AA2018-1

AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATELY OWNED

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January 25, 2018

JTSB 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.

Kazuhiro Nakahashi
Chairman,
Japan Transport Safety Board

Note:

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

AIRCRAFT ACCIDENT INVESTIGATION REPORT

AIRCRAFT DAMAGE DURING TAKEOFF RUN FROM WATER, A PRIVATELY OWNED CESSNA T206H (AMPHIBIAN), JA007P LAKE SHINJI, TAMAYU TOWN, MATSUE CITY, SHIMANE PREFECTURE, JAPAN AT AROUND 11:23 JST, APRIL 15, 2017

December 22, 2017
Adopted by the Japan Transport Safety Board
Chairman Kazuhiro Nakahashi
Member Toru Miyashita
Member Toshiyuki Ishikawa
Member Yuichi Marui
Member Keiji Tanaka
Member Miwa Nakanishi

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Accident	On Saturday, April 15, 2017, a privately owned Cessna T206H, registered JA007P, suffered damage due to a collision with wave during takeoff run from water at Lake Shinji, heading to Tottori Airport for a familiarization flight.
1.2 Outline of the Accident Investigation	On April 15, 2017, the Japan Transport Safety Board designated an investigator-in-charge and one other investigator to investigate this accident. An accredited representative of the United States of America, as the State of Design and Manufacture, participated in the investigation. Comments were invited from the relevant person 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 pilot (hereinafter referred to as "the Pilot) and the passenger, and based on the communication records with Izumo Airport Mobile Communication

Station (hereinafter referred to as “Izumo radio”), the history of the flight up to the accident is summarized below;

On April 15, 2017, a privately owned Cessna 206H (Amphibian) registered JA007P planned to fly from Shinji Lake to Tottori Airport for a familiarization flight with the Pilot and the passenger onboard.

Photo 1 The Aircraft (past)

The Pilot performed the pre-flight inspection from around 10:00 Japan Standard Time (JST; UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock) and he confirmed that fuel was almost full and no abnormality was found on the Aircraft (hereinafter referred to as “the Aircraft”).

On that day, a westerly wind was blowing and whitecaps were observed at the north-side water area of the cape (Yumachi-Hana) which is located at northwest of the pier used by the Aircraft for mooring, however, the water area along the cape where the wind waves were suppressed by the landform were relatively smooth and the situation was possible to takeoff from water. The Pilot judged that based on his own experience, he could take off from water after airborne by the takeoff run for about 300 m within the smooth water area and he did not check the performance for the takeoff from water in the Pilot’s Operating Handbook for Amphibian Operation (hereinafter referred to as “POH”).

The passenger felt that the wind was weak on his arrival at the pier around 10:30, but it was getting stronger around the time to start boarding the Aircraft on 11:00.

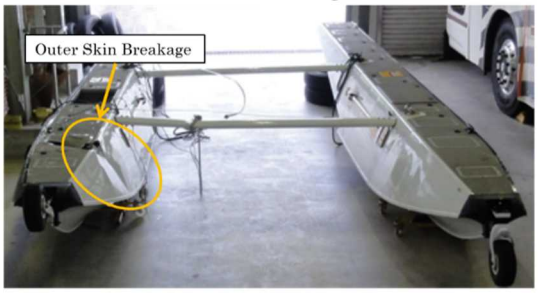
The Pilot started the engine at the pier and taxied to offshore

	point of the fishing port located in about 300 m downwind side (Southeast). During the taxiing on the water, the Pilot performed the takeoff checklist, and he reported to Izumo Radio that he would depart shortly at 11:22 that it arrived at the point to commence the takeoff from water. Following these, the Pilot commenced the takeoff run from water with the normal procedure using flap 20º to northwest direction along the lakeshore at east side of the cape. During the takeoff run, the Pilot did not feel any abnormality at the engine and aircraft, but he felt that acceleration was worse than usual as approaching the rough water surface with whitecaps. Right after that, the Aircraft was on the step and began to bounce, when the Pilot felt a coming airborne, the Aircraft collided with a big wave, at same time it leaned forward and the front of right float came into contact with propellers then the engine stopped. The location where the Aircraft collided with wave was on the water about 100 m offshore of the hotel located at about 400 m east of Yumachi-Hana cape. At 11:23, the Pilot reported to Izumo radio that he could not make a takeoff from water because the wave was too high and cancelled the flight plan. The Pilot transferred to a motorboat of which driver witnessed the accident and rushed there, and tried to tow the Aircraft but failed due to strong wind. The Aircraft started to drift downwind. The passenger transferred to fireboat which arrived at the accident site. After that, the Aircraft was sunk as the float separated while drifting. After the accident, the Pilot thought that till then, when he had passengers on board, he would decrease about a half of full fuel for takeoff from water, but for this time, because he filled up fuel in order to reach Prefectural Nagoya Airfield as a final destination depending on his judgment on the changes of weather condition, the Aircraft become heavy and the takeoff run distance from water increased, so it entered into rough water area. The accident occurred at Lake Shinji in Tamayu Town, Matsue City, Shimane Prefecture (N35º26'17", E133º00'49") at

