

AA2006-4

AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATERY OWNED
PIPER J3C-65, G-KIRK
KANAZAWA CITY, ISHIKAWA PREFECTURE
OCTOBER 21, 2005

September 29, 2006

Aircraft and Railway Accidents Investigation Commission
Ministry of Land, Infrastructure and Transport

The investigation for this report was conducted by Aircraft and Railway Accidents Investigation Commission, ARAIC, about the aircraft accident of Privately Owned Piper J3C-65,G-KIRK in accordance with Aircraft and Railway Accidents Investigation Commission Establishment Law and Annex 13 to the Convention of International Civil Aviation for the purpose of determining cause of the aircraft accident and contributing to the prevention of accidents and not for the purpose of blaming responsibility of the accident.

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Junzo Sato,
Chairman,
Aircraft and Railway Accidents Investigation Commission

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PRIVATELY OWNED
PIPER J3C-65, G-KIRK
KANAZAWA CITY, ISHIKAWA PREFECTURE
OCTOBER 21, 2005, APPROXIMATELY 13:08 JST

August 22, 2006

Decision by the Aircraft and Railway Accidents Investigation Commission
(Air Sub-committee Meeting)

Chairman Junzo Sato
Member Yukio Kusuki
Member Susumu Kato
Member Noboru Toyooka
Member Yukiko Kakimoto
Member Akiko Matsuo

1. PROCESS AND PROGRESS OF THE ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On October 21, 2005, a privately owned Piper J3C-65, G-KIRK, took off from Niigata Airport for a leisure flight. While flying toward Hiroshima Airport, the aircraft suffered engine trouble. At approximately 13:08 JST, the aircraft made an emergency landing on a road in Kanazawa City.

Only the pilot-in-command was on board the aircraft. He suffered slight injuries.

The aircraft was destroyed, but there was no post-crash fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigative Organization

The Aircraft and Railway Accidents Investigation Commission assigned one investigator-in-charge and one investigator to the accident on October 21, 2005. On April 1, 2006, the investigator was replaced owing to personnel reassignment.

1.2.2 Accredited Representative Participating in the Investigation

An accredited representative of the United Kingdom, the country of registration of the aircraft involved in the accident, took part in the investigation.

1.2.3 Implementation of the Investigation

October 21 to 24, 2005	On-site investigation and interviews
November 8, 2005	Teardown examination of the engine
November 14, 2005 to January 17, 2006	Analysis of composition of fuel and lubricating oil
March 28, 2006	Endoscope examination of inside of fuel tank

1.2.4 Interviews with the Organizations Relevant to the Cause of the Accident

Interviews were held with personnel of the organizations relevant to the cause of the accident.

1.2.5 Comment from the Country of Participating Investigation

Comment was invited from the country of registration of the aircraft involved in the accident.

2. FACTUAL INFORMATION

2.1 History of the Flight

On October 21, 2005, a privately owned Piper J3C-65 (dubbed “Cub”), G-KIRK (hereafter called “the aircraft”), took off from Niigata Airport at 10:44 JST for a leisure flight with one person (the pilot-in-command) on board. It then flew toward its destination, Hiroshima Airport. The aircraft had flown to Japan as part of a round-the-world journey.

An overview of the flight plan filed with the Niigata Airport Office of the Tokyo Regional Civil Aviation Bureau is as follows:

Flight rules:	Visual flight rules (VFR)
Departure aerodrome:	Niigata Airport
Off-block time:	10:30 JST
Cruising speed:	70 knots
Cruising altitude:	VFR
Route:	KMC (Komatsu VORTAC) - Tajima - Hiroshima
Destination aerodrome:	Hiroshima Airport
Total estimated elapsed time:	6 hours
Endurance:	8 hours
Number of persons on board:	1

According to verbal statements from the pilot-in-command and eyewitnesses, the sequence of flight operations ending with the crash was as outlined below.

2.1.1 Pilot-in-Command (British)

(1) Flight Ending with the Crash

I was flying on a more-or-less straight-line route from Niigata toward Hiroshima. In the vicinity of Toyama Prefecture, the engine misfired and stopped. The problem felt like a blocked fuel line, not like carburetor icing. I performed the operations that are normally performed in the event of engine stoppage, such as carburetor and mixture checks. I also switched the fuel tank from the front tank (in the nose) to the high tank (in the wings) in order to apply more pressure to the fuel supply system, whereupon the engine restarted. The aircraft’s position was approximately 30 miles from Komatsu Airport at an altitude of 1,000 – 1,500 feet.

