

AI2019-3

**AIRCRAFT SERIOUS INCIDENT
INVESTIGATION REPORT**

**PRIVATELY OWNED
JA3500**

April 25, 2019

 **JTTSB** *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 prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

Nobuo Takeda
Chairman
Japan Transport Safety Board

Note:

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

AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

STOP OF ENGINE IN FLIGHT PRIVATELY OWNED, CESSNA 172K, JA3500 AT AN ALTITUDE OF ABOUT 1,500 FT (ABOUT 500 M) OVER ISHIKARI CITY, HOKKAIDO, JAPAN AT ABOUT 18:50 JST, OCTOBER 6, 2017

April 5, 2019

Adopted by the Japan Transport Safety Board

Chairman	Nobuo Takeda
Member	Toru Miyashita
Member	Yoshiko Kakishima
Member	Yuichi Marui
Member	Yoshikazu Miyazawa
Member	Miwa Nakanishi

1. PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Serious Incident	<p>On Friday, October 6, 2017, a privately owned Cessna 172K, registered JA3500, took off from Sapporo Airfield in order to make a familiarization flight for the passenger, but its engine stopped at about 18:50 (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock) while flying over Ishikari City, therefore it made a forced landing on the sands of Ishikari Beach.</p>
1.2 Outline of the Serious Incident Investigation	<p>This event falls under the case of “continued loss of power of engines in flight” as stipulated in Item (vii), Article 166-4 of the Ordinance for Enforcement of Civil Aeronautics Act (Ordinance of Ministry of Transport No. 56 of 1952), and is classified as a serious incident.</p> <p>On October 6, 2017, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate this serious incident.</p> <p>An accredited representative of the United States of America, as the State of Design and Manufacture of the aircraft involved in this serious incident, participated in the investigation.</p> <p>Comments were invited from parties relevant to the cause of the serious incident and the Relevant State.</p>

2. FACTUAL INFORMATION

2.1 History of the Flight	<p>According to the statements of the captain and the passenger, the records of the GPS receiver brought in by the captain, and the ATC</p>
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communications records, the history of flight is summarized as follows:

At about 18:23, on October 6, 2017, a privately owned Cessna 172K, registered JA 3500, took off from Sapporo Airfield to make a familiarization flight for the passenger who operated an airplane for the first time in about one year, with a captain on the right pilot seat and the passenger on the left pilot seat. The aircraft operated by the passenger went over Sapporo City, then flew toward Otaru City, and flew along the coast line from over Otaru Port toward Ishikari City.

Over Ishikari City, the passenger obtained a landing clearance from the Sapporo Airfield traffic control tower

officer (hereinafter referred to as “the Sapporo Tower”) to land at Sapporo Airfield. The aircraft flying from over Ishikawa City toward northeast made a right turn while reducing the altitude from 1,700 ft to 1,500 ft, and just started flying toward the Sapporo VOR at around 18:50, when the engine stopped and the output power decreased along with decrease in engine sound.

As the propellers got into a state where they were taking wind and rotating, the passenger confirmed that the mixture control was set in the FULL RICH position and activated the starter by switching the fuel selector lever from the BOTH position (See 2.7 (3)) to the right and left, respectively, however, the engine did not start again. After returning the selector lever to the BOTH position, the passenger pulled the carburetor heat lever, but returned it to the original position because the situation did not change. The passenger gave up restarting the engine and the captain took over the control from the passenger. At about 18:52, declaring a state of emergency to the Sapporo Tower, the passenger informed of the engine trouble of the aircraft.

The captain judged that it was difficult to restart the engine because the altitude of the aircraft went down to 1,000 ft or less, and decided to land on the sands of Ishikari Beach with which the captain were particularly familiar.

After making a right turn toward the sea side while reducing the altitude, the captain confirmed the landing position by making a left turn, and made a forced landing on the sands without using the flaps. The aircraft taxied while gradually veering seaward and halted on the soft sands at about 18:54.

