

AA2015-5

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**PRIVATELY OWNED
J A 4 1 5 2**

May 28, 2015



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.

Norihiro Goto
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

CRASH DUE TO A STALL PRIVATELY OWNED BEECHCRAFT A36, JA4152 INTO THE GRASS ON THE SOUTH SIDE OF AMI AIRFIELD AMI TOWN, INASHIKI GUN, IBARAKI PREFECTURE, JAPAN AROUND 13:55 JST, AUGUST 18, 2013

April 24, 2015

Adopted by the Japan Transport Safety Board

Chairman	Norihiro Goto
Member	Shinsuke Endoh
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Yuki Shuto
Member	Keiji Tanaka

SYNOPSIS

< Summary of the Accident >

On Sunday, August 18, 2013, around 13:55 Japan Standard Time(JST, UTC+9hrs), a privately owned Beechcraft A36, registered JA4152, crashed into the grass on the south side of Ami Airfield when it approached runway27 and attempted a go-around.

The pilot and three passengers were on board the aircraft, and everyone sustained injuries.

The aircraft was destroyed, but there was no outbreak of fire.

< Probable Causes >

It is highly probable that this accident occurred as follows:

JA4152 stalled when it attempted a go-around with the low speed situation, in which the stall warning was actuating, during its flight of the final approach course. This caused the Aircraft to crash and to be destroyed; accordingly, all persons sustained injuries.

It is probable that the stall of the Aircraft occurred when the pilot attempted to maintain the level-flight attitude only with aileron operations without rudder operations when he increased the engine power, which resulted in him being unable to operate in such ways that the primary flight controls (ailerons, elevators and rudder) were well-coordinated and being unable to maintain the airplane direction and attitude.

This report uses the following abbreviations:

FAA : Federal Aviation Administration
GPS : Global Positioning System
NTSB : National Transportation Safety Board
RPM : Revolutions Per Minute
VFR : Visual Flight Rules

Conversion table

1kt(s) : 1.852km/h (0.5144m/s)
1ft : 0.3048m
1lbs : 0.4536kg
1nm : 1,852m

1. PROCESS AND PROGRESS OF AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On Sunday, August 18, 2013, at around 13:55 (JST : UTC+9hr, unless otherwise stated, all times are indicated in JST on a 24-hour clock), a privately owned Beechcraft A36, registered JA4152, crashed into the grass on the south side of Ami Airfield when it discontinued a final approach to the runway 27, and then attempted to execute a go-around.

The pilot and three passengers were on board the aircraft, and everyone sustained injuries. The aircraft was destroyed, but there was no outbreak of fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On August 18, 2013, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two investigators to investigate this accident.

1.2.2 Representatives of the Relevant State

An accredited representative of the United States of America, as the State of Design and Manufacture of the aircraft involved in this accident, participated in the investigation.

1.2.3 Implementation of the Investigation

August 19-21, 2013	On-site investigation, aircraft examination and interviews
August 26, 2013	Interviews
September 10, 2013	Engine power control system inspection
September 20-November 19, 2013	Function examination of engine driven fuel pump

1.2.4 Comments from the Parties Relevant to the Cause of the Accident

Comments were invited from the parties relevant to the cause of the accident.

1.2.5 Comments from the Relevant State

Comments on the draft report were invited from the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

On August 18, 2013, a privately owned Beechcraft A36, registered JA4152 (hereafter referred to as “the Aircraft”), took off from Matsumoto Airport for Ami Airfield (hereafter referred to as “the Airfield”) at 12:57, to conduct a familiarization flight, with the pilot in the front left seat and three passengers in the front right seat and rear seats.

The outline of the flight plan was as follows.

Flight rules: Visual flight rules

Departure aerodrome: Matsumoto Airport
Estimated off-block time: 13:15
Cruising speed: 130 kt
Cruising altitude: VFR
Route: Ueda — Kumagaya
Destination aerodrome: Ami Airfield
Total estimated elapse time: 1 hr 30 min
Fuel load expressed in endurance: 5 hr
Persons on board: 4

The history of the flight up to the accident is summarized as follows, according to the record of Handheld GPS device and the statements of the pilot, passengers on board, and witnesses.

2.1.1 History of the Flight based on the Handheld GPS Device Records and other records.

- 12:57 The Aircraft took off from Matsumoto Airport
- around 13:42 The pilot obtained the landing information for the Airfield from the Ami Flight Service.*1
- around 13:50 The Aircraft entered the traffic pattern of the Airfield from over Lake Kasumigaura.
- around 13:55 The Aircraft crashed into the grass on the south side of the Airfield.

2.1.2 Statements of the Persons Concerned

(1) Pilot

The pilot performed preflight inspection before the flight to Matsumoto Airport from the Airfield and there were no abnormalities. The fuel was filled after the flight on the previous day, and the pilot checked that the fuel amount was sufficient and that there was no water mixed in the fuel in the preflight inspection.

The Aircraft took off from the Airfield at 09:56 with the pilot and three passengers on board and landed in Matsumoto Airport at 10:59. After that, the Aircraft took off from Matsumoto Airport at 12:57 to return to the Airfield.

The pilot contacted with the Ami Flight Service about 15nm before the Airfield and obtained the landing information. Thereafter, the Aircraft entered the traffic pattern of runway 27 (hereafter referred to as “RWY 27”) in the Airfield from over Lake Kasumigaura, extended gears and flaps.

The Aircraft approached the extension of the runway centerline at the descent path of 3° in the final approach course.

