

AA2007-7

# AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATERY OPERATED

AEROMOT INDUSTRIA MECANICO -METALURGICA AMT-200

(MOTOR GLIDER, TWO-SEAT), JA201X

TAJIMA AERODROME, TOYOOKA CITY, HYOGO PREFECTURE, JAPAN

MAY 3 2006, AROUND 10:34 JST

December 21, 2007

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 PRIVATERY OPERATED AEROMOT INDUSTRIA MECANICO-METALURGICA AMT-200(MOTOR GLIDER,TWO-SEAT), JA201X 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.

This English version report has been published and translated by ARAIC to make its reading easier for English speaking people those who are not familiar with Japanese. Although efforts are made to translate as accurate as possible, only the Japanese version is authentic. If there is difference in meaning of the texts between the Japanese version and the English version, texts in the Japanese version are correct.

Norihiro Goto,  
Chairman,  
Aircraft and Railway Accidents Investigation Commission

# AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATELY OPERATED AEROMOT INDÚSTRIA MECÂNICO-METALÚRGICA  
AMT-200 (MOTOR GLIDER, TWO-SEAT), JA201X  
TAJIMA AERODROME, TOYOOKA CITY, HYOGO PREFECTURE, JAPAN  
MAY 3, 2006, AROUND 10:34 JST

November 30, 2007

To be approved by the Aircraft and Railway Accidents Investigation Commission  
(Air Subcommittee Meeting)

Chairman	Norihiro Goto
Member	Yukio Kusuki
Member	Shinsuke Endo
Member	Noboru Toyooka
Member	Yuki Shuto
Member	Akiko Matsuo

# **1. PROCESS AND PROGRESS OF THE ACCIDENT INVESTIGATION**

## **1.1 Summary of the Accident**

On May 3, 2006, (Wednesday - national holiday), a privately operated Aeromot Indústria Mecânica- Metalúrgica AMT-200, JA201X, took off from Runway 01 of Tajima Aerodrome for a leisure flight bound for New Kitakyushu Airport. Immediately after takeoff, at about 10:34 JST(Japanese Standard Time; UTC + 9h), the aircraft crashed onto the overrun area to the north of the runway.

Two persons were on board, the Pilot in Command (PIC) and a passenger. Both of them were fatally injured. The aircraft was destroyed and a fire broke out.

## **1.2 Outline of the Accident Investigation**

### **1.2.1 Investigation Organization**

On May 3, 2006, the Aircraft and Railway Accidents Investigation Commission (ARAIC) appointed an investigator-in-charge and another investigator for the investigation of this accident. On January 1, 2007, ARAIC appointed an additional investigator.

### **1.2.2 Representative from Foreign State**

An accredited representative of Brazil, the state of design and manufacture of the aircraft, participated in the investigation.

### **1.2.3 Implementation of Investigation**

May 4 and 5, 2006	On-site investigation, investigation of the aircraft and interviews
May 19, 2006	Investigation on the same type of aircraft
May 22, 2006	Teardown examination of the engine
June 16, 2006	Interviews
January 26, 2007	Teardown examination of propeller pitch change mechanism

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

Comments from the PIC and the passenger as the parties relevant to the cause of the accident were not conducted because both persons were fatally injured in the accident.

### **1.2.5 Comments from the Participating State**

Comments on the draft report was invited from the participating state.

## 2. FACTUAL INFORMATION

### 2.1 History of the Flight

On May 3, 2006, at about 10:32, a privately operated Aeromot Indústria Mecânico-Metalúrgica AMT-200 (dubbed ‘Super Ximango’), JA201X (hereinafter referred to as “the aircraft”) took off from Runway 01 of Tajima Aerodrome (hereinafter referred to as “the aerodrome”) for a leisure flight bound for New Kitakyushu Airport under visual flight rules (VFR) with the PIC in the right seat and a passenger in the left seat.

The outline of the aircraft’s flight plan submitted to the JCAB Osaka Airport Office is as follows:

Flight rules:	VFR
Departure aerodrome:	Tajima Aerodrome
Off-block time:	10:20
Cruising speed:	100 kt
Cruising altitude:	VFR
Route:	Okayama – Kuga
Destination aerodrome:	New Kitakyushu Airport
Estimated flight time:	2 h 30 min
Purpose of flight:	Leisure
Fuel load expressed in endurance:	5 h
Number of persons on board:	2

According to the statements from the eyewitnesses, the sequence up to the crash is as outlined below.

(1) Eyewitness A (Pilot of the Beechcraft )

On the day of the accident, the aircraft and the Beechcraft E33 which I was aboard (hereinafter referred to as “the Beechcraft”) were going to fly together to New Kitakyushu Airport.

The PIC of the accident aircraft (hereinafter referred to as “the PIC”) filled up the aircraft with premium gasoline for automobiles in a filler can(s), which he had purchased at a gas station in town. He then carried out an engine test run and an external inspection of the aircraft. When I asked him about the condition of the aircraft, he said, “No problem.”

Three persons were aboard the Beechcraft, myself and a passenger in the front seats and another passenger (Eyewitness B) in the rear seat.

As the aircraft was to take off at first from Runway 01, the Beechcraft was holding before the stop line in the West Apron, heading at right angle with the runway direction. I kept watching the aircraft from the time it came into my view after start of the takeoff. When the aircraft passed, after take off, in front of the Beechcraft, I did not notice anything abnormal about its climb angle or speed.

I was monitoring through headset the communication between the aircraft and Tajima Flight Service\*<sup>1</sup> (hereinafter referred to as “the flight service”). When the aircraft was somewhere right above the crash site, the PIC said over the radio a word (in Japanese) which means “turning back”, such as “going back” or “returning” although I don’t remember the exact word. This made me think that something had happened.

The aircraft’s height above the ground seemed approximately 40 ~ 50 m at the north end of Runway 01 (hereinafter referred to as “the runway end”), when I felt the aircraft deviated to the right a little.

Contrary to my first impression that the aircraft was going to make a right turn, the aircraft made a tight turn to the left immediately.

During the tight left turn, bank of the aircraft was so deep that I thought it was trying to turn and land on Runway 19. However, the aircraft immediately entered into a left spin, made a turn of heading and crashed with its nose facing north. I think that the propeller was rotating at that time.

After the crash, I saw a large flame erupted near the right wing root.

(2) Eyewitness B (passenger in the rear seat of the Beechcraft)

I took the rear seat of the Beechcraft. As I heard the flight service said “Runway is clear”, I understood that the aircraft would start a takeoff roll. When the aircraft came into view a while later, it was in a climb attitude, but the takeoff roll seemed longer and the rate of climb after liftoff seemed a little less than usual. I guessed that this might be due to the heavy weight of the aircraft having been loaded with maximum fuel and baggage for this long-range flight. Watching the climb of the aircraft, I did not notice anything abnormal except that.

