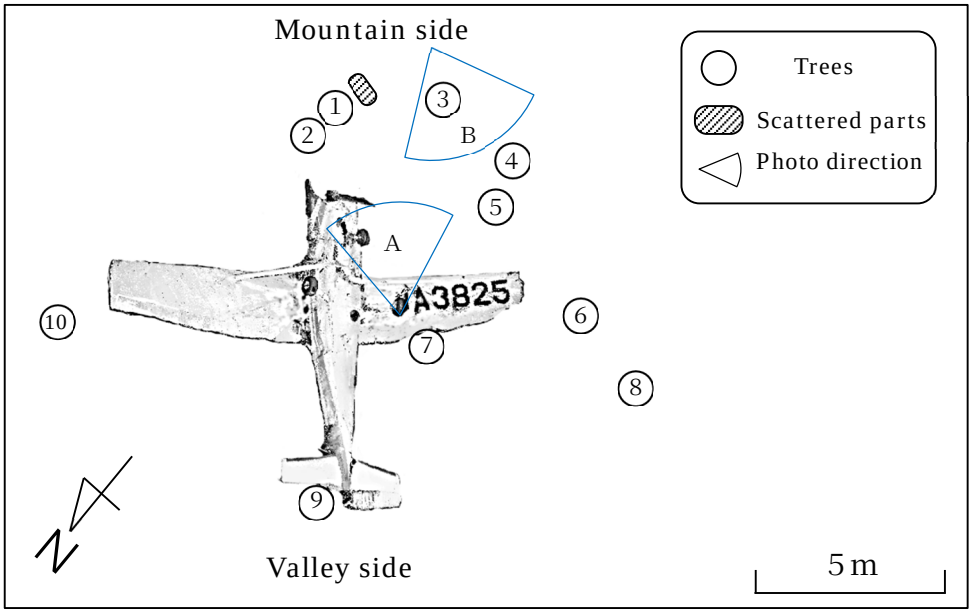


Figure 11: The accident site (Image view from above)

The barks of the two trees (Figure 11① and ②) on the side of the Aircraft's nose (mountain side) were heavily peeled off. Out of the two trees, near the one (Figure 11①) located on the mountain side, scattered around were fragments of the Aircraft. The trees (Figure 11 ③) southwest of these trees were broken off at approximately 1.5 m from the ground. On the trees (Figure 11 ④ and ⑤) east-northeast of the broken trees, newly formed scars were confirmed. In addition, the branches about 3 m high of the trees behind it (Figure 11 ⑥ and ⑧) were sharply broken off.

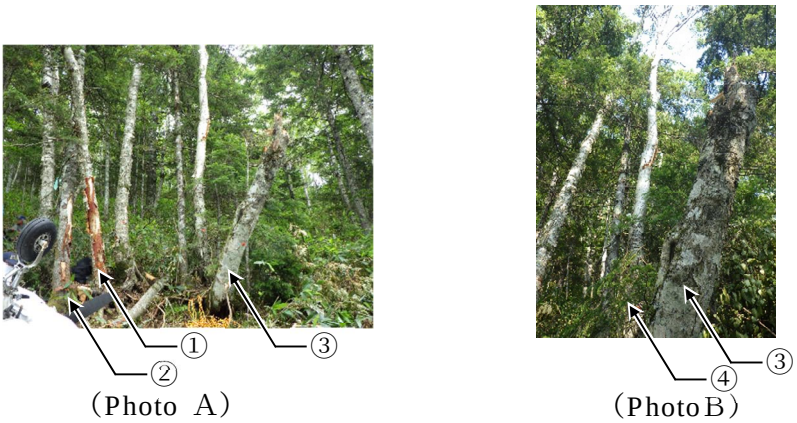


Figure 12: Site photograph

No damage was observed to trees adjacent to the trees (Figure 11 ⑥ and ⑧) whose branches were sharply broken off.

(3) Estimated flight route and the surrounding terrain

According to the captain, the estimated flight route immediately before the crash was the one from the Point A to the Point B of Figure 13. The topographic cross section profile for this route is shown in Figure 14. In addition, around this route, there were mountains over 1,000 m (about 3,280 ft) on the south and east, and there were mountains over 800 m (about 2,600 ft) on the north, thus, it was surrounded by mountains in all three directions.