The pilot felt that the wind condition was unstable. The Aircraft sank after being affected by wind before the runway threshold; therefore, the pilot raised the Aircraft’s nose by slightly pulling the control column and simultaneously added power but felt that there was no change in the engine power. Due to this, the approach path was higher than usual and the airspeed was also reduced, and the Aircraft horizontally flew over the runway 5-7m above the ground while the stall warning system was actuating.

*1 “Flight Service” refers to the radio station operated by the Airfield administrator. In order to have communications with aircraft regarding flight support.

When the Aircraft approached near the halfway of the runway and the remaining runway distance was about 2/3, the pilot became concerned about overrun and decided to attempt a go-around.

Although he moved the throttle lever to full power, there was no change in the engine sound, and he felt that the engine power did not increase at all.

After this, the pilot attempted to maintain the aircraft attitude only with the aileron operations to the right side without the right rudder operations despite the fact that the pilot felt the aircraft yawing to the left direction after being exposed to the gust from the right direction.

This is due to the fact that the pilot had thought that the rudder control immediately stops functioning if the airspeed reduces even though aileron control functions until the end.

The pilot considered the vapor lock *2 as the cause of the malfunction of engine but thought that vapor lock would be released if he kept the mixture lever, propeller lever, and throttle lever in the full positions.

The pilot did not retract flaps and gears at the time of a go-around and also kept the auxiliary fuel pump off. The Aircraft engine never stopped, and the pilot did not feel any aircraft abnormality aside from malfunction of engine.

The Aircraft kept yawing in the left direction while rolling to left and sliding sideways. The nose dipped, and the left wing first made contact with the ground while the stall warning system was actuating, and then the Aircraft crashed.

(2) Passenger A

Passenger A, who has a Private Pilot Certificate, was sitting in the left rear seat and saw another flying aircraft (aircraft operated by the later mentioned Witness A) in front of them near Lake Kasumigaura. The Aircraft entered the traffic pattern after this aircraft. Passenger A heard the stall warning horn was ringing when they entered the final approach course and thought that the pilot was reducing the airspeed to the minimum.

Passenger A saw the grass, which was on the left side of the runway, in the front of the Aircraft.

After this, Passenger A heard the Aircraft engine's sound increasing and thought that the pilot started a go-around due to the fact that the approach course veered to the left.

Although the Aircraft's nose-up attitude greatly increased, it did not climb. The Aircraft started to turn left while Passenger A also could not feel the aircraft accelerating. Passenger A thought that turning left in such circumstances would result in a stall.

(3) Passenger B

Passenger B, who was sitting in the right rear seat, had boarded small airplanes stationed in the Airfield many times, and he also had boarded the Aircraft several times.

*2 "Vapor lock" refers to partial or complete blockage of fuel flow caused by restricted fuel flow when fuel gasifies and turns into vapor inside of piping or pump in the system. There are three causes for the phenomenon, including ① reduced pressure on the fuel, ② increased fuel temperature, and ③ excessive disturbance of the fuel.(P-184 "Piston Engine" the Japan Aeronautical Engineers' Association issue)

Passenger B had confirmed that the altitude was reduced due to the pilot reducing the power too soon before the runway during the Aircraft's final approach to the Airfield and that the pilot increased the power again to correct the situation.

After this, Passenger B could recognized that the Aircraft's power increased and that the Aircraft attempted a go-around due to the fact that the engine sound became very loud in the similar manner as when touch and go*3 is performed. The Aircraft further yawed to the left direction, stalled without climbing, then crashed.

(4) Passenger C

It was the first time for Passenger C, who was sitting in the front right seat, to fly in the Aircraft; therefore, he is not very familiar with flying in general and does not remember well.

However, he was aware that the Aircraft was yawing in the left direction during the final approach, rather than staying on the extension of the runway centerline.

(5) Witness A

Although Witness A landed in the Airfield about three minutes before the accident occurrence, he felt that there was nothing particularly unusual when he heard the radio communication between the Aircraft and the Ami Flight Service in the air.

The situation in which Witness A approached the Airfield was wind direction 210° and wind velocity about 7-8 kt. Although there had been a slight airflow turbulence, the situation did not greatly affect the control. However, landing on RWY 27 in general sometimes causes wind to affect airframe on the final approach course due to the geological circumstances when there is side wind from south.

Witness A saw the Aircraft approaching the final approach course at the apron after his landing, but he did not feel that there was any particular abnormality.

Witness A clearly heard the Aircraft engine sound increasing after he entered the office from the apron; accordingly, he thought that the Aircraft started a go-around.

(6) Witness B

Witness B was engaged in Ami Flight Service in the office and provided the using runway 27, wind direction 160°, and wind velocity 5kt in response to the request for landing information by the Aircraft. Witness B saw the Aircraft, which was entering the traffic pattern but did not see a go-around being performed. He heard that the engine sound of the Aircraft became very loud in the office.

(7) Witness C

Witness C was in the refueling area on the south side of the runway and was preparing to fuel the Aircraft after it landed while watching the landing approach of the Aircraft. The Aircraft veered from the course along the extension of the runway centerline and was flying toward Witness C on the final approach. After that, Witness C saw the Aircraft tilting to the left slightly before above his head, the nose dropping, and the Aircraft rapidly tilting as if to suddenly collapse and falling beyond the woods.

*3 "Touch and Go" refers to the flying method in which a landed aircraft immediately accelerates and takes off after landing without stopping on the runway. It is mainly used in takeoff/landing training.

This accident occurred into the grass about 140m south of the Airfield (36°01' 20" N and 140°15' 55" E) and the time of this accident was around 13:55 on August 18, 2013.