When the aircraft passed flying in front of the Beechcraft, the landing gear was completely retracted.

After the aircraft flew over the runway end and at the moment the pilot of the Beechcraft said, “We will soon be able to taxi down,” I saw the nose of the aircraft directed towards the Beechcraft.

The PIC had from time to time conducted trainings of emergency landing immediately after takeoff. This time, like those trainings, the aircraft made its nose down and directed towards the Beechcraft. So, seeing the scene, I said, “Oh, (the PIC) wants to return.” The aircraft’s landing gear was still retracted at that time. The aircraft made its nose further down, and when the lower surface of the aircraft became visible after turning, the landing gear was extended.

The aircraft impacted the ground with its nose facing north.

I have an airplane pilot license. Usually, the aircraft is able to return in the direction opposite to takeoff, if its height above the ground over the runway end is approximately 250 ft (76 m). However, this time its height above the ground was approximately 150 ft (46 m), I thought it was difficult for the aircraft to reverse the heading.

---

\*<sup>1</sup> : Tajima Flight Service is the flight advisory radio station operated by the management organization of Tajima Aerodrome.

The PIC had a habit to conduct test-run of the engine of the aircraft approximately every two weeks unless it rains. He performed the last test-run on April 22 before the crash.

(3) Eyewitness C

When I was unloading baggage from a car in front of my office, the aircraft in takeoff climb was emitting irregular coughing noises that could suggest abnormal engine operation, by which I found something wrong with the aircraft. So I watched the aircraft from then on.

The aircraft remained over the runway, but its height above the ground was low and it was flying unstably. The aircraft changed its heading to the right before reaching over the runway end, then got it back to the north and continued to climb.

Height above the ground of the aircraft reached its maximum over the runway end, where the aircraft directed rightward in nose-up attitude, then it suddenly made a left turn with a bank angle of more than 60°. When its heading turned 180°, it took nose-down attitude and descended vertically while spiraling leftward. Immediately before the crash, I heard puffing noises that could suggest stopping engine. The aircraft impacted the ground with its nose facing north and its propeller rotating.

Upon crashing, the propeller and other things flew separated in pieces and a fire broke out in the forward portion of the airframe.

(4) Eyewitness D (duty personnel of the flight service)

I was on duty with one of my colleagues in the ground to air radio communication room. At the time of the accident, my colleague was in charge of radio communication and I was making surveillance of surroundings, standing next to him.

At 10:27, the aircraft started moving from the West Apron to the taxiway. After taxiing on the runway, it turned around on the turning pad of the runway and, at the takeoff start point, conducted a short time engine test run. At 10:31, the aircraft radioed "Ready," in reply to which my colleague radioed back "Runway is clear." There was a wind of approximately 5 ~ 7 kt. from the north at that time and it was relatively stable. After the aircraft started a takeoff roll, I shifted my attention to the northern part of the runway. When I looked back again at the southern part, the aircraft appeared to be airborne near the runway distance marker light "2". The aircraft flew across the line of sight from my standing position to the top of the hill located opposite and west side of the runway.

When looking at the aircraft, I felt nothing unusual while it climbed shallower than usual and did not gain much height after it flew past in front of the building in which the ground to air radio communication room is located (hereinafter referred to as "the tower").

I was surprised to see that the aircraft turned a little to the right, then made a tight left turn at relatively low altitude over the area just beyond the northern peripheral road. As the aircraft entered a left turn, it transmitted by radio intention "to turn back", although my memory is not sure whether it was "go back" or "return". The

transmission was not in haste but of single word. Usually it is accompanied by a reason of the return. At the instant I wondered why, the aircraft crashed.

I have seen the takeoff of the aircraft several times before. But this time, the aircraft's height near the runway end was lower than usual and I think it was too low to restore its attitude. At the end of the left turn, I saw the aircraft's nose pointed the south. But without maintaining this condition, the aircraft directed its nose downward and, as it appeared to me, it fell vertically and crashed. Just after the crash, flames immediately engulfed the aircraft.

The accident occurred at around 10:34, in the overrun area (lat. 35°31'06"N, long. 134°47'13"E), approximately 32 m north of the north runway end marking of Runway 01. (See Figures 1 and 3.)

## **2.2 Injuries to Person**

Two persons on board, the PIC and a passenger, were fatally injured.

## **2.3 Damage to the Aircraft**

### **2.3.1 Extent of Damage**

The aircraft was destroyed.

### **2.3.2 Damage to Each Aircraft Component**

- (1) Fuselage: Destroyed by fire
- (2) Wings: Destroyed by fire except that the left wing portion near and including the fuel tank and the right wing outer portion (hereinafter referred to as "outer wing") remained damaged
- (3) Empennage: Destroyed by fire
- (4) Engine: Crushed and burned
- (5) Propeller: Of the two blades, one was fractured at the root while the other was fractured at approximately 30 cm from the root.

(See Figure 3.)

## **2.4 Damage to Objects Other than the Aircraft**

None

## **2.5 Crew Information**

PIC: Male, age 31

Private pilot certificate (glider)

February 6, 1995

Rating - Motor glider

July 28, 2000

2nd class aviation medical certificate

Validity

Until March 21, 2007

Total flight time

342 h 54 min

Flight time in the last 30 days	0 h 00 min
Flight time on the aircraft type	77 h 06 min
Flight time in the last 30 days	0 h 00 min

## 2.6 Aircraft Information

### 2.6.1 Aircraft

Type	Aeromot Indústria Mecânico-Metalúrgica AMT-200
Serial number	200.062
Date of manufacture	September 16, 1996
Certificate of airworthiness	No.05-46-03
Validity	Until August 21, 2006
Airworthiness category	Motor glider Utility (U)
Total time in service	1,160 h 40 min
Time in service since last periodical check (50-hour check conducted on November 28, 2005)	3 h 19 min

The aircraft was made of fiber-reinforced plastic (FRP). The outer wings were foldable while on the ground.

The inner portion of each wing (hereinafter referred to as “inner wing”) was equipped with no flap whereas each outer wing was equipped with inner and outer ailerons that are operated as one piece.

(See Figure 2.)

### 2.6.2 Engine

Type	Rotax 912A2
Serial number	4.410.461
Date of manufacture	June 12, 2001
Total time in service	328 h 55 min
Time in service since last periodical check (50-hour check conducted on November 28, 2005)	3 h 19 min

The engine was of horizontally opposed, 4-cylinder, 4-stroke type with a displacement of 1,200 cm<sup>3</sup>. The cylinders were numbered as follows: forward right as 1, forward left as 2, aft right as 3 and aft left as 4.

### 2.6.3 Propeller

The propeller of the aircraft was connected to the engine via reduction gears.

The propeller pitch was manually selected from the following 3 positions: minimum, maximum and feather. No instrument was provided in the cockpit to indicate the selected propeller pitch. The position of the pitch lever did not indicate whether the propeller pitch was at the minimum or maximum.