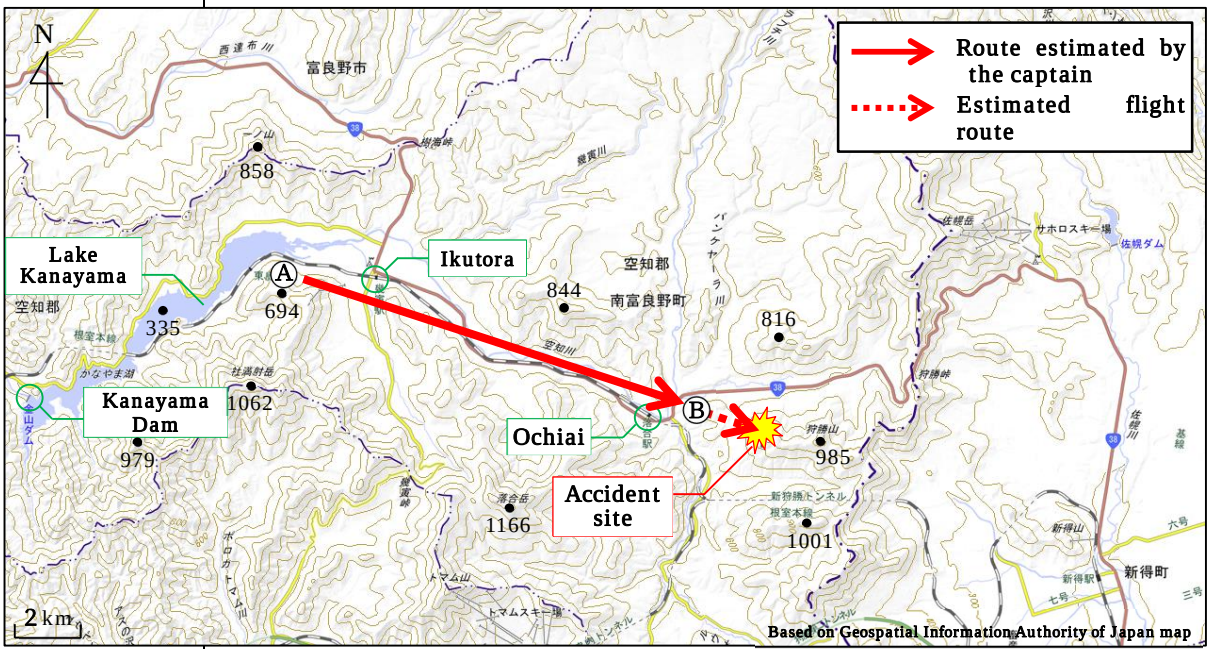


Figure 13: Estimated flight route immediately before the accident and its surrounding terrain

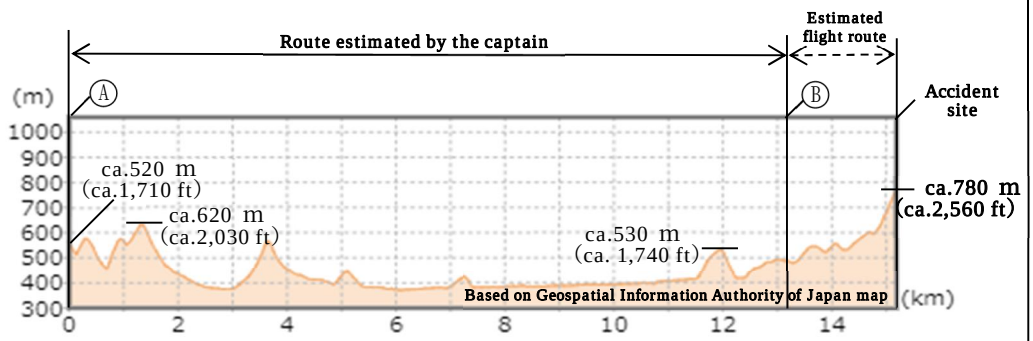


Figure 14: Topographic cross section profile for the estimated flight route

(4) Stall speed

The flight manual includes the following descriptions on stalls. (Excerpt)

5-8 Stall speed

Conditions: Power off

Notes: (1) The maximum altitude loss during a stall recovery may be as much as 180 feet.

(2). KIAS values are approximate.