The engine subsequently ran without problems, but I took a route close to the coast in case of an emergency landing. On the day of the accident, I had to go to South Korea via Hiroshima, so I believe my judgment was affected by get-homeitis (a mental state in which a pilot tries to reach his/her destination on schedule at all costs, which has been the cause of many accidents).

A hill was ahead of the aircraft, but it was hard to see because of mist. However, I

thought there would probably be a place where I could land if something untoward happened. Upon passing over the hill, I saw a forest and noted that there was no place where I could make an emergency landing. While I was considering whether to continue to Hiroshima or turn back, the engine stopped again. The altitude at this time was 1,200 – 1,500 feet. After immediately switching fuel tanks, I visually determined that the height above the ground was only about 700 feet so I descended at a reduced speed in order to improve the glide ratio. At approximately 600 feet above the ground, the engine started but the reason was not clear. Should the engine have continued to run, the aircraft could have continued flying, but there might have been no place for an emergency landing should the engine have malfunctioned. I thus decided that continued flying was dangerous. During the descent, the engine was in a “half-drive” condition, repeatedly running and stopping. Determining that the trouble was completely fuel-related, I turned off the tank selector. The altitude was quite low. There was a sports ground ahead, and I could see a lot of children there. I saw nearby a road with nobody on it, so I decided to make an emergency landing there; I glided down and landed there, adjusting my altitude a number of times of slips.

In Japan, I had flown from Fukui Airport to Hakodate Airport, from Hakodate Airport to Memanbetsu Airport, and from Memanbetsu Airport to Niigata Airport. At Niigata Airport, avgas (aviation gasoline) was not obtainable so automotive gasoline was filled in the tanks.

It is written in documents published by the engine manufacturer, Continental, that it is permitted for the engine to be operated with automotive gasoline.

(2) Accident-Related Items before Flight to Japan

Before flying to Japan, the aircraft was parked in the open air for about five months in South Korea, so I conducted careful inspections and checks prior to departure with the engineer. I removed the strainer and carburetor and found that thick slime (foreign matter with a grease-like consistency) had collected in the strainer. So I cleaned the area where the slime seemed to accumulate using some the compressed air blows. I thought it was possible that South Korean automotive gasoline contained a substance that caused the slime. I fueled the aircraft with avgas and conducted another test run. The idling rpm decreased and stabilized about 650 rpm next day and the slime was not observed, I decided to fly to Japan.

2.1.2 Eyewitnesses

(1) Eyewitness A (Road Construction Worker)

A light aircraft flew toward me from the direction of Mount Takao (southeast) at a height of 50 – 60 meters, flew across the road, circled once counterclockwise, and flew in a straight in line with the road that was under construction.

Owing to the construction noise, I did not hear any engine sound. The propeller was turning, but I did not know whether it was windmilling or being turned by the engine. When

the light aircraft came overhead, there were about six road construction workers present but none of them heard any engine sound. As the light aircraft passed overhead, its height looked to be about 20 – 30 meters. The crash was preceded by a sudden decrease in altitude. An electric wire was suspended across the road, the light aircraft looked to passing under that wire.

Subsequently, the light aircraft struck a mini-truck, turned rightward, hit a normal-size cargo truck (hereafter called “the truck”), and stopped. I was not aware whether the light aircraft had struck a special-purpose vehicle that was in a place nearer to me than the abovementioned vehicles.

After the crash, the pilot got out of the light aircraft.

(2) Eyewitness B (Road Construction Worker)

I was 100 – 150 meters forward of the place where the accident aircraft made its emergency landing. I watched the light aircraft flew in my direction over the road under construction at a considerably low altitude. I watched the aircraft until it landed, but I did not think I heard any engine sound. The light aircraft hit the truck with a loud sound, whereupon it changed direction.

The accident occurred on a road that was under construction in Kanazawa City. The time of the accident was approximately 13:08 JST.