(See Figure 1 Estimated Flight Route and Accident Site Layout)

2.2 Injuries to Persons

The pilot and one passenger in the rear seats sustained serious injuries with bone fractures, and the other passengers sustained minor injury with bruises and sprains.

2.3 Damage to the Aircraft

2.3.1 Extent of Damage

The aircraft was destroyed

2.3.2 Damage to the Aircraft Components

- (1) Fuselage: Damage to the front lower section
- (2) Wings: Damage to the right wing, damage to the leading edge at the end of the left wing
- (3) Engine: Damage. Especially major damage to the right lower section
- (4) Propeller: Damage to all three blades
- (5) Landing gears: Breakage to the right main landing gear and the nose landing gear



Photo: Accident Aircraft

(Taken after mowing the weeds around the aircraft)

2.4 Personnel Information

Pilot: Male, Age 62

Private Pilot Certificate (Airplane)	November 7, 2003
Type rating for Single Engine Piston Land	November 7, 2003
Class 2 aviation medical certificate	
Validity	October 17, 2013
Total flight time	776 hr 30 min
Flight time in the last 30 days	2 hr 40 min

Flight time on the type of airplane 563 hr 00 min
 Flight time in the last 30 days 2 hr 40 min

(The total flight time and the flight time on the type of airplane are according to the pilot's memory. The flight time in the last 30 days is according to the record in the Aircraft flight log book.)

2.5 Aircraft Information

2.5.1 Aircraft

Type Beechcraft A36
 Serial number E-2682
 Date of manufacture December 2, 1991
 Certificate of airworthiness Dai-Tou 24-419
 Validity December 4, 2013
 Category of airworthiness Airplane Normal N or Utility U
 Total flight time 5,789 hr 55 min
 Flight time since last periodical check
 (100 - hour inspection on November 20, 2012) 37 hr 55 min
 (See Figure 2 "Three Angle View of Beechcraft A36")

2.5.2 Weight and Balance

When the accident occurred, the weight of the Aircraft was estimated to have been about 3,400 pounds, and that the position of center of gravity (CG) was estimated to have been at 82 inches aft of the reference line. It is therefore highly probable that both the weight and the center of gravity were within the allowable range (the maximum take-off weight of 3,650 pounds; the CG range that corresponds to the weight at the time of the accident: 77.7 to 87.7 inches).

2.5.3 Fuel and Lubricating Oil

The fuel was aviation gasoline 100 and the lubricating oil was Exxon ELITE MIL-L-22851.

2.6 Meteorological Information

- (1) The weather conditions at the Airfield at the time of the accident were clear, with good visibility, and without clouds that would affect the landing approach.
- (2) The wind direction and wind velocity observed by the anemometer located on the roof of the airfield office were 160° and 5 kt at around 13:42.
- (3) The weather observations at the Ami Fire Defense Headquarters located about 4.6 kilometers west-southwest of the Airfield around the time of the accident were as follows:

Table: Wind direction/wind velocity records (21 m above sea level)

Time	13:30	13:35	13:40	13:45	13:50	13:55	14:00
Average wind direction	South-southwest	South-southwest	South	South-southwest	South	South-southwest	South-southwest
Average wind velocity (kt)	12.0	11.3	10.9	10.7	9.7	9.9	9.5
Maximum instantaneous wind velocity (kt)	20.6	20.6	19.8	18.5	18.3	18.3	16.5

2.7 Details of the Accident Site and Damage

2.7.1 The Accident Site Description

The Airfield is a non-public airfield*⁴, and there are many privately owned aircraft parked here. The Airfield is located about 20 m above sea level, and the runway is paved at 600 m in length and 25m in width. There are stopway areas of 60 m on either end. In addition, runway designation marking of 09/27 representing the runway direction, runway centerline marking, and taxiway centerline marking are located on the runway.

The accident site is located about 12 m above sea level and was a soft grassy area surrounded by woods on about 140m the south side of the Airfield.

The Aircraft halted with the nose facing east (about 80° in the magnetic bearing), which was the opposite direction from the approach direction.

(See Figure 1 “Estimated Flight Route and Accident Site Layout”)

2.7.2 Details of Damage

(1) Fuselage

The front lower section was damaged, but there was no damage to the rear fuselage.

(2) Wings

The right wing suffered buckling damage, and the left wing suffered major damage to the leading edge near the wing tip. The flaps were in the down (full down position within 3 levels) position.

(3) Engine

Structural parts in the lower engine part suffered major damage, and the damage around the right side cylinders was especially great. The engine mount was broken.

(4) Propeller

All of the three blades were bent backwards and damaged.

(5) Landing gears

Nose landing gear was broken back toward the left, and the right main landing gear was broken inward. However, no major damage was found in the left main landing gear, and it was locked in the down position.

(See Photo : Accident Aircraft)

2.8 Test and Research

2.8.1 Inspection of the Airframe and Engine Systems

Filters of the Aircraft engine systems (oil, fuel, induction air) were checked, but no abnormality was found. The lubricating oil was no contamination such as foreign metal. Wiring and ignition plug status inspection was conducted for the engine ignition system, but no abnormality was found.

In terms of the engine power control system, the movements of the throttle lever and mixture lever in the cockpit were smoothly communicated to the engine side without restriction. No abnormality was found.

When the remaining fuel was extracted from the Aircraft, its quantity was approximately the same as the calculated quantity, which was gained by deducting the quantity corresponding to the flight time on the day of the accident from the estimated fuel quantity before the flight. No

*⁴ “Non-public airfield” refers to airfield that can only be used by those who have been permitted by the Airfield administrator.

abnormality was found in its quality, and there was no water mixed in the fuel, either.