The minimum pitch is used during engine start, takeoff/landing and climb. The maximum

pitch is used during cruising. The feather pitch is used during gliding.

Propeller pitch can be changed as follows; set at the specified rotational speed then operate the pitch lever. The pitch is changed through a mechanism that utilizes the centrifugal forces generated by the propeller revolution.

As described in 2.12.2 (2), change from minimum to maximum pitch is performed at 3,800 rpm while change from maximum to minimum pitch is performed at 2,200 ~ 2,400 rpm.

Change to feather pitch can be performed irrespective of the rotational speed.

#### **2.6.4 Landing Gear**

The landing gear of the aircraft extends by gravity and spring forces almost immediately when the landing gear control lever is operated. The aircraft's maintenance manual and other relevant materials do not indicate the time required for operation. In the cockpit, a red light is illuminated while the gears are moving and a green light is illuminated when the gears are down-locked.

#### **2.6.5 Weight and Balance**

The weight of the aircraft at the time of the accident is estimated to have been approximately 857 kg, which is estimated to have exceeded the allowable limit (maximum takeoff weight of 850 kg).

The position of the aircraft's center of gravity at the time of the accident is estimated to have been 129.9 cm aft of the reference point.

The allowable range of the center of gravity for the maximum takeoff weight of 850 kg is 129.0 ~ 132.7 cm.

#### **2.6.6 Fuel and Lubricating Oil**

The fuel was premium gasoline for automobiles.

The lubricating oil was PROSTAGE SL/CF (20W-50) for piston engines.

#### **2.6.7 Information on Recent Flights and Maintenance of the Aircraft**

According to the records in the aircraft's logbook, the aircraft received a 50-hour check including check for ignition plug condition and a flight test on November 26 ~ 28, 2005, at Futaba Glider Field in Yamanashi Prefecture. It flew back to the aerodrome (Tajima) on November 28, 2005.

After the 50-hour check, the aircraft flew for 3 h 19 min to arrive at the aerodrome, during which there were no problems. After that, the aircraft was stored in a hangar without any flight for approximately 5 months until the day of the accident.

There are no records describing engine test runs that may have been conducted during the period when the aircraft was in storage.

### **2.7 Meteorological Information**

The aeronautical weather observation at the aerodrome covering the time of the accident was as follows:

10:00 Direction of wind ... 010°; Velocity of wind ... 8 kt;  
Prevailing visibility ... more than 10 km;  
Clouds: amount ... 3/8, type ... cumulus, ceiling ... 3,000 ft;  
Temperature ... 11°C; Dew point ... 3°C; Altimeter setting (QNH) ... 30.13 inHg

10:53 Direction of wind ... 360°, variable between 320° and 040°; Velocity of wind ... 8 kt;  
Prevailing visibility ... more than 10 km;  
Clouds: amount ... 2/8, type ... cumulus, ceiling ... 4,000 ft;  
Temperature ... 12°C; Dew point ... 4°C; Altimeter setting (QNH) ... 30.12 inHg

## 2.8 Accident Site and Wreckage Information

### 2.8.1 Accident Site Conditions

After the crash, the aircraft was destroyed and engulfed in flames, and the fire consumed most of the airframe.

Fragments of the aircraft were found scattered in a circle of an approximately 25 m radius surrounding the engine compartment.

The ground facilities near the crash site sustained no damage. No scratch marks made by the crash were found near the crash site, for example on the overrun areas. An inspection conducted by the aerodrome management organization after the crash found no abnormalities along the path on which the aircraft had moved on the day of the accident, and on the west apron. (See Figures 1 and 3.)

### 2.8.2 Details of Damage to the Aircraft

Damage to the main components of the aircraft is as follows:

(1) Fuselage

- ① The fuselage was sharply bent in the vicinity of the fire wall.
- ② The cockpit was consumed by fire.
- ③ The canopy was broken and separated from the fuselage together with its frame.
- ④ The empennage was torn forward of the horizontal stabilizer and consumed by fire, bent approximately 30° to the left relative to the aircraft axis. Only several control cables remained connected to the forward part of the fuselage.

(2) Wings

- ① Both wing tips were severely damaged.
- ② Left wing

The outer wing was consumed by fire except for its spar.

Both ailerons were found lying on the grass, of which position of the outer aileron was approximately 5 m aft and approximately 0.5 m outside of the wing tip, and position of the inner aileron was at approximately 4 m aft and approximately 1 m outside of the wing tip.

The inner wing was severely damaged, but the area around the fuel tank showed no major burnout damage.

Black stains were found on the surface of the overrun area around the bottom of

the fuel tank. The inner and outer wings were remained connected and locked.

③ Right wing

The right wing was found slanted forward at an angle approximately 25° relative to the fuselage. The outer wing showed no signs of fire damage, but it was broken by ground impact. Both ailerons were separated from the wing, of which position of the outer aileron was at approximately 1.5 m aft of the wing tip, and the position of inner aileron was just near the wing tip.

The inner wing was consumed by fire. The inner and outer wings remained connected and locked.

(3) Empennage

The empennage was consumed by fire.

(4) Engine

The engine was severely compressed by the airframe aft of it and was burned as a whole. Especially the right side of the engine was severely crushed. The original shapes remained only near the No. 2 and No. 4 cylinder heads on the left side of the engine.

(5) Propeller

The spinner integral with the propeller shaft (including the forward bearing) was found lying in front of the aircraft.

Of the two wooden blades, one blade (hereinafter referred to as “blade A”) was torn at its root inside the spinner and found lying to the right forward of the airframe wreckage, while the other blade (hereinafter referred to as “blade B”) was torn at a point approximately 30 cm from its root, but the separated portion could not be found. The spinner was crushed flat at an angle approximately 30° relative to the propeller rotational plane, and showed a mark (wrinkle) indicating that the propeller had been rotating.

It was not possible from the wreckage to determine the propeller pitch setting.

The main parts of the propeller pitch change mechanism (hereinafter referred to as “the pitch change mechanism”) remained inside the propeller hub.

The root portion of the blade B could be rotated by hand over a certain pitch angle range. The root portion of the blade A could not be rotated by hand because a part of the pitch change mechanism (rod and yoke) was seized, in deformed condition at the time of the crash.

(6) Landing gear

The left and right wheels were found crushed in the extended position under the wings.

(See Figure 3.)

### 2.8.3 Condition of the Airframe and Position of the Switches and Levers

(1) Condition of the airframe was as follows:

- ① The landing gear control lever was in the down position.
- ② The spoiler lever was in the retract position.