(See Figure 1 and Pictures 1, 2.)

2.2 Injuries to persons

The pilot-in-command was slightly injured.

2.3 Damage to the Aircraft

2.3.1 Extent of Damage

Substantial

2.3.2 Damage to Aircraft Components

Fuselage:	Severely damaged at front; deformed at rear
Wings:	Right wing severely damaged
Engine:	Carburetor come off
Propeller:	Torn off

2.4 Damage to Objects Other than the Aircraft

One special-purpose vehicle, one mini-truck, and one truck were damaged.

2.5 Pilot Information

Pilot-in-command:	Male; age 60
Private pilot license (airplane)	
Issued by United Kingdom Civil Aviation Authority (CAA)	January 21, 2002
Type rating for single reciprocating engine (land)	
Aviation medical certificate	
Joint Aviation Authorities Class 2 (issued by CAA)	
Validity	Until December 30, 2005
Total flight time	Approx. 6,000 hours
Flight time in the last 30 days	Approx. 20 hours
Flight time on the aircraft type	Approx. 5,000 hours
Flight time in the last 30 days	Approx. 20 hours

(verbally reported by the pilot-in-command)

2.6 Aircraft Information

2.6.1 Aircraft

Type	Piper J3C-65
Aircraft serial number	12490
Date of manufacture	1944
CAA certification	
Certificate of Validity — Permit to Fly — PFA (Popular Flying Association)	
PR007647/001	
Validity	Until April 12, 2006
Category	Airplane utility U
Total flight hours	5,133 hours and 40 minutes

(verbally reported by pilot in-command)

(See Figure 2.)

2.6.2 Engine

Type	Continental C90-12F
Serial number	44160-4-12
Date of manufacture	Unknown
Total time in service	304 hours and 40 minutes

(verbally reported by pilot-in-command)

2.6.3 Maintenance Condition of Aircraft

The aircraft was not carrying any document corresponding to an aircraft logbook, so it had no maintenance records. Inspections and maintenance were performed by an aircraft maintenance engineer in Australia in April 2005, and as a result the aircraft had a CAA Certificate of Validity — Permit to Fly — PFA. Other day-to-day inspections and maintenance were performed by the pilot-in-command.

2.6.4 Weight and Balance

Unknown

2.6.5 Fuel and Lubricating Oil

The fuel was automotive gasoline (regular gasoline). The lubricating oil was Phillips SAE 20W-50 Multiviscosity Oil.

2.7 Meteorological Information

Aviation routine weather reports for Komatsu Airport (located approximately 28 kilometers southwest of the accident site) covering the time period of the accident gave the data shown below.

12:00 JST Direction of wind ... 270°; Velocity of wind ... 10 knots; Prevailing visibility ... 10 kilometers or more; Clouds ... few 010, broken 200; Temperature ... 20°C; Dew point ... 11°C; Altimeter setting (QNH) ... 29.97inches Hg

13:00 JST Direction of wind ... 270°; Velocity of wind ... 11 knots; Prevailing visibility ... 10 kilometers or more; Clouds ... few 010, broken 200; Temperature ... 20°C; Dew point ... 12°C; Altimeter setting (QNH) ... 29.95inches Hg

2.8 Accident Site and Wreckage Information

2.8.1 Accident Site Conditions

The accident site was on a road under construction in the Kubo district of Kanazawa City. The aircraft stopped with its nose pointing south-southwest and its left wing riding up onto the load bed of the truck. The bottom of the forward fuselage was damaged by contact with the vehicles on the ground.

(See Pictures 1, 2.)

2.8.2 Details of Damage to the Aircraft

Damage to the aircraft's main components is as follows.

- (1) Fuselage

The engine mounting was severely damaged, and the bottom of the cowling was severely damaged. The skin of the bottom surface was distorted and severely damaged. The aft fuselage was deformed and severely damaged.

(2) Wings

The right wing was severely damaged at its bracing, and its main spars and fabric were broken.

(3) Engine

The carburetor was damaged, and it was torn off from the engine.

(4) Propeller

The tips of the propeller blades flew off. Also, the one of the blades was caught in the load bed of the truck and fractured at its metal-protected leading edge.