2.8.2 Examination on the Vapor Lock

With the cooperation of NTSB (United States National Transportation Safety Board) and the engine manufacturer, engine driven fuel pump overhaul inspection and function examination were conducted. However, no abnormality that would cause the vapor lock described in 2.1.2(1) was found.

In addition, the engine manufacturer reported that there is no report of the vapor lock with the naturally-aspirated engine*⁵, which is installed in the Aircraft, at low altitude.

2.9 Additional Information

2.9.1 Analysis of the Handheld GPS Installed in the Aircraft

The handheld GPS device installed in the Aircraft recorded the flight route, altitude, and time information leading to the accident regarding the Aircraft's flight on the day of the accident. (See Figure 1 "Estimated Flight Route and Accident Site Layout")

2.9.2 Guidance on Private Pilot Competency Retention

The notification (Koku-Ku-Jo No.2077 dated March 28, 2003) from the Division Direction of the Civil Aviation Bureau titled "Guidance on Private Pilot Competency Retention" states as follows.

It is highly recommended that Private pilots should actively make efforts to retain their competency, using this guidance as a basic reference.

1. Training workshop for aviation safety

(1) Private pilots should attend a workshop for aviation safety within two years prior to its flight to try to acquire knowledge on safety and enhance safety awareness.

(2) Those private pilots who had their foreign certificates converted to corresponding Japanese versions should attend a workshop for aviation safety promptly following the conversion to try to acquire knowledge on safety and enhance safety awareness.

(The rest is omitted)

2. Recent flight experience

(1) If the private pilot has less than three takeoff/landing experiences using the same category or class of aircraft as the said aircraft within 180 days prior to its flight, the pilot should try to retain his competency by receiving practical training (including training using the flight simulation or the flight training device approved by the Civil Aviation Bureau)

(The rest is omitted)

The pilot had his foreign certificates converted to Japanese private pilot certificate and attended the training workshop for aviation safety in March of 2005, but he had not attended it since then.

In addition, part of the Civil Aeronautics Act was amended on May 25, 2011, and the Pilot Competency Assessment System*⁶, which aims to maintain Pilots' competency and improve

*⁵ "Naturally-aspirated engine" refers to engines that take in air within the cylinder in the atmospheric pressure (natural air intake) without using a supercharging machine (device that compresses the inflow air), such as turbo-chargers, superchargers, etc.

*⁶ The "Pilot Competency Assessment" is a form of competency assessment conducted within two years preceding a flight on those holding a Pilot Competency Certificate issued by the Minister of Land, Infrastructure, Transport and Tourism. The oral test covers the subjects of recent revised aviation law and the knowledge and learning to be

their competency, was introduced. This system specifies that those possessing a Pilot Competency Certificate must not operate such as aircraft, unless they have passed the assessment by pilot competency assessors within two years prior to the flight to determine whether or not they possess necessary knowledge and skills to operate aircraft.

This system has been in effect since April 1 of 2014, but equivalent assessment had been conducted since April 1 of 2012 as a transitional measure prior to this. Those who have received the equivalent assessment were considered to have passed the Pilot Competency Assessment System after April 1 of 2014. The pilot had not received the equivalent assessment when this accident occurred.

2.9.3 Airspeed for Safe Operations

The airplane flight manual of the Aircraft includes the following descriptions regarding the airspeed for safe operations.

(Excerpt)

Section IV Normal Procedures

1. Airspeeds for safe operations (3,650 LBS)

(Some portions omitted)

Landing approach

Flaps DOWN (30°) 79 kts

Flaps UP (0°) 90 kts

Balked Landing Climb 80 kts

The final approach airspeed at the time of the accident with the Aircraft weight being about 3,400 lbs described in 2.5.2 was 80 kt.

2.9.4 Go-around

- (1) The airplane flight manual includes the following description regarding a go-around maneuver (excerpt)

BALKED LANDING

a. Throttle FULL THROTTLE, 2,700 RPM

b. Mixture FULL RICH

c. Airspeed 80 kts

(Until clear of obstacles, then trim to normal climb speed.)

d. Flaps UP (0°)

e. Landing Gear RETRACT

f. Cowl Flaps OPEN

- (2) The following description is included in the "Airplane operation textbook" (P-116 the third

regularly reviewed. The practical test covers pre-flight procedures and basic competency such as traffic pattern flight and takeoff/landing, as well as knowledge on non-normal and emergency procedures.

edition of Japan Civil Aviation Promotion Foundation issue) for go-around procedures:

4.4 Go-around

(Some portions omitted)

(1) Go-around maneuver and the guidelines

(Some portions omitted)

- a. *While maintaining the direction, increase the power to full. Maintain the safe rising attitude for the pitch.*

Smoothly open the throttle to the full open position while simultaneously holding the control column to maintain the nose in the safe climb attitude and maintain the direction with the rudder in order that the nose does not yaw left or right. When doing so, attention must be paid to the airspeed and the attitude.

- b. *Maintain the Safe rising and conduct trim control^{*7}.*

The trim is already adjusted in order that it is suitable for landing on the final approach ; accordingly, the column pressure changes if the power and airspeed increase. Conduct trim control to remove this pressure while maintaining the safe climb attitude.

- c. *When the aircraft reaches the safe altitude and safe speed, retract the gears.*

After the trim control is completed and the airplane reaches the safe altitude and speed, retract the gears. Gear retract operation should be done after the safe climb attitude is established and the airplane is no longer sinking and must not be done in a hasty manner. During operation, sufficient attention must be paid to the airspeed in order that the airplane does not stall.