- ③ Approximately 4 liters of remaining fuel could be drained from the left wing tank. The fuel was tinted red and contained no water or other foreign matter. According to the information provided by the police who conducted a composition analysis of the fuel, lead was not detected in it. Premium gasoline for automobiles currently sold at gas stations is unleaded and tinted red.
- (2) Position of the main handles and other controls was as follows:
  - ① Throttle: Fully open
  - ② Cowl flap: Open
  - ③ Choke handle: Pushed in
  - ④ Fuel selector valve: Midpoint between “right” and “closed”

(See photograph.)

## **2.9 Medical Information**

According to the information from the police, both the PIC and the passenger died mainly of cerebral contusion caused by blows to their heads.

## **2.10 Information on Aeronautical Radio Facilities**

At the time of the accident, normal radio communications were maintained between the aircraft and the flight service.

## **2.11 Fact-Finding Tests and Research**

### **2.11.1 Engine Teardown Examination**

As a result of a teardown examination of the engine, the following was confirmed.

- (1) Carbon deposits (hereinafter referred to as “deposits”) of an unusually large amount were found on the center electrode, ground electrode, insulator and others on the lower ignition plug of the No. 1 cylinder.

A small amount of deposits was found on the ground electrodes of the upper ignition plug of the No. 1 cylinder and of the lower ignition plug of the No. 3 cylinder. No deposits were found on any of the ignition plugs of the No. 2 cylinder, No. 3 cylinder (upper ignition plug) and No. 4 cylinder.

A discharge test resulted with that only the lower ignition plug of the No. 1 cylinder developed an abnormal red arc while all of the seven other ignition plugs showed normal arcing.

The seven ignition plugs except the lower one of the No. 1 cylinder had the center electrode insulators that had turned white.

- (2) More than usual amounts of deposits were found in the No. 1 cylinder, on the inner surface of the cylinder head as well as on the top surface and side surface (down to the oil scraper ring) of the piston. The amounts of the deposit are largest on the lower side of the engine, becoming smaller towards the upper side. The side surface of the piston was rough due to the deposits. Usual amount of deposits were found in the No. 2, No. 3 and No. 4 cylinders.

- (3) The choke valve of the carburetor which supplied fuel to the No. 1 and No. 3 cylinders was found burned and at an approximately 40% open position, whereas the choke valve of the carburetor which supplied fuel to the No. 2 and No. 4 cylinders was found burned and at an approximately 60% open position. Concerning carburetors, the choke and throttle cables, choke lever return springs, and connectors between the carburetor and the fuel line were found normally installed.

The carburetors could not be tested for functions as they were burned.

The fuel system, electrical system (excluding the ignition plugs), cooling system and lubrication system were burned and could not be tested.

### **2.11.2 Teardown Examination of the Propeller Pitch Change Mechanism**

A teardown examination was conducted on the propeller pitch change mechanism and the following conditions were confirmed.

- (1) The yoke of the pitch change mechanism was deformed and partially torn off by impact. The parts connected to the yoke, i.e. the stop, stop plate, rod, fork and pitch change block, retained their original shapes.
- (2) Of the four studs that connect the yoke to the thrust plate, two were bent and separated from the yoke. The other two were bent but still connected to the yoke, and their return springs were still in place.
- (3) As described in 2.8.2 (5), the root portion of the torn-off blade B could easily be turned by hand. This is because the pitch change block, the part that connected the root portion of the blade to the fork, was broken. The root portion of blade A, on the other hand, was found normally connected to the pitch change block.
- (4) The stop plate and its spring were in normal condition.
- (5) The stop plate was in the minimum pitch position.
- (6) The stop was found displaced by approximately 1 mm towards the maximum pitch position due to deformation of the yoke.

(See Figure 4.)

### **2.11.3 Estimation of Height above the Ground of the Aircraft based on Eyewitness Information when Passing in front of the Tower**

- (1) The following values were derived from actual measurement and map data.
  - a) Height of the eye point of eyewitness D (above the ground): Approximately 16 m
  - b) Horizontal distance of a perpendicular line drawn from the tower to the runway centerline: Approximately 188 m
  - c) Horizontal distance from the tower to the top of the west side hill (elevation approximately 231 m) which is located on the extension of the perpendicular line drawn from the tower to the runway centerline (the line mentioned in "b"): Approximately 625 m
- (2) Based on the above-mentioned (1) estimated value of height above the ground of the aircraft is determined as follows:

After calculating the angle above a horizontal plane when eyewitness D looked at the top of the hill which is located to the west of the runway, based on this angle, the height above the ground when the aircraft flew past the tower is calculated as approximately 28 m.

#### **2.11.4 Information based on TV News Images**

A TV camera with a fixed shooting angle was installed in the northwest corner of the roof of the aerodrome terminal building and it took images of the crash scene. Since only the recorded images aired on TV was used, an accurate analysis could not be made due to coarse image and narrow field of view, but the images provided information as outlined below.

- (1) The localizer antenna (red) located to the north of the runway of the aerodrome is visible slightly above the center of the images.
- (2) The line connecting the TV camera position and the localizer antenna crosses the extension of the runway centerline at an angle of approximately 30°.
- (3) The aircraft first appears on the upper periphery of the image, in nearly the same direction of the localizer antenna. While the aircraft moves down on the images, it moves slightly toward the right and then toward the left before it falls with the nose almost facing straight down and crashes at a position slightly to the left of the localizer antenna.
- (4) When the moving image was broken down into still images, there exists an image that showed the aircraft's wings almost parallel with the vertical axis of the image (here in after referred to as "image-A").
- (5) In some still images immediately preceding the image-A the wings and fuselage of the aircraft turning left can be recognized.
- (6) Some still images immediately succeeding image A show the fuselage almost parallel with the vertical axis and the wings almost parallel with the horizontal axis of the screen.

(See Figure 1.)

## **2.12 Other Relevant Information**

### **2.12.1 The Aerodrome and its Surroundings**

The elevation of the aerodrome is 176 m. Its sole runway is 01/19, 1,200 m long, 30 m wide and has a 60 m overrun area on each end. Alongside the runway, three runway distance marker lights are installed at approximately 300m intervals. Marker "2" is located just halfway along the runway (approximately 600 m from the south end of the runway). From the marker "2" position, the distance along the runway to a point in front of the tower is approximately 370 m, and the distance from this point to the north end of the runway is approximately 230 m.

The terrain to the north and east of the aerodrome is lower than the aerodrome. A river runs to the north of the aerodrome. There are flood plains along the river, on which aircraft can make emergency landings.

(See Figure 1.)