2.9 Fact-Finding Tests and Research

2.9.1 Results of Teardown Examination of Engine

(1) A large amount of foreign matter with a grease-like consistency (hereafter called “foreign matter”) had collected in the vicinity of the carburetor’s inlet screen. The foreign matter blocked most of the inlet screen.

(2) Corrosion and rust were observed inside the strainer, but no filter blockage was observed.

(3) The spark plug at the bottom of the No. 1 cylinder showed evidence of oil fouling, but it generated sparks normally.

(4) The engine in general was free of abnormalities except for loss of the carburetor.

(5) The crankshaft and connecting rod assembly could be turned freely by hand without showing any seizure.

(6) The alignment marks on the camshaft gear and crankshaft gear were correctly aligned, meaning the cam timing was correct.

2.9.2 Investigation of Cause of Engine Trouble

(1) Detected in the foreign matter in the vicinity of the inlet screen in the carburetor were not bacteria (aerobic bacteria, yeast, and anaerobic bacteria) but was mainly aluminum.

Peaks that were thought to correspond to water were seen in the results of infrared absorption spectrography analysis.

(2) The aircraft has four fuel tanks, all made of aluminum: three high tanks located in the wing center section, right wing and left wing respectively, and one front tank located in the nose. Corrosion was observed in all of the tanks except the one in the wing center section.

(3) The viscosity of the lubricating oil was 169.9 millimeters per second, which means it was within the 20W-50 standard range of 120–180 millimeters per second.

The total acid number^{*1} and total base number^{*2} were within the normal ranges.

Iron, copper, aluminum, tin, and other metallic components were detected at low levels, and an abnormally large amount of moisture was detected.

(4) In the lubricating oil inside the lubricating oil filter, iron, copper, aluminum, tin, and other metallic components were detected at low levels.

(5) Fuel density was approximately 0.74 grams per cubic centimeter, a value within the normal range, but a large amount of gum was detected.

The distillation characteristics were those of typical gasoline.

(6) In the strainer, no bacteria (aerobic bacteria, yeast, and anaerobic bacteria) were detected.

Rust was seen inside the strainer and in part of the fuel filter.

Peaks that were thought to correspond to water were seen in the results of infrared absorption spectrography analysis.

(See Figure 3.)

2.10 Other Necessary Information

2.10.1 Article 127 of Civil Aeronautics Law of Japan (Use of Foreign Aircraft in Japan)

The aircraft was approved as exempted from article 127 of the Civil Aeronautics Law of Japan.

The airworthiness of the aircraft and the qualifications of the pilot were regarded as being compliant with the Civil Aeronautics Law of Japan.

2.10.2 Refueling Performed in Japan

(1) Fukui Airport: October 7: Avgas (45 liters)

(2) Hakodate Airport: October 8: Avgas (76 liters)

(3) Memanbetsu Airport: October 11: Automotive regular gasoline (60 liters)

October 14: Automotive regular gasoline (20 liters)

October 18: Automotive regular gasoline (20 liters)

(4) Niigata Airport: October 21: Automotive regular gasoline (100 liters)

Companies selling avgas existed at Memanbetsu Airport and Niigata Airport.

^{*1} The amount of acidic components in oil is measured as an indication of oil deterioration. The measurement is performed by means of neutralization titration using potassium hydroxide with a standard concentration.

^{*2} The amount of basic components in oil is measured as an indication of oil deterioration. The measurement is performed by means of neutralization titration using hydrochloric acid with a standard concentration.

2.10.3 Statement on Fuel in Federal Aviation Administration (FAA)-Approved Manual for Engine of Aircraft

There is the following statement in the FAA-approved overhaul manual for the engine of the aircraft on fuel used in the engine.

Continental C90-12F type engines are designed to operate efficiently on gasoline of aviation quality with octane ratings at least equal to 80/87. Tetraethyl lead content should not exceed 1/2 cc. per gallon. The fuel should be free from water and as free as possible from solid particles.

3. ANALYSIS

3.1 Qualifications of Pilot-in-Command

The pilot-in-command possessed a proper CAA-issued pilot's licence and a valid aviation medical certificate.

3.2 Airworthiness Certification of Aircraft

The aircraft had a CAA-issued certificate, and maintenance and inspections had been performed on it by an aircraft maintenance engineer in Australia.