- d. *When the airplane reaches a suitable altitude (altitude prescribed in the airplane flight manual), retracted flaps.*

If flaps were extended, retract the flaps. When retracting the flaps, be sure to thoroughly comply with the altitude limit and the speed limit. When flaps are retracted, the lift (and drag) reduces and the nose down. The altitude also tries to lower. Therefore, apply plenty of back pressure to the control column (pull the control column backward for support) and maintain the climb attitude.

- e. *Set the airplane to straight and climbing and control the trim again.*

Control the trim again to the climbing configurations, establish the climb attitude, and fly according to the following plan.

A go-around requires quick and continuous operations; accordingly, the pitch attitude and airspeed tend to be disrupted in a hurry. Be sure not to panic, keep calm, and thoroughly follow the correct procedures. Report to the control tower after a safe attitude is established. Since the gears and the flaps on the airplane, the nose tends to try to up in full power.

Therefore, thoroughly maintain the flight control and first attempt to stabilize the airplane's attitude.

2.9.5 Stall

(1) Stall speed and stall warning of the Airplane

^{*7} "Trim control" refers to the reduction of the steering force on the piloting system and stabilization of the flight attitude by adjusting the aerodynamic force against the control surface by moving the small control surface installed on the main control surface with an independent operation system.

According to the airplane flight manual of the Aircraft, the stall speed in the level-flight attitude at the time of the accident with the estimated aircraft weight (about 3,400 lbs) was about 60 kt.

The stall warning system of the Aircraft warns the pilot that the aircraft is in the stalling state or approaching the stalling state by the sensor (stall warning vane) located on the leading edge of the left wing operating and generating the alarm.

The flight test procedures by the aircraft manufacturer mention that the stall warning actuates 5-10 kt before the stall speed, and it included the record regarding the stalling performance of the Aircraft that the stall warning was actuated at 68kt and stalled at 58 kt in the power-off condition with the aircraft weight of about 3,340 lbs at the time of the airworthiness certificate inspection in the previous year.

(2) Use of aileron and rudder in the recovery operations from a stall

The “Airplane Flying Handbook” (2004) issued by the FAA (Federal Aviation Administration) includes the following description regarding the recovery operation from a stall.

It should be noted, the description shown in this quote describes the opposite direction situation from the situation in the accident of the Aircraft.

(Excerpt)

USE OF AILERON / RUDDER IN STALL RECOVERY

Using the ailerons requires finesse to avoid an aggravated stall condition. For example, if the right wing dropped during the stall and excessive aileron control were applied to the left to raise the wing, the aileron deflected downward (right wing) would produce a greater angle of attack (and drag), and possibly a more complete stall at the tip as the critical angle of attack is exceeded. The increase in drag created by the high angle of attack on that wing might cause the airplane to yaw in that direction. This adverse yaw could result in a spin unless directional control was maintained by rudder, and / or the aileron control sufficiently reduced.

Even though excessive aileron pressure may have been applied, a spin will not occur if directional (yaw) control is maintained by timely application of coordinated rudder pressure. Therefore, it is important that the rudder be used properly during both the entry and the recovery from a stall. The primary use of the rudder in stall recoveries is to counteract any tendency of the airplane to yaw or slip. The correct recovery technique would be to decrease the pitch attitude by applying forward-elevator pressure to break the stall, advancing the throttle to increase airspeed, and simultaneously maintaining directional control with coordinated use of the aileron and rudder.

The above describes the importance of the “coordinate of primary flight controls (ailerons, elevators, and rudder)” in recovery procedures from a stall.

2.9.6 Propeller effect of the single-engine airplane

When the engine power of propeller rotating clockwise single-engine airplane, such as the Aircraft, is suddenly increased, the following propeller effects on flight characteristics suddenly and significantly occur due to the synthetic force of the engine and propellers. Therefore, attention must be paid.

(1) Influence of Slipstream impact

Spiraling slipstream (propeller slipstream) is created by

the propeller, and it flows rearward along the fuselage. Spiraling slipstream generated by a propeller rotating clockwise eventually strikes the left face of the vertical stabilizer, yawing the nose of the airplane to the left. The force becomes stronger at low forward speed and high propeller speed, as in a takeoff or go-around.

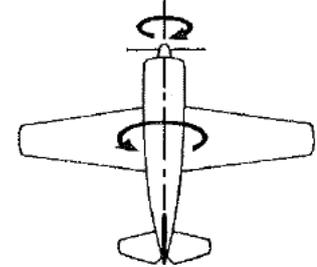


Excerpt from Pilot's Handbook of Aeronautical Knowledge, FAA

Figure1 "Propeller slipstream"

(2) Influence of Torque reaction

The propeller is revolved by the engine in the same direction of rotation as the engine. In reaction to this rotation force, the counter torque that is generated tries to rotate the airplane around the longitudinal axis in the direction opposite to the engine rotation. With right rotating propeller airplane, the force to tilt the airplane in the left direction works. The force becomes stronger at low forward speed and high propeller speed.

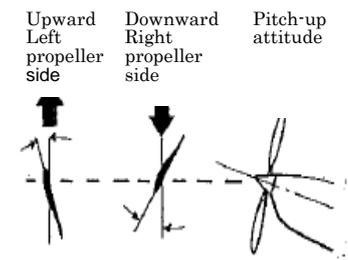


Excerpt from "Aerodynamics I", the Japan Aeronautical Engineers' Association

Figure 2 "Torque reaction"

(3) Influence of the P-Factor

If the airplane attitude has a raised nose with high engine power, the angle of attack on the propeller and the relative wind on the propellers become greater on the right propeller side, which rotates downward on the propeller rotation surface, than the left propeller side in addition to the above force. The thrust generated on the right propeller side increases; accordingly, the force to yaw the nose in the left direction becomes greatly effective. This force becomes more greatly effective the more the engine speed and the greater the pitch-up attitude. Such asymmetric loading of the propeller between left and right propeller rotation surfaces is called the P-Factor. It becomes greatly effective when the airplane is flying at a low speed with high power, affecting the aircraft attitude.