Most Rearward Center of Gravity *Fig5･8-1*

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2300	UP	42	50	45	54	50	59	59	71
	10°	38	47	40	51	45	56	54	66
	40°	36	44	38	47	43	52	51	62

Most Forward Center of Gravity *Fig5･8-2*

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2300	UP	47	53	51	57	56	63	66	75
	10°	44	51	47	55	52	61	62	72
	40°	41	47	44	51	49	56	58	66

(5) Slow flight in flight training

The following descriptions are included in the Airplane Flying Handbook, issued by the Federal Aviation Administration of the United States of America. (Excerpt)

Performing the Slow Flight Maneuver

(Omitted)

Slow flight in a single-engine airplane should be conducted so the maneuver can be completed no lower than 1,500 feet AGL, or higher, if recommended by the manufacturer. In all cases, practicing slow flight should be conducted at an adequate height above the ground for recovery should the airplane inadvertently stall.

(6) Flight training certificate of the Aircraft and the trainee

As for the flight training, the Aircraft was granted permission under the proviso of Article 92 of the Civil Aeronautics Act had been obtained. In addition, the trainee had obtained a student pilot permission required by Article 35 of the Civil Aeronautics Act.

(7) Map (see Figure 15) being used in the accident flight

On the survey map used by the captain and the trainee, it was written that the altitude above ground level (AGL) was 400 m, the ground speed was 110 km/h, and the flight altitude was 2,600 ft.

In addition, the Aircraft was being used for aerial survey by the owner company, the survey map used in the accident flight had been created by the owner company.

(8) Search and rescue

After the crash, the trainee made contact with the Aircraft owner by his smartphone. The Aircraft owner who received the call made contact with the police.

After that, the trainee received calls on his smartphone from the Aircraft owner, the police, and fire station and civil aviation bureau. The trainee stated

that he became worried about running out of battery power of his smartphone. As being told to transmit signal by ELT, he was looking for the ELT but failed to find it. According to the instructions by the police, the trainee reported the crash site by reading up the latitude and longitude displayed by long-pressing its own position on the google map.

And then, a helicopter of operated by the Hokkaido Police Aviation Unit appeared above the sky, the two people were rescued.

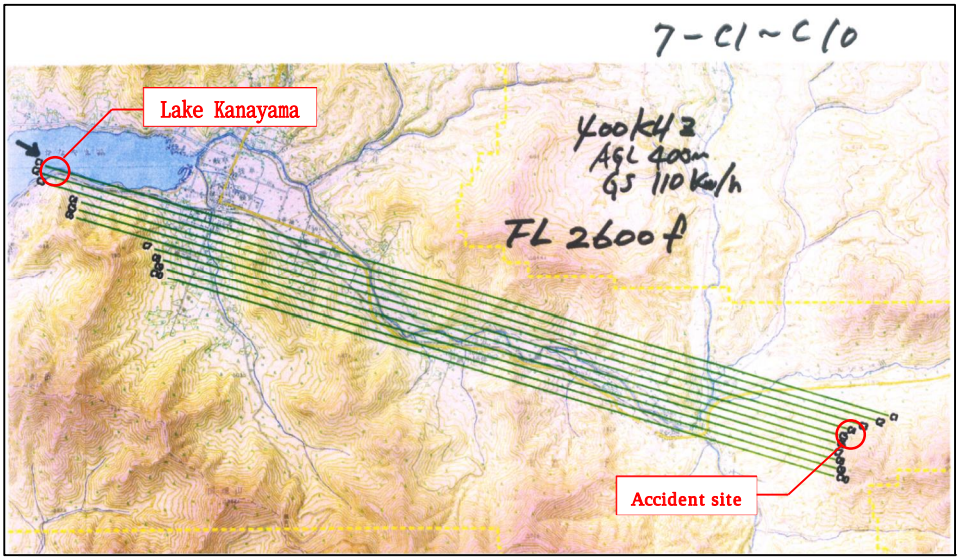


Figure 15: Map used as a reference (Red letters: additional notes)

3. ANALYSIS

(1) Wind conditions around the accident site

The JTSB concludes that during the time period relevant to the accident (13:00 to 14:00), a wind profiler at Obihiro had observed a wind of 10 kt (about 5.1 m/s) from east to southeast, and no major fluctuation in wind direction and velocity was observed, in addition, a wind of 10 kt or more was not observed at Ikutora, Shintoku and Shimukappu, which are located around the accident site.