As indicated in part 2.9.1 of this report, no engine abnormality that would have led to the accident was discovered from the results of the teardown examination of the engine.

3.3 Relevance of Weather

It is estimated that the weather conditions were good and that they did not influence the accident.

3.4 Factors Related to Engine Trouble

(1) Vicinity of Inlet Screen in Carburetor

(a) As stated in part 2.9.1(1) of this report, a large amount of foreign matter had collected in the vicinity of the carburetor's inlet screen and had blocked most of the inlet screen. It is estimated that the fuel flow was restricted by this foreign matter such that engine trouble occurred.

(b) It is estimated that the slime that was discovered by the pilot-in-command when he performed inspections in South Korea (see part 2.1.1(2) of this report) and the foreign matter that was found in the vicinity of the inlet screen during the investigation were identical.

Because the pilot-in-command stated that he used compressed air to clean out the foreign matter and partly because no remaining foreign matter was found inside the strainer or in the filter, it is considered very likely that the inside of the strainer and the filter were cleaned adequately. However, it is estimated that unremoved foreign matter flowed to the inlet screen and blocked it owing to inadequate internal cleaning of other fuel-line sections and the carburetor.

(c) As stated in part 2.1.1(2) of this report, the aircraft was parked in the open air for about five months in South Korea. It is considered possible that the aircraft was also parked in the open air for a long period previously. As a result, it is estimated that gasoline in the fuel tanks evaporated, creating gum, peroxide, and organic acid, that the gum accumulated in large quantities, and that the organic acid and moisture that had collected in the fuel tanks caused the aluminum tanks to corrode.

(2) Lubricating Oil

As stated in part 2.9.2(3) of this report, moisture was detected in the lubricating oil. It was raining when the samples were taken after the accident, so it is estimated that rainwater mixed with the lubricating oil while the samples were being taken.

Since no causative link to the engine trouble was found in the components other than the moisture, it is estimated that the engine oil was not related to the engine trouble.

(3) Fuel

As stated in parts 2.1.1(1), 2.6.5, and 2.9.2(5) of this report, the fuel was ordinary automotive gasoline. However, the automotive gasoline sold in Japan satisfies the conditions indicated in part 2.10.3 of this report so it is estimated that the fuel was not related to the engine trouble.

(4) Fuel Filter (Strainer)

As stated in parts 2.9.1(2) and 2.9.2(6) of this report, the test results did not indicate detection of bacteria in the fuel filter. It is estimated, therefore, that the generation of the foreign matter was not caused by bacteria.

3.5 Inspections and Maintenance

(1) As stated in part 2.1.1(2) of this report, the aircraft was parked in the open air for about five months in South Korea before its flight to Japan. It is estimated that the foreign matter was not a substance formed in a short time, it goes without saying that it is essential to ensure favorable parking conditions when an aircraft is parked for a long period. It is considered unlikely that the foreign matter would have formed if the fuel tanks had been emptied.

(2) The pilot-in-command stated that thick slime had collected in the strainer, that he cleaned it out using compressed air, fueled the aircraft with avgas, and conducted a test run, whereupon the idling speed was normal at approximately 650 rpm, leading him to infer that the slime had gone and to resolve to fly to Japan. However, it is estimated that the cleaning was inadequate and that the foreign matter was not completely removed.

It is estimated that, after the aircraft's subsequent departure from South Korea, unremoved foreign matter again collected in the vicinity of the inlet screen during flight in Japan.

3.6 The Pilot-in-Command's Judgement and Action

It is estimated that the pilot-in-command continued his flight toward Hiroshima without changing his destination because the engine returned to normal as a result of his switching the fuel tank from the front tank to the high tanks.

It is estimated that a subsequent recurrence of engine trouble over an urban area of Kanazawa City caused the pilot-in-command to decide that continued flight was unsafe and to decide to make an emergency landing on a road that was under construction.

4. PROBABLE CAUSE

The accident was caused by aircraft colliding with parked vehicles on a road under construction, while performing an emergency landing following engine trouble during flight.

It is estimated that the engine trouble was caused by restriction of the fuel flow by blockage of most of the carburetor inlet screen by foreign matter.