## 2.12.2 Description of Limitations, Normal Procedures and Performance in the Flight Manual of the Aircraft

### (1) Limitations

#### **Chapter 2 Limitations (extracts)**

1. *Maximum takeoff weight: 1,874 lb (850 kg)*

5. *Powerplant operating limitations*

5.3 *Fuel*

*Fuel: Aviation gasoline  
AVGAS 100/130 or AVGAS 100LL*

*Fuel tank capacity: 11.89 US gal (45 L) × 2*

*Usable fuel: 11.62 US gal (44L) × 2*

*Unusable fuel: 0.26 US gal (1 L) × 2*

6. *Other limitations*

6.3 *Boarding capacity: Maximum number of persons on board: 2  
Minimum number of persons on board: 1 (left seat)*

7. *Limitations on the use of instrument and control systems and other systems*

7.1 *Instrument markings*

*Airspeed indicator (extract from table)*

*Approach speed with maximum takeoff weight: 59 knots (110 km/h)*

*Engine instrument (extract from table)*

*Tachometer operating limitation (red radial): Max 5,800 rpm (for 5 min)*

### (2) Normal operating procedures

#### **Chapter 4 Normal procedures (extracts)**

5. *Engine start*

• *Fuel selector valve – Open  
(Engine start)*

• *Maintain 2,500 rpm for one min*

• *Switch to another fuel tank*

7. *Flight*

A. *Before takeoff*

- *Propeller – Low pitch*
- *Maximum static rpm\*<sup>2</sup> – Confirm 5,100 ± 100 rpm*
- *Fuel selector valve – Confirm open*

B. *Takeoff and climb*

- *Power – Takeoff power (Maximum 5,800 rpm for 5 min, then 5,500 rpm)*
- *Rotation – 49 knots (90 km/h)*
- *Brakes – Apply (to stop the wheels)*
- *Landing gear – Up*

---

\*<sup>2</sup> : Maximum static rpm is the maximum speed of the engine revolution that is stationary on the ground.

- *Climb* – *59 knots (110 km/h): Air speed for best rate of climb*

*C. Cruising*

- *Propeller pitch* – *Cruising (Procedure: At 3,800 rpm, move the pitch lever approx. 30° left, then back to the original position.) Confirm that the speed drops to 3,300 rpm or below.*

*(Procedures skipped from “Maximum continuous power operation” to “Cowl flaps.”)*

*(Note): If the propeller pitch needs to be changed from the maximum to minimum position while the engine is in operation, reduce the speed to 2,200 ~ 2,400 rpm, then move the pitch lever 30° left and bring it back to the original position. Confirm that the speed increases. Pitch change must be performed at 54 knots (100 km/h) or below to reduce the force needed to move the lever.*

(3) Performance

**Chapter 5 Performance (extracts)**

*2.2 Stall speed (extract from table)*

*The stall airspeed is 42 knots (78 km/h) and the altitude loss is 262 ft (80 m) under the following configuration: the aircraft is at a maximum takeoff weight of 1,874 lb (850 kg), the propeller is at the minimum pitch, the landing gear is extended, the spoilers are closed, and the engine is at idle.*

*2.3 Takeoff distance (extract from performance table)*

*Maximum takeoff weight: 1,874 lb (850 kg)*

*Elevation: Sea level*

*Outside air temperature: 59°F (15°C)*

	<i>Paved runway</i>
<i>Takeoff roll distance</i>	<i>738 ft</i>
<i>Takeoff distance for 49 ft obstacle clearance</i>	<i>1,060 ft</i>
<i>Takeoff speed (IAS)</i>	<i>49 knots</i>

*2.4 Takeoff distance variation with elevation and outside air temperature (distance: ft)*

*(Extract from performance table)*

*At 0 ft elevation*

*Outside air temperature 10°C: 1,007 ft (307 m)*

*Outside air temperature 20°C: 1,115 ft (340 m)*

*At 1,000 ft (305 m) elevation*

*Outside air temperature 10°C: 1,171 ft (357 m)*

*Outside air temperature 20°C: 1,273 ft (388 m)*

### 3.1 Gliding Performance

- *Maximum glide ratio: 30:1 at air speed of 58 knots (107 km/h)*

### 3.3 Climb

<i>Weight:</i>	<i>1,874 lb (850 kg)</i>
<i>Altitude:</i>	<i>Sea level</i>
<i>Outside air temperature:</i>	<i>59°F (15°C)</i>
<i>Flying speed:</i>	<i>59 knots (110 km/h)</i>
<i>Rate of climb:</i>	<i>512 ft/min (2.6 m/s)</i>

#### 2.12.3 Description of Emergency Procedures in Pilot's Guidebook

The following are the instructions (extracts) described in a guidebook for small-aircraft pilots concerning emergency procedures for a situation in which the engine(s) fails immediately after takeoff and there is not enough runway distance remaining in front of the aircraft.

- (a) Nose: Down*
- (b) Throttle: Fully closed*
- (c) Choose a forced landing site in an area ahead.*
- (d) Mixture, fuel : Cut off*
- (e) Switches : All off*

*The most important thing to cope with engine trouble after liftoff is to never let the aircraft enter a stall.*

*Push down the nose and fully close the throttle. What is crucial is not to make a turn in an attempt to return to the airport.*

#### 2.12.4 Operator's Manual

The Operator's Manual (edition: 2, May 31, 1996) for the Rotax 912A2 engine installed on the aircraft provides the following information:

- (1) According to Section "8.2 Fuel consumption," the rate of fuel consumption at takeoff power is 24.0 liters/h.
- (2) According to Section "10.2.2 Fuel," automobile gasoline is recommended as the fuel to be used. The section also states that aviation gasoline may be used only when automobile gasoline is not available.

#### 2.12.5 Information from the Manufacturer of the Aircraft

The manufacturer of the aircraft provided the following information:

- (1) Information on the fuel selector valve

A fuel selector valve from an aircraft of the same type was bench checked. The check results showed that when the valve position was midway between the "Right" and "Closed", fuel did not flow from the "right" tank into the line toward the engine.

Another check was conducted on an aircraft of the same type, in which the engine stopped in 25 seconds on average when the fuel selector valve position was set midway between the "Right" and "Closed".

(2) Information on takeoff with maximum propeller pitch

Aircraft of the same type are not authorized for takeoffs with the maximum propeller pitch, so the manufacturer has not received any reports about that from users.

The maximum static rpm is 5,100 rpm with the minimum pitch and approximately 4,200 rpm with the maximum pitch.

(3) Information on excessive weight and required runway distance

According to the company's past experience, additional runway length required for approximately 30 kg in excess of the maximum takeoff weight is not more than approximately 50 m.

### **3. ANALYSIS**

**3.1** The PIC possessed an adequate airman certificate and valid airman medical certificate.

**3.2** The aircraft had a valid certificate of airworthiness and was properly maintained and inspected.

#### **3.3 Engine System of the Aircraft**

##### **3.3.1 Engine Test Run**

As described in 2.1 (2), the eyewitness B stated, "It was a habit for the PIC of the aircraft to conduct engine test runs of the aircraft approximately once every two weeks unless prevented by rain." As described in 2.6.7, however, there were no records of an engine test run, so it is not known how many times the engine test runs were conducted during the five-month storage period.