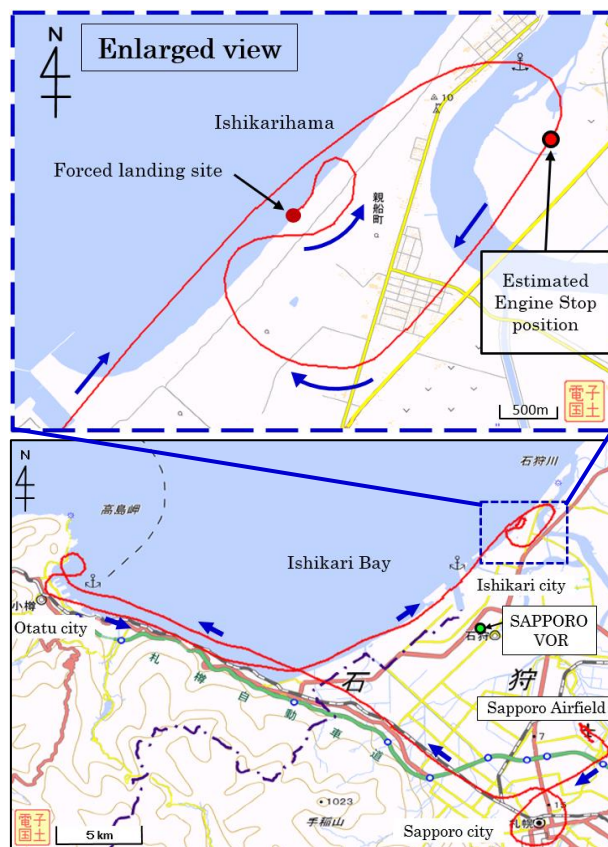


Figure 1 Estimated Flight Route

	<p>This serious incident occurred at about 18:50 on October 6, 2017, at an altitude of about 1,500 ft over Ishikari City, Hokkaido (43° 14' 21" N, 141° 21' 29" E).</p>										
2.2 Injuries to Persons	None										
2.3 Damage to Aircraft	None										
2.4 Personnel Information	<p>(1) Captain Male, Age 63</p> <p>Commercial pilot certificate (Airplane) September 17, 1973</p> <p>Pilot competence assessment Expiry of practicable period for flight November 12, 2017</p> <p>Type rating for single-engine (land) December 15, 1972</p> <p>Class 1 aviation medical certificate Validity date: April 20, 2018</p> <p>Total flight time 13,005 hours 22 minutes</p> <p>Flight time in the last 30 days 41 hours 01 minute</p> <p>Flight time on the same type of aircraft About 11,000 hours 00 minute</p> <p>Flight time in the last 30 days 41 hours 01 minute</p> <p>(2) Passenger Male, Age 49</p> <p>Private pilot certificate (Airplane) February 8, 2005</p> <p>Pilot competence assessment Expiry of practicable period for flight October 9, 2018</p> <p>Type rating for single-engine (land) February 8, 2005</p> <p>Class 2 aviation medical certificate Validity date: December 13, 2018</p> <p>Total flight time 525 hours and 00 minute</p> <p>Flight time in the last 30 days 0 hour and 00 minute</p> <p>Flight time on the same type of aircraft 350 hours and 00 minute</p> <p>Flight time in the last 30 days 0 hour and 00 minute</p>										
2.5 Aircraft Information	<p>(1) Type Cessna 172K</p> <p>Serial number 17257739</p> <p>Date of manufacture November 18, 1968</p> <p>Certificate of Airworthiness No.To-29-150</p> <p>Validity date June 29, 2018</p> <p>Total flight time 7,895 hours 09 minutes</p> <p>Flight time since the last periodical check (200h check on June 26, 2017) 30 hours 06 minutes</p> <p>(2) When the serious incident occurred, the weight and the balance of the aircraft were both within the allowable range.</p>										
2.6 Meteorological Information	<p>According to the captain, the weather on the day was slightly cloudy, and an easterly wind of about 5 kt was blowing.</p> <p>The weather observed by the Ishikari observation station, located about 5 km south-west of the forced landing site, at around the time of the serious incident was as follows:</p> <table border="1"> <thead> <tr> <th></th> <th>Wind direction</th> <th>Wind velocity</th> <th>Temperature</th> <th>Precipitation amount</th> </tr> </thead> <tbody> <tr> <td>17:00</td> <td>south-southeast</td> <td>2.4 m/s</td> <td>14.9 °C</td> <td>0 mm</td> </tr> </tbody> </table>		Wind direction	Wind velocity	Temperature	Precipitation amount	17:00	south-southeast	2.4 m/s	14.9 °C	0 mm
	Wind direction	Wind velocity	Temperature	Precipitation amount							
17:00	south-southeast	2.4 m/s	14.9 °C	0 mm							