	around 11:23 on April 15, 2017. (See Fig. 1 Area Map of Accident Site, Fig. 2 Accident Site and Photo 2 Salvage of the Aircraft.)
2.2 Injuries to persons	None
2.3 Damage to Aircraft	Extent of the damage on the Aircraft: substantial ① Nose Propeller; Deformed damage Right side bottom of the nose; Outer skin deformed damage Right bottom of Engine Firewall; Deformed damage ② Float; Separated from the Aircraft and the float outer skin had breakage. ③ Fuselage; Deformed damage on the left bottom of outer skin of fuselage

Photo 2 Salvage of the Aircraft

Right front of the Aircraft



Separated Float

Left rear of the Aircraft

Photo 3 Damage of the Aircraft

2.4 Personnel information

The Pilot — Male, Age 71

Private pilot certificate (Airplane) — May 16, 2004

Type rating for Single engine land and sea

Specific pilot competence certificate

Expiration date of piloting capable period; — March 2, 2018

Class 2 aviation medical certificate

Validity — September 4, 2017

Total flight time — 1,209 hours 55 minutes

Total flight time on the type of aircraft — 1,076 hours 00 minutes

Flight time in the last 30 days — 13 hours 46 minutes

2.5 Aircraft information

(1) Type — Cessna T206H

Serial Number — T20608528

Date of Manufacture — April 6, 2005

Airworthiness Certificate — No. Dai-2016-688

Validity — March 2, 2018

Total Flight Time — 1,177 hours 11 minutes

(2) At the time of the accident, the weight of the Aircraft is estimated to have been 3,782 lb (maximum takeoff weight; 3,972 lb) and the position of the center of gravity was within the allowable range.

(3) Float size; approximately 7 m in length, approximately 0.8 m in height

2.6 Meteorological information

Observations according to the Matsue Meteorological Office

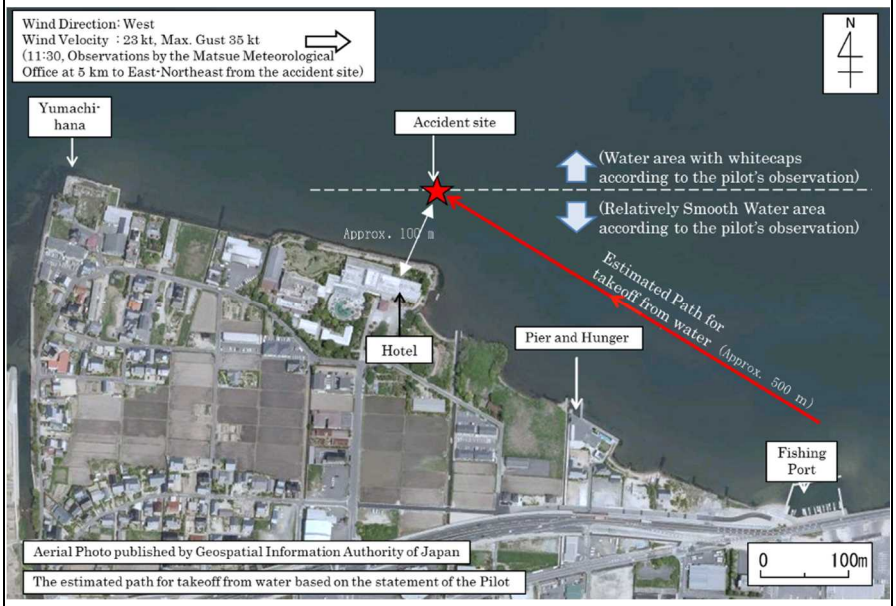
Clear weather; Temperature 21°C

Wind (wind velocity; conversion of m/s into kt)

Time	Wind Direction	Average Wind Velocity	Maximum Instantaneous Velocity
10:00	West-Southwest	8 kt	16 kt
30	West	11 kt	16 kt
11:00	West	14 kt	28 kt
10	West	18 kt	30 kt
20	West	20 kt	32 kt
30	West	23 kt	35 kt