"Airplane Operation Textbook" published by the Japan Civil Aviation Promotion Foundation

Figure 3 "P-Factor"

2.9.7 Engine Power and Excess Horsepower

"Aerodynamics" (second edition P-114 : Aeronautical engineering seminar I) published by the Japan Aeronautical Engineers' Association includes the following descriptions and relevant diagrams regarding the relationship between engine power and excess horsepower.

(Excerpt)

When the utilized horsepower and required horsepower curves are overlapped on one diagram, it shows the relationship described in the figure (Figure 4).

(Some portions omitted)

Excess horsepower is utilized for acceleration if the altitude is maintained at a certain level, and it is utilized for

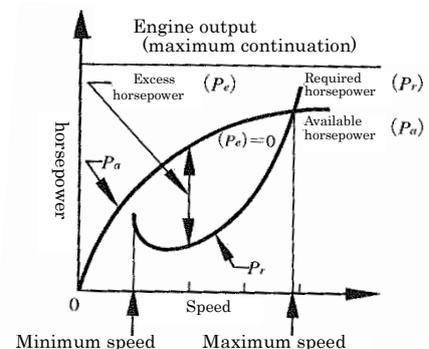


Figure 4 "Curves of available/required horsepower and excess horsepower"

rising if the altitude is not maintained at a certain level.

Excess horsepower is the difference between the utilized horsepower and the required horsepower at a certain speed. As shown in Figure 4, the required horsepower increases and utilized horsepower reduces in area close to the minimum speed (stall speed); Consequently, the excess horsepower reduces.

3. ANALYSIS

3.1 Qualification of Flight Crew

The pilot held valid airman competence certificate and valid aviation medical certificate.

3.2 Airworthiness Certificate

The Aircraft had a valid airworthiness certificate and had been maintained and inspected as prescribed.

3.3 Effects of Meteorological Conditions

As described in 2.6, the weather conditions at the Airfield at the time of the accident were clear, with good visibility, and without clouds that would affect the landing approach. As described in 2.1.2(5), according to the statement of Witness A, who landed in the Airfield immediately before the accident, it is highly probable that the wind direction and wind velocity were 210° and 7-8 kt, respectively. This was cross wind component from the left side at about 6-7 kt.

According to the statements of the pilot and witness A described in 2.1.2(1) and 2.1.2(5), it is somewhat likely that the wind was disturbed due to geological effects on the final approach course of the Airfield. However, it is probable that it was not enough to make the pilot's approach operations difficult.

In addition, south or south-southwest wind was prevailing on the day of the accident, and large variations in wind direction were not observed. Therefore, it is probable that the gust from the right direction (north), which was felt by the pilot when he started a go-around, described in 2.1.2(1) did not occur.

3.4 Airframe and Engine Status

As described in 2.1.2, Passengers A and B as well as Witnesses A and B heard the increased engine sound when the Aircraft was attempting a go-around.

Regarding the vapor lock, which the pilot considered as one of the possible causes for the malfunction of engine, due to the above increased engine sound, inspection and test results for relevant components described in 2.8.2, and the opinion of the engine manufacturer, it is highly probable that the vapor lock did not occur.

In addition, as described in 2.8.1, no abnormality was found in the Aircraft's airframe or engine systems; therefore, it is probable that the engine was normal.

3.5 Development of the Accident

3.5.1 Final Approach Speed and Course

As described in 2.1.2(2), Passenger A stated that the Aircraft's stall warning was ringing over

the final approach course of the Airfield.

As described in 2.9.5(1), the stall speed of the Aircraft in the level-flight attitude at the time of the accident with the estimated aircraft weight was about 60 kt. In addition, the Aircraft's stall warning system actuates 5-10 kt before this stall speed; accordingly, it is highly probable that the final approach airspeed of the Aircraft was less than 70kt, which was smaller than the final approach airspeed described in 2.9.3.

After that, according to the pilot's statement in 2.1.2(1), the Aircraft horizontally flew from the final approach course of the Airfield to the Airfield sky while the stall warning system was actuating. It is highly probable that the airspeed further decreased as a result before the go-around maneuver was started and that the Aircraft was flying in an unstable manner at a low speed.

In addition, according to the statements in 2.1.2(2), (4) and (7), and the flight route information retained in the handheld GPS device described in 2.9.1, it is highly probable that the Aircraft yawed away from the extension of the runway centerline in the final approach course.

From these, it is somewhat likely that normal landing was difficult for the Aircraft due to the airspeed, which was significantly smaller than the normal final approach airspeed, and the yawing of the path in the final approach course. Therefore, it is probable that the situation required the pilot to decide to attempt a go-around at an early stage with enough time by prioritizing safety.

3.5.2 Go-around maneuver

It is highly probable that the pilot increased the engine power from an extreme slow state, in which the stall warning system was actuating, but it is highly probable that the Aircraft's excess horsepower was little with reduced acceleration and climbing capabilities even when the Aircraft's engine is shifted to full power, as described in 2.9.7.