##### **3.3.2 Formation of Deposits in the Combustion Chamber of No. 1 Cylinder**

As described in 2.11.1 (1) and (2), unusually large amounts of deposits were found on the lower ignition plug, the cylinder head and the side surface of the piston.

The deposits on the side surface of the piston as described in 2.11.1 (2) are considered to be the remnants of engine lubrication oil that accumulated while the engine was stopped, and not to be produced while the engine was operating.

Based on the analysis described above and the recent flight records of the aircraft described in 2.6.7, it is estimated that the deposits found in the combustion chamber of the No. 1 cylinder were formed during the five-month storage period following the 50-hour check of the ignition plugs.

Engine lubrication oil may flow back from the oil tank to the engine crankcase. If an aircraft is in storage for an extended period of time, the amount of backflow oil can become so much that the oil level in the crankcase rises until, although very rarely, the oil flows into the combustion chambers. It is considered possible that such a situation arose in the engine of the aircraft, allowing the engine lubrication oil in the crankcase to flow back into and accumulated in the combustion chamber, when the engine was started afterward, such oil formed deposits in the combustion chamber of the No. 1 cylinder including those found on the ignition plugs.

##### **3.3.3 Ignition Condition of the Ignition Plugs of the No. 1 Cylinder**

It is considered possible that the lower ignition plug described in 2.11.1 (1) failed to discharge while the engine was running after the deposits were formed. It is estimated, however, that the upper ignition plug was discharging normally while the engine was running although it had small amounts of deposits, because normal discharge was observed in the discharge test and the center electrode had turned white.

As described in 2.1 (1), the eyewitness A stated with regard to the engine test run performed by the PIC before the flight, "When I asked the PIC about the condition of the aircraft, he said 'No problem'" It is therefore considered that the PIC recognized that the engine operation

was normal.

### 3.3.4 Effect of the Deposits on the Engine

As described in 3.3.1 ~ 3.3.3, it is estimated that the aircraft's engine was able to operate almost normally while deposits had formed in the No. 1 cylinder. It is therefore estimated that the deposits did not have influence on the aircraft's takeoff flight path, which was lower than that derived from the performance data described in 3.7.2.

### 3.3.5 Carburetor Condition

As described in 2.8.3 (2), the on-site examination conducted just after the accident revealed that the choke handle was in the pushed-in position. In the subsequent teardown examination, the choke valves were found at nearly half-open position\*<sup>3</sup> as described in 2.11.1 (3).

It is considered possible that these conditions were attributable to the choke cables having been bent by the impact of the crash or by the crushing of the engine compartment.

## 3.4 Abnormal Conditions of the Engine of the Aircraft

As described in 2.11.1 (1), the center electrodes of all seven ignition plugs, excluding the lower plug of the No. 1 cylinders, had turned white. It is, therefore, estimated that the engine's combustion temperature had been higher than normal. However, it is not possible to determine its cause.

As described in 2.1 (3), the eyewitness C stated that he heard an irregular "coughing" sound from the aircraft during climb and a "puffing" sound immediately before the crash. Therefore, it is considered possible that the aircraft's engine had temporarily suffered from a malfunction due to backfire\*<sup>4</sup> or afterfire\*<sup>5</sup> during climb.

It is considered possible that backfire or other malfunction may have occurred due to:

- (1) Too lean or too rich air-fuel mixture
- (2) Premature ignition caused by deposits in the cylinder

As described in 2.8.3 (2), the fuel selector valve position was found to be midway between the "Right" and "Closed". In light of the following reasons, it is considered possible that the valve was in the normal position during flight but the impact forces of the crash then moved it.

- (1) According to the statements of the eyewitnesses, it is considered that the engine was running until the moment of the crash.
- (2) Because it takes approximately 25 seconds from the time when the fuel selector valve is placed midway between the "Right" and "Closed" positions to the time when the engine stop, according to the information provided by the manufacturer of the aircraft

---

\*<sup>3</sup>: By pulling the choke handle, the opening of the choke valve is adjusted, via the choke lever. The flight manual states that the choke handle should be pulled as necessary during engine starts.

\*<sup>4</sup>: Backfire means such a phenomenon that when the air-fuel mixture is too lean, flame propagates slowly, which causes the combustion to last until the end of the exhaust stroke, then the mixture in the intake manifold is ignited during the time of valve overlap, and the flame propagates back to the air intake system.

\*<sup>5</sup>: Afterfire means such a phenomenon that when the air-fuel mixture is too rich, flame propagates slowly, which causes unburned mixture to be discharged in the exhaust, and ignited, or when the air-fuel mixture is discharged unignited into the exhaust due to ignition plug failure and is then ignited there.

described in 2.12.5, it is considered that a period of time longer than 25 seconds had elapsed from the time of start of takeoff during which the selector valve could have been operated to the time when the engine could have fallen into a temporarily malfunctioning condition.

### **3.5 Fuel of the Aircraft**

According to the situation in which the aircraft had been filled with fuel as described in 2.1 (1) and the results of the examination of the remaining fuel as described in 2.8.3 (1), it is recognized that the aircraft was loaded with automobile premium gasoline.

As described in 2.12.2 (1), the flight manual specifies the use of AVGAS100/130 or AVGAS100LL. The octane rating\*<sup>6</sup> for automobile premium gasoline is 98 to 100. There is no difference between these aviation fuels and automobile premium gasoline.

The manufacturer of the aircraft specifies use of aviation gasoline in the “Limitations” section of the flight manual as described in 2.12.2 (1), but as described in 2.12.4 (2), the manufacturer of the aircraft’s engine recommends automobile gasoline and permits the use of aviation gasoline only if automobile gasoline is not available. Therefore, this accident is considered to have no relations with the fuel used in the aircraft.

### **3.6 Propeller System of the Aircraft**

#### **3.6.1 Propeller Pitch Change Mechanism Condition**

The teardown examination showed that the stop plate was at the minimum pitch position as described in 2.11.2 (5), whereas the stop was approximately 1 mm displaced toward the maximum pitch side as described in 2.11.2 (6).

At the maximum pitch position, the rod (for pitch change) is moved forward of the aircraft than from the minimum pitch position by a distance equivalent to the thickness of the stop (approximately 1.5 mm).

The stop plate is subject to both centrifugal and spring forces but it remains fixed by frictional force as long as it is pressed aft by the yoke.

Given that one side of the yoke was bent aft against the propeller hub indicating the possibility of a slight movement of the stop toward the maximum pitch side and that the two studs connecting to the yoke were deformed, it can hardly be said that after the crash the propeller pitch retained the position during flight.