	18:00	southeast	1.8 m/s	14.3 °C	0 mm
	18:50	southeast	2.2 m/s	13.6 °C	0 mm
	19:00	southeast	2.2 m/s	13.8 °C	0 mm
2.7 Additional Information	<p>(1) Fuel Capacity</p> <p>About 91 liters (24 gal) of fuel on each wing and a total of about 182 liters (48 gal) of fuel in both wings can be loaded on the aircraft. On September 22, a total of 87 liters was refueled onto the aircraft to fill the left and right fuel tanks to the maximum fuel capacity (about 182 liters) in Sapporo Airfield. After that, the aircraft flew on September 30 and October 1, and on the day of the serious incident, it made two flight (the total flight time from refueling until making those flights was 4 hours 17 minutes). The serious incident occurred on the second flight (The aircraft started moving at about 18:08, the engine stopped at about 18:50.).</p> <p>Before the flight, the captain confirmed that both of left and right fuel quantity indicators were indicating 1/4 (about 23 liters), but he did not check visually the fuel level from the fuel filler caps. Calculating at the rate of fuel consumption of 35 ℓ/h based on his past experiences, the captain assumed that it would be possible for the aircraft to fly for about one hour in terms of estimation of the onboard fuel quantity that the fuel quantity indicators showed.</p> <p>The captain and the passenger looked at the fuel quantity indicators to confirm the quantity of the remaining fuel during the flight, but they did not notice a one-sided reduction in fuel between tanks. In addition, when the engine stopped, they did not confirm the values on the fuel quantity indicators.</p> <p>(2) The situation of the fuel system (See Figure 2)</p> <p>In the investigation of the aircraft, the following facts were found out.</p> <ul style="list-style-type: none"> • The fuel of the aircraft flows from the left and right fuel tanks to the strainers (small mesh for filtering foreign matter and others) via the screens (coarse mesh for filtering foreign matter and others) and the selector valve. The fuel is supplied from the strainers to the inside of the engine via the carburetor. The engine primer is used, when necessary, to start engine in cold weather. The trace of the fuel leak could not be confirmed in the plumbing of fuel system. • After the flight, there was no remaining fuel in the right fuel tank, and in the left fuel tank remained about 21 liters of fuel where water was found. • After removing the left fuel tank, it was found that the sealant for preventing water infiltration was applied to around the fuel filler caps, and the sealant was applied to the right fuel tank as well. The sealant had already been applied to the fuel tanks when the captain purchased the aircraft, but the timing when it was applied to the aircraft was unclear. No other abnormality was found. 				

- There was a small amount of water on the bottom of the strainers.
- The vent line in the left fuel tank was not clogged and the vent valve also worked normally.
- The malfunction, such as restricting the fuel flow of the fuel lines from the fuel tanks of the left and right to the carburetor, could not be confirmed.

According to the captain, water was drained from the left / right fuel tanks and the fuel strainers during pre-flight check, but the amount of drained water was not measured.

The aircraft was operated with the selector lever positioned at BOTH during the flight and even on the ground, and the selector lever had not been moved from the BOTH position until the engine stopped during this flight.

(3) Situation of the selector valve (See Figure 3 and Photo 1)

The selector valve body and the selector lever are connected by a mechanical linkage. When the selector lever is set to the left position, the fuel is supplied from the left wing fuel tank, and when the right position is selected, the fuel is supplied from the right wing fuel tank. When it is set to the BOTH position at the center, the fuel is supplied from the right and left fuel tanks.

In the investigation of the aircraft, the selector lever was at the BOTH position, there was no abnormality in the operation of the selector valve, and no foreign matter or abnormality causing clogging inside the valve could be confirmed.