It is estimated that the cause of the accumulation of foreign matter in the vicinity of the inlet screen in such a quantity that the restricted fuel flow was the insufficient removal of the matter although it was done.

Figure 1 Estimated Flight Route

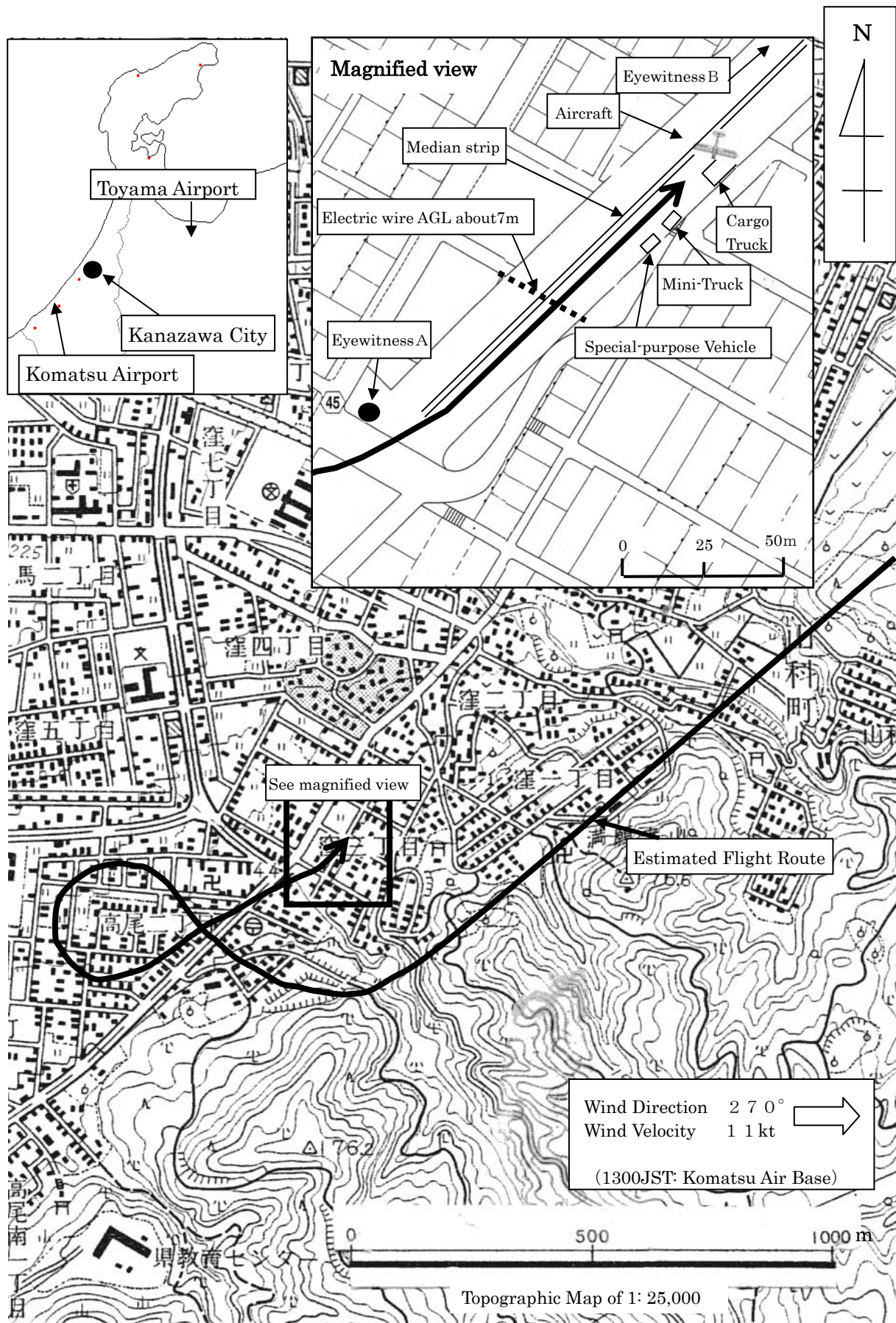


Figure 3 Float Chamber & Strainer

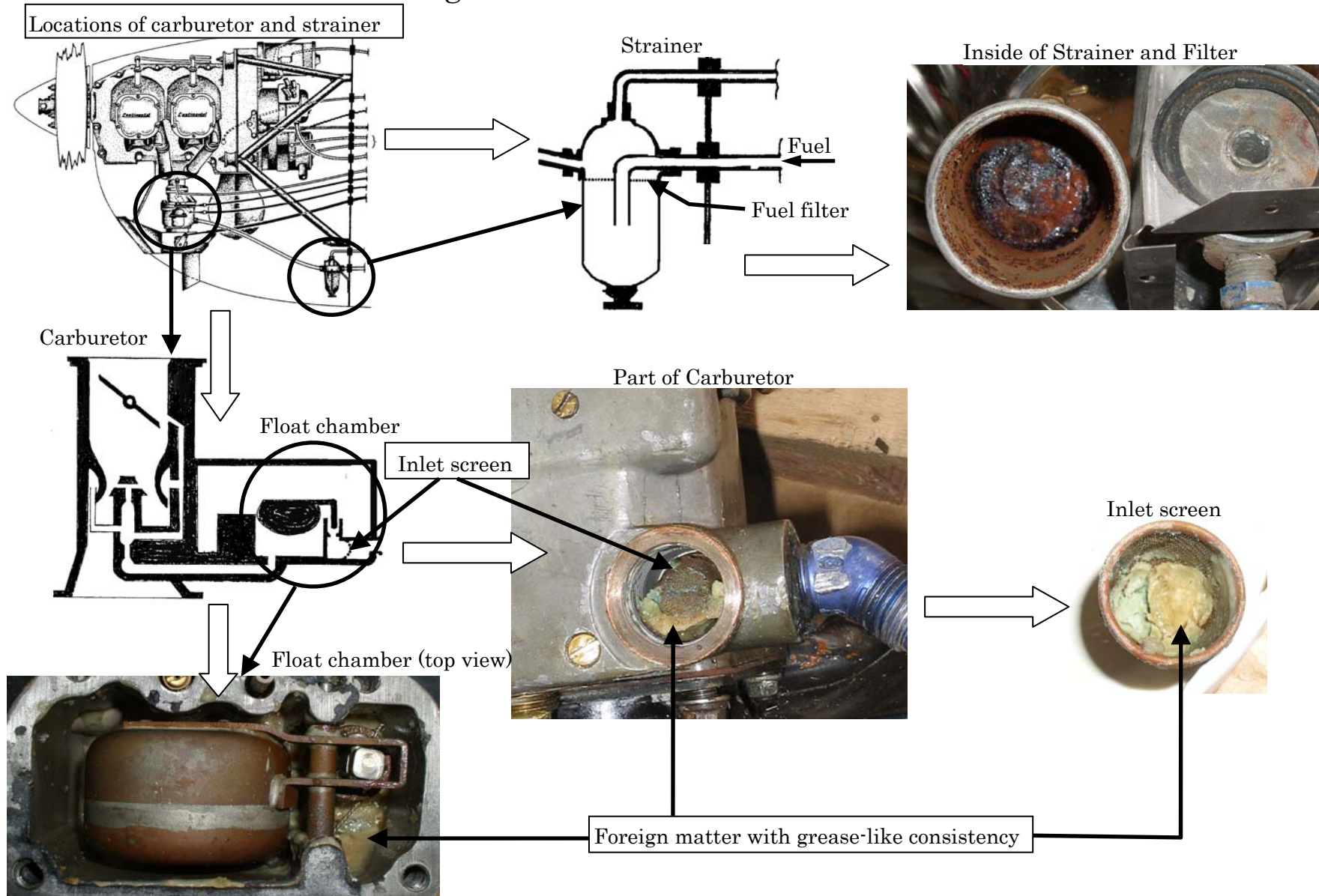
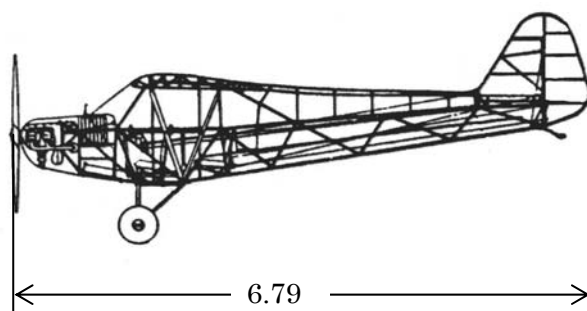