#### **3.6.2 Setting of the Propeller Pitch**

According to the statements of the eyewitnesses in 2.1, they described the climb after takeoff of the aircraft as follows: “I did not notice anything abnormal about its climb angle or flying speed.” “...the takeoff roll distance seemed longer than usual and the rate of climb after liftoff seemed a bit poor.” “... it climbed at a smaller rate than usual and did not have a substantial gain in height, ...” Given that none of the eyewitnesses mentioned that the aircraft’s rate of climb changed

---

\*<sup>6</sup> : The octane rating is an index of the antiknock ability of a fuel. The maximum index number is 100.

greatly, it is considered that the aircraft was climbing at an almost constant rate.

If, during the test run of the engine mentioned in 1.2 (1) and (4), the PIC set the propeller to the maximum pitch to check the propeller pitch change function but forgot to return it to the minimum pitch, it is considered possible that the aircraft began the takeoff roll with the propeller in the maximum pitch position, because the position of the pitch lever did not provide him with any means to determine whether the propeller was at the maximum or minimum pitch position.

If an aircraft initiates a takeoff roll with the propeller at the maximum pitch, the thrust available from the propeller is lowered because its propelling efficiency is reduced and the maximum revolutionary speed cannot be reached, and consequently, the takeoff roll distance is substantially extended compared to a normal takeoff. Considering the PIC's flying and other related experiences, he would have been able to notice the unusually long takeoff roll distance. But he continued the takeoff. It is, therefore, considered possible that the PIC judged the longer-than-usual takeoff roll distance was caused by the heavy takeoff weight of the aircraft.

Based on these things, it is considered possible that the low takeoff flight path of the aircraft might be caused by the PIC performing the takeoff with the propeller mistakenly in the maximum pitch position.

### **3.7 Takeoff Climb of the Aircraft**

#### **3.7.1 Analysis Based on the Eyewitness Statements**

- (1) Position and height above the ground of the aircraft immediately before the steep turn  
Immediately before making a steep left turn, the aircraft position was approximately over the runway end and its height above the ground was approximately 40 ~ 50 m, according to the eyewitness statements described in 2.1.

It is difficult to estimate how far the aircraft continued a straight climb because the eyewitnesses had no usable ground references for estimating the aircraft position and they were observing the aircraft from positions off the runway. However, since the eyewitnesses positions were within a relatively short distance (slightly over 100 m to less than 300 m) from the runway end, it is estimated that the aircraft position was almost over the runway end.

- (2) Estimation of the aircraft's height above the ground at the runway end  
Based on the statement by the eyewitness D as described in 2.1 (4), it is assumed that the aircraft lifted off at a point halfway along the runway (at a point corresponding to runway distance marker light "2").

When a line is drawn from this liftoff point to a point approximately 28 m above the ground in front of the tower as described in 2.11.3 (2), the extension of the line provides a height above the ground of approximately 45 m at the runway end.

Based on these things, it is considered that the aircraft's height above the ground over the runway end was approximately 40 ~ 50 m.

#### **3.7.2 Analysis Based on the Performance Table**

On the assumption that the aircraft was in normal condition, the height above the ground

of the aircraft when passing in front of the tower and that over the runway end, under the conditions of the day of the accident, are calculated as follows from the performance table in the aircraft's flight manual as indicated in 2.12.2.

(1) Assumptions

- a) The aircraft started its takeoff from the south end of Runway 01.

The south end of Runway 01 is adopted as the takeoff start point because, the aircraft turned around on the turning pad according to the statement of the eyewitness D as described in 2.1 (4).

- b) The aircraft flew above the centerline of the runway.

According to the statement of the eyewitness C as described in 2.1 (3), the aircraft changed its heading before it reached the runway end. However, as it took only a short time for the heading change, it is assumed that the aircraft was climbing straight.

- c) The aircraft was climbing at a flying speed of 59 kt (110 km/h).

While no objective data is available regarding the flying speed of the aircraft during the climb, it is assumed that the aircraft was climbing at a speed specified in the flight manual.

- d) The climb rate was at 512 ft/min.

It is assumed that the aircraft was climbing at a rate indicated in the flight manual.

Since none of the eyewitness statements described in 2.1 mention any change in climb angle before the aircraft started a steep left turn, it is assumed that the aircraft climbed at an almost constant rate.

- e) The wind component in the direction of the runway on the day of the accident (headwind, 6 ~ 8 kt) is used. In this condition, the climb angle gets approximately 12 ~ 16% greater than that in no-wind conditions.

(2) The following values are used for calculating the aircraft's height above the ground.

- a) Distance between the takeoff start point on Runway 01 and the point on the runway in front of the tower, based on the distance measurements indicated in 2.12.1: Approximately 970 m

- b) 49 ft (15 m) obstacle clearance takeoff distance (elevation at 176 m and outside air temperature at 11°C): Approximately 340 m

- c) Climb angle: Approximately 4.9° under no-wind conditions;

Approximately 5.5 ~ 5.7° in the winds on the day of accident

(3) Based on (1) and (2) above, the aircraft's heights above the ground are calculated from the performance table as follows:

	No wind	Headwind component 6 kt	Headwind component 8 kt
Height above the ground when passing in front of the tower	69 m	76 m	78 m
Height above the ground when over the runway end	89 m	98 m	101 m

The above estimations include a certain degree of error as they are based on assumptions.

- (4) Heights above the ground from the Performance-table which will be used for later analyses

Heights above the ground indicated below will be used as approximate values in the later analyses.

- Height above the ground when the aircraft was passing in front of the tower:  
Approximately 75 m
- Height above the ground over the runway end:  
Approximately 100 m

### **3.7.3 Flight Path of the Aircraft**

The analysis results described in 3.7.1 and 3.7.2 are summarized below.

The height above the ground of the aircraft over the runway end is estimated approximately 40 ~ 50 m, which is 50% or less of approximately 100 m which is obtained from the performance data in the aircraft's flight manual. This tendency holds true for both the aircraft's height above the ground in front of the tower and the takeoff roll distance. It is, therefore, considered that the aircraft was not using its performance fully.

## **3.8 Steep Turn and Crash of the Aircraft**

### **3.8.1 Flight Attitude Estimated from the TV Camera Images**

It is estimated that, based on the TV images described in 2.11.4, the aircraft was in a left turn almost over the runway end, and when recorded as the image A, the nose was nearly level but the aircraft banked at a large angle, and immediately after that, the nose fell rapidly and crashed.

This almost coincides with the eyewitness statements described in 2.1.

### **3.8.2 Left Steep Turn almost over the Runway End**

From the statements of the four eyewitnesses described in 2.1, it is estimated that, when the aircraft climbed to almost over the runway end, the PIC decided to land on Runway 19, and, in order to reverse the aircraft's heading, he at first made a right turn in a nose-up attitude and then made a left turn with an excessively large bank angle while reporting "turn back" by radio.

### **3.8.3 Operation of the Landing Gear**

According to the eyewitness B described in 2.1 (2), he stated that, "(When) the aircraft made its nose down and directed towards the Beechcraft,.. the aircraft's landing gear was still retracted. When the lower surface of the aircraft became visible after turning, the landing gear was extended," it is considered that the operation was made to extend the landing gear during a left turn.