On the other hand, excessive play parts were confirmed at the hinges (2 places) of the mechanical linkage connecting the selector valve body and the selector lever. On this account, merely selecting the predetermined position by rotating the selector lever would not accurately transmit the rotation motion to the selector valve body via the mechanical linkage, and the valve body was not set in the

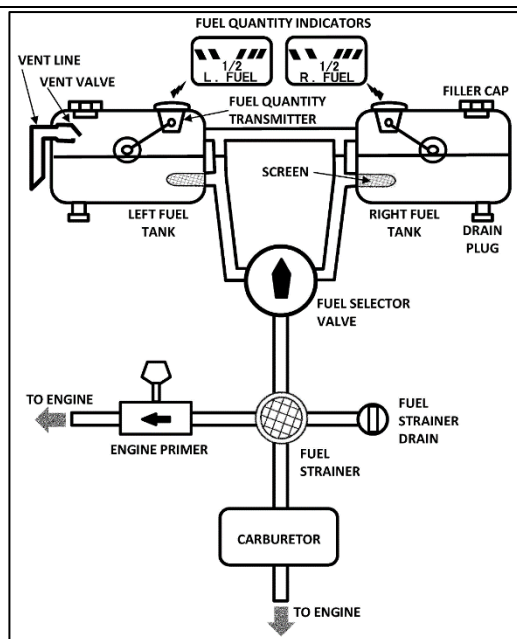


Figure 2 Fuel System

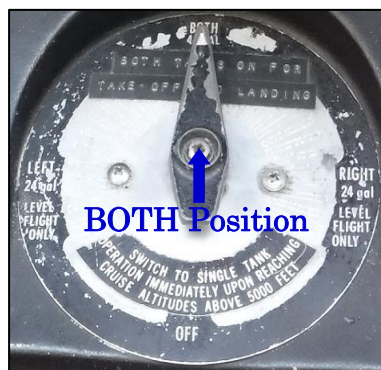


Photo 1 Selector Lever

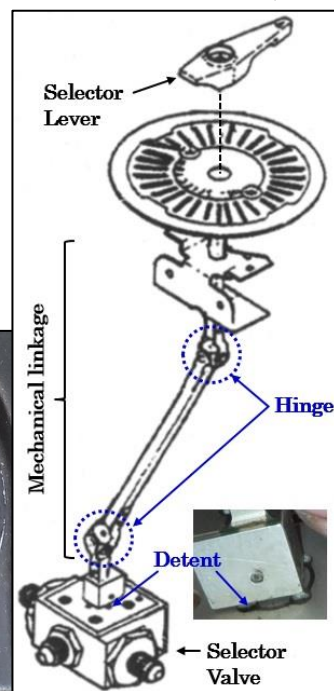


Figure 3 Selector Valve

	<p>intended detent position (a dent in the detent). However, it was possible to set the selector valve body in the detent position by greatly rotating the selector lever beyond the range of the play parts, and it was able to confirm that the selector valve was set in the detent position.</p> <p>How to operate the selector valve is described on the placard of selector valve as follows: “<i>Both tanks on for takeoff and landing</i>”, “<i>Switch to single tank operation immediately upon reaching cruise altitudes above 5,000 ft</i>”. The captain was always flying with the selector valve set in the BOTH position.</p> <p>The captain had left the aircraft’s selector valve in the BOTH position even on the ground, taking into account the circumstances where a one-sided fuel load between tanks would occur at the time of supplying fuel.</p> <p>Neither did the captain nor the passenger remember if they had operated the selector lever except when trying to restart the engine during the flight.</p> <p>(4) Maintenance of the fuel systems</p> <p>The maintenance manual of the aircraft describes the maintenance of the fuel systems as follows: (Excerpt)</p> <ul style="list-style-type: none"> ·Condition inspection of fuel selector valves ······ each 50 hours ·Condition inspection of fuel filler caps ·········· each 50 hours <p>According to the maintenance record of the aircraft, maintenance was carried out in accordance with the maintenance manual set by the aircraft manufacturer.</p> <p>In addition, the selector valve body was replaced with the overhauled valve on June 10, 2017 due to the fuel leak from the valve body.</p> <p>(5) Forced landing site</p> <p>The forced landing site was a flat sand beach facing Ishikari Bay with no big obstacles.</p>
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Photo 2 Forced landing site

3. ANALYSIS

3.1 Involvement of Weather	None
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	Yes
3.4 Analysis of Findings	<p>(1) Stop of the engine</p> <p>Judging from the fact that the right fuel tank was empty at the time of forced landing of the aircraft, it is probable that the fuel in the right fuel tank was exhausted due to an one-sided reduction in fuel between tanks that might allow air to enter the fuel system via the selector valve from the right fuel tank piping, which resulted in not allowing the fuel to reach the engine.</p> <p>It is somewhat likely that there was a small amount of water found in the left fuel tank and the strainers despite of draining water from the left and right</p>

fuel tanks during pre-flight check, because the deterioration of the sealant applied to the edge of the caps might allow rain water to enter around from the fuel filler caps, and the rain water was not fully drained, which resulted in the engine stop with the water entering in the fuel system.