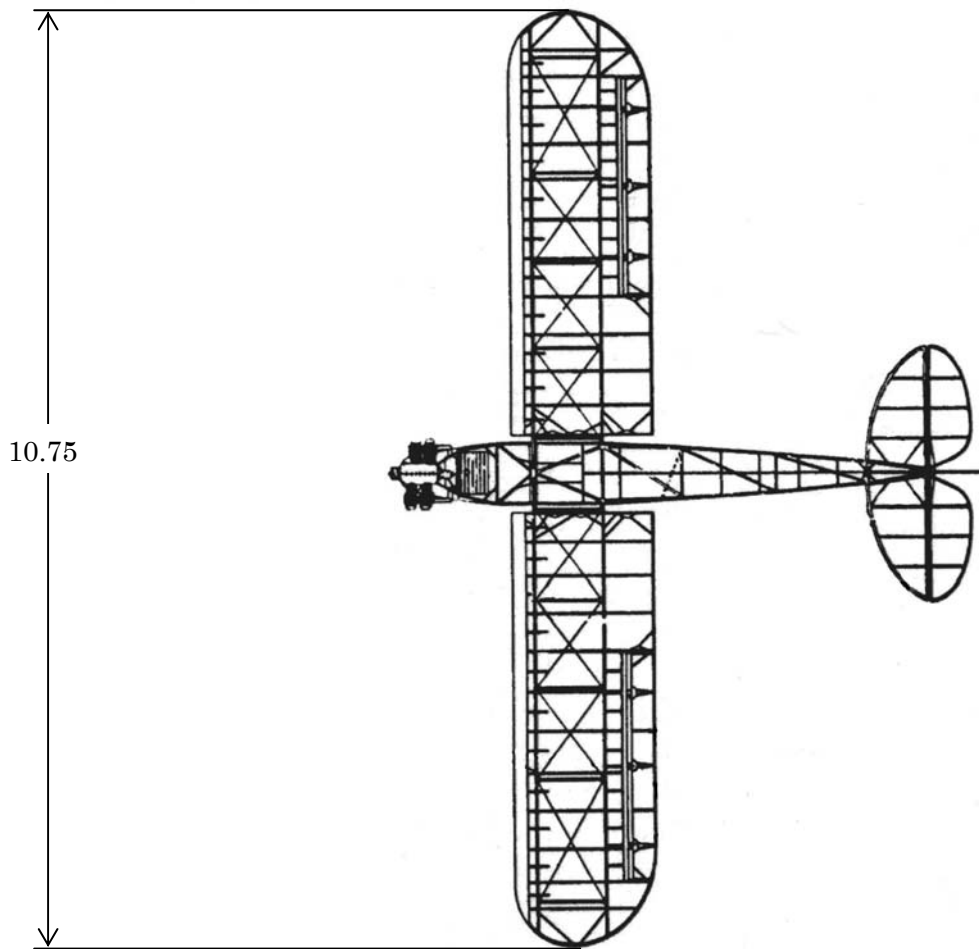
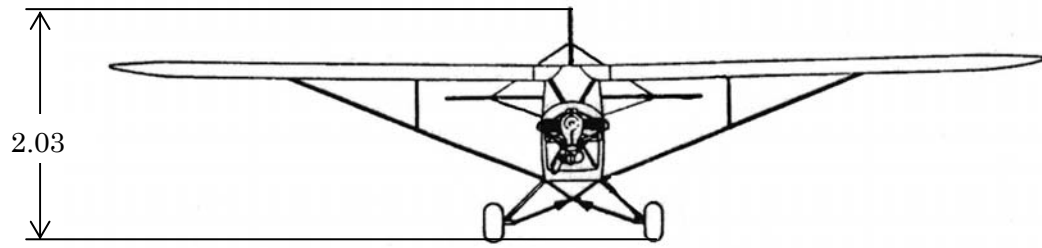


Figure 2 Three-angle-view of Piper J 3 C-65

Unit : m



Picture 1 Accident Aircraft — 1



Picture 2 Accident Aircraft — 2