Given these considerations, the wind conditions over a wide area around the accident site are more likely a light wind field, with no significant wind fluctuation. The PIC the Hokkaido Police Aviation Unit, who conducted the search and rescue operations for the captain and the trainee, stated that around the accident site, there was no significant weather that might affect their flight. As weather observations around the accident site did not change significantly over time between the time period the Aircraft was flying and the time period the rescue operations were conducted, it is possible that there was no such downdraft that could lower the altitude of the aircraft whose engine output was increased to full power.

On the other hand, regarding the statement of the captain saying that they encountered downdraft in the vicinity of the accident site, it could not be identified because local observation data around the accident site were not available.

(2) Circumstances at the time of the crash

The JTSB concludes that from the extent of the damage to the trees around the accident site and to the Aircraft, the Aircraft most likely crashed into the slope from west-southwest. In addition, it is highly probable that the spinner hit the trees (Figure 11 ① and ②) whose barks were

heavily peeled off. The broken trees (Figure 11 ③) were most likely damaged because the strut supporting the left main wing contacted with them. Based on these, immediately before the crash into the slope, the attitude of the Aircraft was most likely tilted to the left with the nose down and the undersurface of fuselage facing toward the mountain slope. It is highly probable that the speed at that time was significantly low.

It is highly probable that the Aircraft was flying at a low speed immediately before the crash, and while turning in order to avoid the mountain, the engine output was increased to the maximum power, and the nose was raised, therefore, it started to spin. As the speed at the time of the crash was estimated to be significantly low, it was more likely quite short time between the times of starting to spin to the time of crashing into the slope. In addition, from these considerations, it is probable that the captain was delayed in noticing that the Aircraft was approaching the mountain, and it is possible that his outside watch was not sufficient.

(3) Flight altitude

The JTSB concludes that the captain and the trainee stated that the flight altitude before the crash was approximately 3,000 ft, however, on the other hand, on the map used in their flight, it was written that the flight altitude was 2,600 ft, and the flight altitude could not be identified because the Aircraft was not equipped with any flight data recorders, which also were not brought in onboard.

(4) Awareness of safe flight

The airspace where the flight training was conducted at the time of the accident had the mountains over 1,000 m (about 3,280 ft) on the south and east and those over 800 m (about 2,600 ft) on the north, and was surrounded by mountains in all three directions. Thus, making a round-trip flight in the airspace likely results in approaching those mountains when turning or unintentionally, it is necessary to ensure sufficient safe altitude when conducting flight training in such an airspace accordingly.

Besides, there were some areas where elevation exceeds 500 m (about 1,640 ft) immediately below the estimated flight route, and it is probable that even with a flight altitude of 3,000 ft, it had been less than 1,500 ft AGL that is the safe altitude for the slow flight training.

Furthermore, it is very dangerous behavior for the captain to move from the right pilot seat to the left pilot seat during the flight. As mentioned above, the flight at the time of the accident was most likely conducted with significant lack of awareness of safe flight.

(5) Flight data record

The JTSB concludes that in the accident investigation, the accident site investigation could estimate the flight condition immediately before the crash, but the flight condition leading to the accident could not be identified because the Aircraft was not equipped with any devices to record flight condition, which also were not brought in onboard.

It is probable that if a FDM (Flight Data Monitoring) device had been brought in on board the Aircraft, the flight condition would have been able to be confirmed in detail, and the flight condition leading to the accident should have been identified. In order to prevent a recurrence of similar small aircraft accidents, it is more likely necessary to promote the installation of flight data recorders for small aircraft such as the FDM device enabling to record the detailed flight condition.

In addition, looking back on the past flight with the recorded flight data more likely makes it possible to improve the maneuvering skills and identify risks in the flight.

(6) Search and rescue

The JTSB concludes that although the ELT had been brought in onboard the Aircraft, as it

was placed in a box, the person on board was not able to find it, therefore, it is desirable that the ELT should be put in easily touchable and operable condition in order to prepare for the unexpected situation.

4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this accident was that in the mountainous terrain, when conducting flight training at a low speed without securing sufficient AGL, the Aircraft approached the mountains unintentionally, which more likely resulted in failing to avoid and crashing into the mountain slope.

Regarding the reason why the Aircraft approached the mountain unintentionally and failed to avoid them when conducting flight training without ensuring sufficient AGL, it is most likely because of the lack of awareness of safe flight.

5. SAFETY ACTIONS

In order to prevent a recurrence of similar accidents to this one, as described in "3. ANALYSIS", it is probable necessary to conduct flight training while selecting safer training area depending on the training contents and ensuring sufficient AGL.