(2) One-sided reduction in fuel between tanks

Judging from the indication values of fuel quantity confirmed by the captain, it is probable that the aircraft carried about 46 liters of fuel and it is estimated that the aircraft consumed about 25 liters of fuel as deducting approximately 21 liters of the remaining fuel from the 46 liters. It is probable that because the aircraft started the engine at about 18:08 and its engine stopped at about 18:50, therefore, the engine operating time during this period of the time was about 42 minutes; and when calculating at a fuel consumption rate of 35 l/h that was used by the captain, the estimated fuel consumption quantity would be about 24 liters, which is close to the value obtained by deducting the quantity of the remaining fuel from that of the onboard fuel. Therefore, it is somewhat likely that the fuel in the left fuel tank was almost unconsumed.

It is probable that there were excessive play parts at the hinge parts of the mechanical linkage connecting the selector valve body and the selector lever, the selector valve was not set in a normal detent position of BOTH; and as the selector valve was moved to the side of the right fuel tank, the fuel flowed from the right tank, which led to an one-sided reduction in fuel between tanks. In addition, judging from the facts that the fuel in the left tank was almost unconsumed, and that there was no malfunction such as restricting the fuel flow of the fuel lines from the fuel tanks of the left and right to the carburetor, it is also somewhat likely that the selector lever was set in the position to restrict the fuel flow from the left tank and the fuel in the left tank was not consumed.

It is somewhat likely that the captain and the passenger could have prevented from the one-sided reduction in fuel between tanks if they had confirmed not only the position of selector lever by checking visually but also the detent position of the BOTH by actually operating the selector lever during pre-flight check.

(3) Operation before and after the engine stop

It is probable that the captain and the passenger looked at the fuel quantity indicators to confirm the remaining fuel quantity during the flight, but they did not notice the one-sided reduction in fuel between tanks, because they did not fully confirm them; and that they could have noticed the one-sided reduction in fuel between tanks and taken appropriate actions such as returning to the Airfield before the engine stopped, if they had fully confirmed the fuel quantity indicators.

It is somewhat likely that the engine did not start again even though the passenger switched the fuel selector lever to the right and left respectively to operate the starter, because air entered the fuel system and the selector valve was not switched normally.

It is highly probable that the captain gave priority to making a forced landing, judging that it could be dangerous to conduct any further operation to restart the engine because the altitude of the aircraft had gone down to 1,000 ft or less when he took over the control from the passenger.

(4) Maintenance of aged aircraft

About 49 years had passed since the aircraft was manufactured, therefore, it is probable that there was excessive play parts in the mechanical linkage due to the hinges worn after long-term use.

According to the maintenance record of the aircraft, maintenance was carried out in accordance with the maintenance manual set by the aircraft manufacturer, however, it is probable that the selector valve was used as it was because it was able to confirm that the selector valve was set in the detent position, and there was no problem in terms of function. It is natural for users to perform maintenance on the aircraft when a malfunction is found, but it is important to make efforts to perform the preventive maintenance, if required, even when excessive play parts are confirmed in selector lever and others.

4. PROBABLE CAUSES

It is probable that in this serious incident, the engine stopped during the flight, because the fuel in the right fuel tank was exhausted due to the one-sided reduction in fuel between tanks that might allow air to enter the fuel system, which resulted in not allowing the fuel to reach the engine.

It is also somewhat likely that an one-sided reduction in fuel between tanks occurred, because the selector lever was not set in a normal detent position of the BOTH and the fuel flow from the left fuel tank was restricted.

It is probable that the fact that the captain and the passenger did not fully monitor the fuel quantity indicators during the flight contributed to the engine stop due to drying up of the fuel in the right fuel tank.