2.7 Accident Site

The accident site was at Lake Shinji in Tamayu Town, Matsue City, Tottori Prefecture. The Aircraft commenced takeoff run from water heading to northwest at about 100 m offshore of the coast

	line. The Aircraft collided with wave when it entered the north-side water area of the cape (Yumachi-Hana), stopped, was drifted downwind (to east side) for about 1,500 m, and was sunk as the float separated while drifting.  **Fig. 1 Area Map of Accident Site**  **Fig. 2 Accident Site**
2.8 Additional Information	(1) Takeoff from water of the seaplane Concerning the seaplane procedure to takeoff from water, PP.4-3, 4-4, 4-5, 4-16, and 8-2 of U.S. DEPARTMENT OF FEDERAL AVIATION ADMINISTRATION Flight Standard Service "SEAPLANE OPERATIONS HANDBOOK", 2004, have the following descriptions; (Excerpts, adding Figure 4)

① Stage to take off from water

a. Idling Position

The engine is at idle rpm, the buoyancy of the floats supports the entire weight of the seaplane and it remains in an attitude similar to being at rest on the water.

b. Plowing Position

Commence to takeoff run from water as raising the seaplane's nose with the sterns sink farther into the water by setting the engine power for takeoff from water. The resistance at this moment reaches its peak.

c. On the step Position

Because increase in hydrodynamic lift generated on floats by water current. Hydrodynamic lift support the weight of the seaplane, the float essentially clear of water, continues to accelerate at condition of decreased water resistance, increases of lift generated at wings lift the Aircraft off.

Fig.3 Flow of Takeoff from Water

② Takeoff from rough water surface

Open the throttle to takeoff power just as the floats begin rising on a wave. This prevents the float bows from digging into the water. Apply a little more back elevator pressure than on a smooth water takeoff. This raises the nose to a higher angle and helps keep the float bows clear of the water.

Once on the step, the seaplane can begin to bounce from one wave crest to the next, raising its nose higher with each bounce, so each successive wave is struck with increasing severity. To correct this situation and to prevent a stall, smooth elevator pressures should be used to set up a fairly constant pitch attitude that allows the seaplane to skim across each successive wave as speed increases.

If the wavelength is less than half the length of the floats,

the seaplane is always supported by at least two waves at a time. If the wavelength is longer than the floats, only one wave at a time supports the seaplane. This creates dangerous pitching motions, and takeoff should not be attempted in this situation.

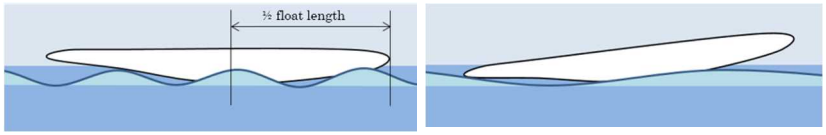


Fig. 4 Relation between waves and float

As a general rule, if the height of the waves from trough to crest is more than half the height of the floats from keel to deck, takeoffs should not be attempted except by expert seaplane pilots.

③ Evaluation of Sea water surface condition (hereinafter referred to as "Sea State")

Wind is the primary cause of ocean waves and there is a direct relationship between speed of the wind and Sea State in the immediate vicinity. Windspeed forecasts can help the pilot anticipate Sea State.

Table Relation between Wind Velocity and Sea State

BEAUFORT WIND SCALE WITH CORRESPONDING SEA STATE CODES

Beaufort Number	Wind Velocity (Knots)	Wind Description	Sea State Description	Sea State	
				Term and Height of Waves (Feet)	Condition Number
0	Less than1	Calm	Sea surface smooth and mirror-like	Calm, glassy 0	0
1	1-3	Light Air	Scaly ripples, no foam crests		
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Calm, rippled 0 – 0.3	1
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Smooth, wavelets 0.3-1	2
4	11-16	Moderate Breeze	Small waves, becoming longer, numerous whitecaps	Slight 1-4	3
5	17-21	Fresh Breeze	Moderate waves, taking longer form, many whitecaps, some spray	Moderate 4-8	4
6	22-27	Strong Breeze	Larger waves, whitecaps common, more spray	Rough 8-13	5
7	28-33	Near Gale	Sea heaps up, white foam streaks off breakers	Very rough 13-20	6
8	34-40	Gale	Moderately high, waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks		
9	41-47	Strong Gale	High waves, sea begins to roll, dense streaks of foam, spray may reduce visibility		
10	48-55	Storm	Very high waves, with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	High 20-30	7
11	56-63	Violent Storm	Exceptionally high waves, foam patches cover sea, visibility more reduced	Very high 30-45	8
12	64 and over	Hurricane	Air filled with foam, sea completely white with driving spray, visibility greatly reduced	Phenomenal 45 and over	9

Figure 8-1. Beaufort wind scale.