It is probable that the "propeller effect of the single-engine airplane," which was described in 2.9.6, suddenly and greatly became effective and that the Aircraft started to bank and yaw in the left direction. However, it is highly probable that the pilot attempted to maintain the Aircraft's horizontal attitude only with aileron operations on the right side without stepping on the right side rudder pedal. It is probable that this operation by the pilot was affected by the pilot's incorrect knowledge of stall recovery operations and lack of understanding regarding the importance of right rudder operation to respond to the propeller effect.

It is probable that the primary flight controls (ailerons, elevators and rudder) were not well-coordinated in the Aircraft's flying status due to the pilot's recovery operations.

In addition, it is somewhat likely that the yawing to left of the airframe at the beginning of the go-around, which the pilot stated was due to the gust from the right side described in 2.1.2(1), was due to this propeller effect.

3.5.3 Process of the Flight up to the Complete Stall

Near the left wing tip of the Aircraft, the angle of attack in the appearance increased due to the synthesized force of the wind from below and wind from ahead as it banked in the left direction in addition to the increase of the angle of attack on the wing on the side that dipped due to the careless aileron operations during a stall, which is described in 2.9.5(2), resulting in the stall angle being surpassed; it is probable that the Aircraft further banked in the left direction. On the other hand, it is somewhat likely that the angle of attack decreased for the right wing, which was raised, due to the synthetic force of the wind from the above and wind from ahead, resulting in its distance away from the stall angle.

It is probable that the decreasing of the lift and sudden increase of the drag simultaneously occurred in the dipped left wing of the Aircraft, that the aircraft experienced rolling and yawing in the left direction, and that the overall airframe entered a stall condition (complete stall) while these effects were escalating.

As a result, it is highly probable that as a result, the airframe attitude of the Aircraft rapidly shifted in the left direction as mentioned in Witness C's statement, which is described in 2.1.2(7).

3.5.4 Lack of Awareness and Understanding that May Have Affected the Pilot Maneuvering

As described in 2.1.2(1), the pilot attempted to respond to the banking/yawing of the Aircraft in the left direction only with the aileron operations to the right side without the right rudder operations when he started a go-around. The reason for this was that the pilot had thought that it was possible to control the attitude until the end with aileron operations, even though the rudder first stopped effectiveness as the airspeed decreased.

However, as described in 2.9.5(2), aileron must not be used in a careless manner in order to maintain the level of the wings while there is not sufficient airspeed such as during stall recovery operations therefore, the rudder must be used in an effective manner. As the airspeed decreases, flight control system starts to lose effectiveness in the order of ailerons, elevators, and rudder. In the recovery from a stall, the effectiveness starts to appear in the reverse order. When attempting a go-around, the nose direction must thoroughly be maintained with the rudder operations while paying attention to the airspeed and airframe attitude by following the procedures in the airplane flight manual, which are described in 2.9.4.

It is highly probable that the pilot maneuvering were affected by the pilot's incorrect awareness regarding stall recovery operations and lack of understanding regarding the propeller effect. It is probable that the recovery from a stall and a go-around procedures were inappropriate for the Aircraft.

3.6 Private Pilot Competency Retention

Private pilots have fewer opportunities to constantly maneuver aircraft. It is highly recommended that they should actively make efforts to gain knowledge and especially retain their competency for safety maneuvering, as described in 2.9.2.

The Review System on Pilot Competency Assessment, which came into effect on April 1, 2014, objectively assesses the knowledge and competency for safety operation; therefore, it is a good opportunity for those who are assessed to also review their knowledge and competency in a calm manner.

However, although competency confirmation regarding a go-around, which is relevant to this accident, is set as one of the practical test subjects, it is also possible to confirm the procedure by oral test. In addition, there is no subject set for the practical test regarding stalling or its recovery operations. In the case of private pilots, after they are trained on the subject as part of the test items to acquire the certificate, it is probable that they have few opportunities to undergo training regarding stalling or its recovery operations.

Due to these perspectives, it is highly recommended that they should actively make efforts to gain knowledge for safety operation by receiving workshops for safety operation, or a practical training, as described in 2.9.2. Regarding the competency retention, even if a pilot passes the Review System on Pilot Competency Assessment, there is as much time as two years maximum before the next review. Therefore, they should actively make efforts to retain their competency by

referring to the “Guidance on Private Pilot Competency Retention,” which is described in 2.9.2, even if the Pilot Competency Assessment is still valid.