	(2) Performance to Takeoff from Water Calculating from Table "Takeoff Distance from Water" 9 in Chapter 5 "Performance" of POH, the takeoff run distance from water was 502 m and the total distance to clear 50 ft obstacle was 812 m under the following condition which is close to the corresponding condition to the time of the accident occurrence; Condition; Flap: 20º, Weight: 3,792 lb Headwind component: 16 kt Outside temperature: 20ºC, Water surface: Rippled (non-glassy) water

3. ANALYSIS

3.1 Involvement of weather	Yes
3.2 Involvement Of pilot	Yes
3.3 Involvement of equipment	None
3.4 Analysis of known items	(1) Meteorological effects Based on the observations at Matsue Meteorological office approximately 5 km east-northeast (downwind side) from the accident site, it is probable that after 11:00 the west wind was getting strong and the wind velocity was an average 20 to 23 kt during the accident time zone. Therefore, at the north side water area of the cape where wind waves could not be suppressed because of its landform, it is somewhat likely that big waves such as up to 8 ft (2.4 m) in height which is three times of float height had emerged based on the Table "Relation between Wind Velocity and Sea State". (2) Situation at takeoff from water According to the statement of the Pilot, it is highly probable that after starting the engine at the pier, the Aircraft commenced the takeoff run to Northwest direction from offshore water of the fishing port located about 300 m to southeast as starting point. According to the situation of the accident site, it is probable that the takeoff distance from water was about 500 m from the

position of commencing the takeoff till the position of the collision with wave. It is probable that right before this, because the Pilot felt a coming airborne, this acceleration of the Aircraft was almost same as the takeoff run distance from water (502 m) in POH. However, the takeoff distance from water in POH was total distance of the takeoff run distance from water to the airborne and the distance to clear 50 ft obstacle from the airborne, and this is estimated to be about 812 m as described in 2.8 (2).

It is probable that when the Aircraft was about to become airborne as performing about 500 m takeoff run from water, it is suffered damage because it collided with such a big wave which was too high to pass over.

(3) Judgment and action taken by the Pilot

It is probable that the Pilot did not consider carefully to the weight of the Aircraft which had fuel almost full with the passenger on board, based on his experiences till then, he assumed that it would become airborne with the takeoff run from water for about 300 m within relatively smooth water area along the east shore of the cape where the wind waves were suppressed by the landform of the upwind side, so he did not check the performance for the takeoff from water in POH in advance. Because of this, it is probable that the Pilot did not recognize that a distance to complete the takeoff from water include the distance to clear 50 ft high obstacle after being airborne and it requires the distance of about 812 m, and as a result, he commenced the takeoff run from water without securing the required distance for the takeoff.

According to these, it is probable that because the Pilot thought the Aircraft was already on the step position and he felt that becoming airborne was imminent even though he felt that the acceleration was worse than usual when approaching the rough water area with whitecaps, he did not reject the takeoff from water before the collision with big wave.

Furthermore, it is probable that because the wind was stronger around 11:00 when the Pilot commenced the boarding than the wind around 10:00 when he started the pre-flight preparation, the Sea State right before the takeoff from water was

	changed and the wave height at offshore become higher. However, it is somewhat likely that the Pilot did not recognize these changes. (4) Prevention of similar accidents Generally, In order to prevent accidents during a takeoff from water, the following measures shall be considered; ① After confirming the takeoff performance from water with due consideration to the weather condition of the day, Sea State, weight of aircraft and others, the water area where those requirements were satisfied shall be secured at the pre-flight. ② Prior to commencing takeoff run from water, the final decision shall be made for the takeoff from water after checking in detail whether the conditions like wind direction, wind velocity, Sea State and others were changed from the time of planning or not. ③ During takeoff run from water, the condition of aircraft, acceleration and others shall be confirmed, if any abnormality is felt, reject the takeoff from water, immediately.

4. PROBABLE CAUSES

In this accident, it is highly probable that the Aircraft suffered damage because it collided with big wave during the takeoff run from water.

Regarding to the collision with big wave during the takeoff run from water, it is probable that because the Pilot did not check the performance to takeoff from water in POH in advance and commenced the takeoff run from water without securing the required takeoff distance from water, and because the Pilot thought that becoming airborne was imminent when approaching the rough water area, he did not reject the takeoff from water before the collision with big wave.