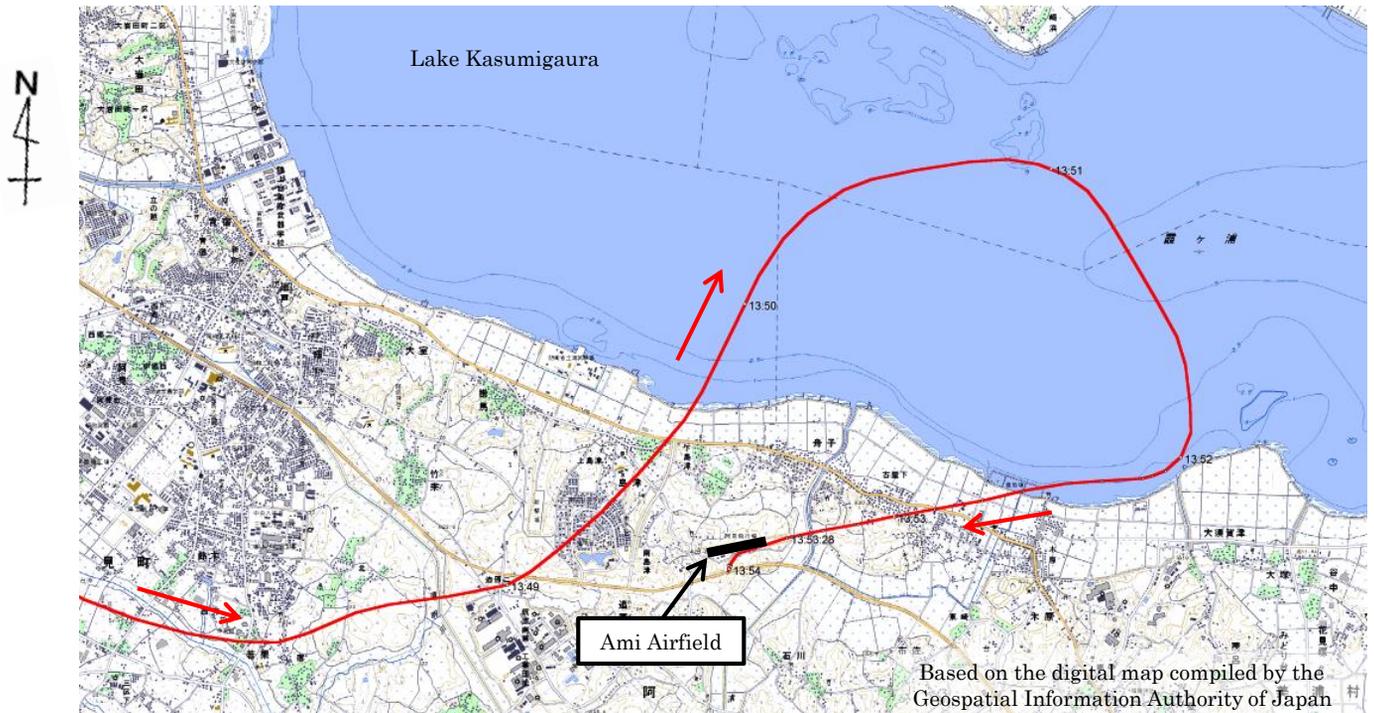
4. PROBABLE CAUSES

It is highly probable that this accident occurred as follows:

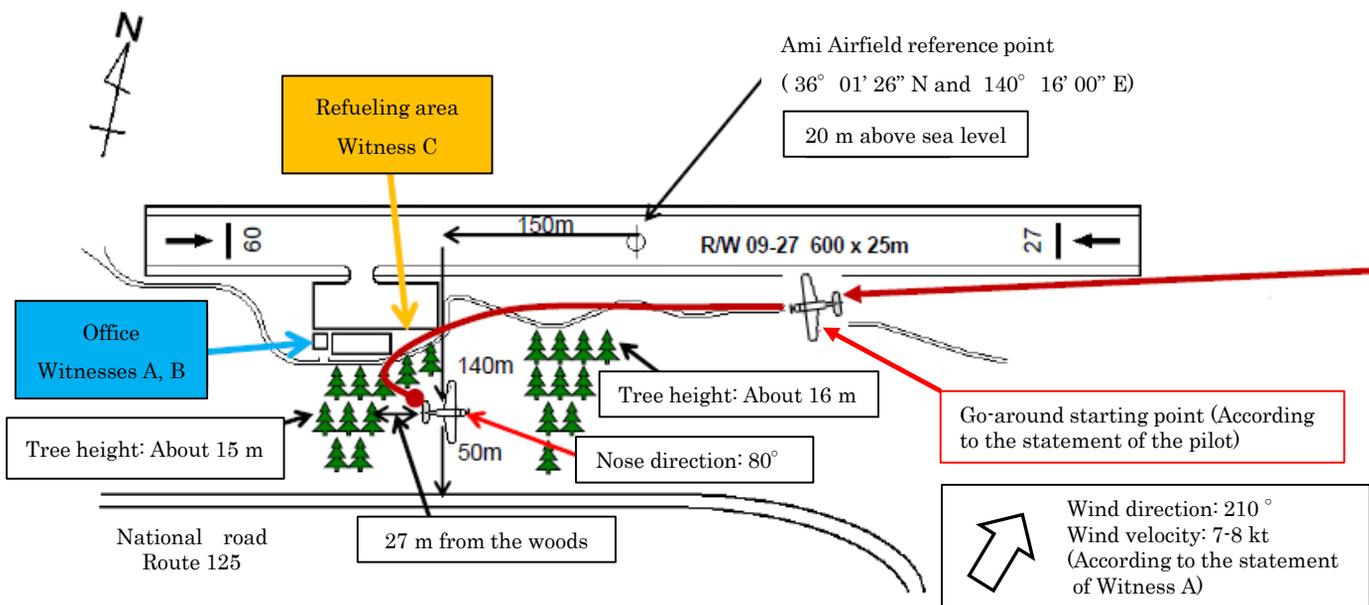
The Aircraft stalled when it attempted a go-around with the low speed situation, in which the stall warning was actuating, during its flight of the final approach course. This caused the Aircraft to crash and to be destroyed; accordingly, all persons sustained injuries.

It is probable that the stall of the Aircraft occurred when the pilot attempted to maintain the level-flight attitude only with aileron operations without rudder operations when he increased the engine power, which resulted in him being unable to operate in such ways that the primary flight controls (ailerons, elevators and rudder) were well-coordinated and being unable to maintain the airplane direction and attitude.

Figure 1 Estimated Flight Route and Accident Site Layout



< According to the handheld GPS device records >



< According to the handheld GPS device records and the statements of the witnesses >

Figure 2 Three Angle View of Beechcraft A36

Unit: m