### **3.8.4 Excessive Bank Angle and Stall Speed**

As to the flying speed of the aircraft during climb immediately before the crash, based on that the landing gear was retracted after liftoff and the climb was continued, it is considered that

the aircraft made liftoff at a rotation speed of 49 kt (90 km/h), accelerated to the best rate of climb speed of 59 kt (110 km/h) and was climbing per the normal procedure described in 2.12.2 (2).

As described in 2.12.2(3) the stall airspeed of the aircraft is 42 kt (78 km/h) with the conditions of maximum takeoff weight, minimum propeller pitch, extended landing gear, retracted spoilers and engine at idle. If, under the same conditions as these, the aircraft makes a level turn with a 60° bank angle, its stall speed is estimated as approximately 59 kt (110 km/h) and any further increase in bank angle sharply raises the stall speed.

In light of the above, it is considered that the aircraft stalled due to too large a bank angle at the above-mentioned airspeed during the climb and entered into a spin.

### **3.8.5 Stall and Loss of Altitude**

As described in 2.12.2 (3), under the conditions of maximum takeoff weight, minimum propeller pitch, extended landing gear, retracted spoilers and the engine at idle, the altitude loss from stall to recovery is 262 ft (80 m).

The aircraft's height above the ground over the runway end was approximately 40 ~ 50 m. This height is estimated to have been insufficient for the aircraft to recover from the stall when the aircraft stalls during straight flight and to have been extremely insufficient to recover from a spin.

### **3.8.6 Post-Stall Situation**

Based on the conditions of the crash site as described in 2.8.1 and 2.8.2 and the circumstances including the steep turn as described in 3.8.1 ~ 3.8.5, it is estimated that the aircraft stalled during a steep turn, entered into a spin and crashed onto the ground with a steep angle.

## **3.9 PIC's Judgment**

### **3.9.1 From Takeoff Roll to Liftoff**

Based on that the PIC said "No problem." to the eyewitness A as to the engine test run before departure as described in the statement of the eyewitness A in 2.1 (1) and that the deposits in the cylinder is not estimated to affect engine operation as described in 3.3.4, it is considered that the engine was running almost without problem.

In addition, because it is considered that the PIC would have aborted the takeoff if he had felt anything abnormal or its sign with the engine operation during the takeoff roll, it is considered that there were no conditions in which the PIC found something abnormal with the engine operation.

Moreover, as to the longer-than-normal distance from the start of takeoff roll to the liftoff point, it is considered that the PIC judged it to be caused by the takeoff weight heavier than usual, continued rolling and took off as it reached liftoff speed. And as to the climb after liftoff, it is considered that the aircraft was making less than usual but stable climb. Based on those, it is considered that the PIC did not find anything abnormal in engine operation until he decided to turn back.

### **3.9.2 Decision of Return to Steep Turn**

It is considered that during climb, the PIC noticed an abnormal noise as described in 3.4 or something abnormal related to the noise, then almost over the runway end, he made a brief right turn followed by a steep left turn in an attempt to return to the runway.

Concerning the reason why the PIC made a steep turn and tried to return in spite of low altitude, it is considered possible that he thought that he could return to the runway by making a turn back quickly while the engine was still generating power. This is based on that the aircraft made a turn at a lower altitude than the return altitude used in usual training, that the landing gear was extended during the turn, and that the throttle was found fully open position as described in 2.8.3 (2).

Concerning that the bank angle became excessively large, it is considered possible that the control was moved too much in a hurry to return.

In cases that the engine develops a problem immediately after takeoff, the PIC should not try in haste to land on the runway from which he took off and should make a judgment to return after gaining sufficient height above the ground. As described in 2.12.3, it was necessary to make nose down as necessary and maintain the speed to prevent the aircraft from stalling.

Even if a situation had not allowed the aircraft to return to the runway of the aerodrome immediately, it was possible to maintain the height above the ground and speed by gliding toward the lower-elevation terrain to the north and east of aerodrome as described in 2.12.1, consequently, even with the engine inoperative, it is considered that a choice could be made to conduct an emergency landing where appropriate, such as on the flood plains.

## 4. PROBABLE CAUSE

In this accident, the aircraft was destroyed and burst into flames, and the PIC and a passenger aboard were killed. The cause of the accident is estimated that, while the aircraft was climbing after takeoff, it made a steep turn with an excessively large bank angle at a low altitude almost over the runway end in an attempt to return to the aerodrome, then it stalled and entered into spin from which it could not recover and crashed, as the aircraft's height above the ground was not sufficient to recover.

As to that the aircraft tried to return at a low altitude, and made a steep turn with an excessively large bank angle, it is estimated that a certain anomaly happened to operating conditions of the engine of the aircraft.

However, the nature and cause of the anomaly could not be identified.

Figure 1 Estimated Flight Route

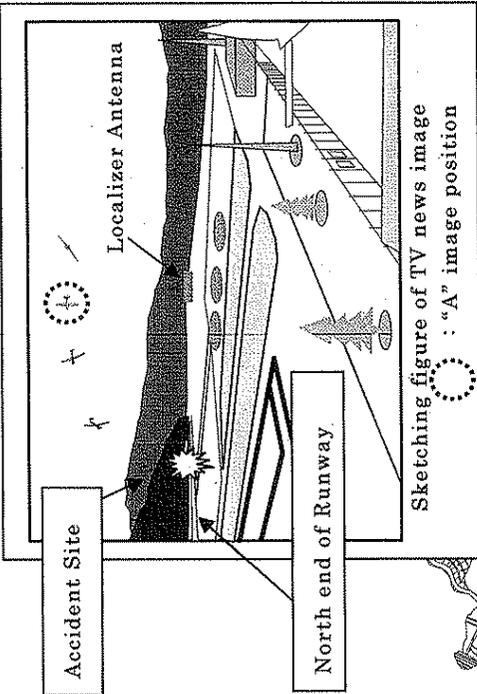
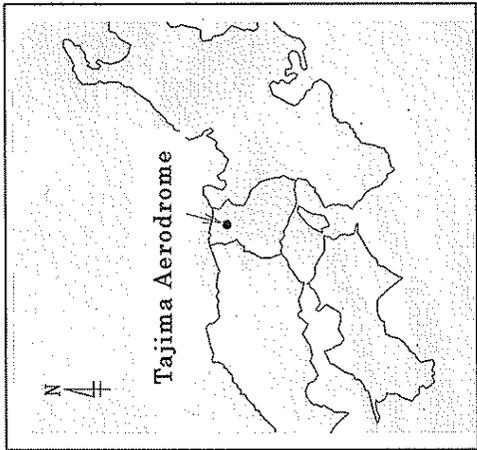
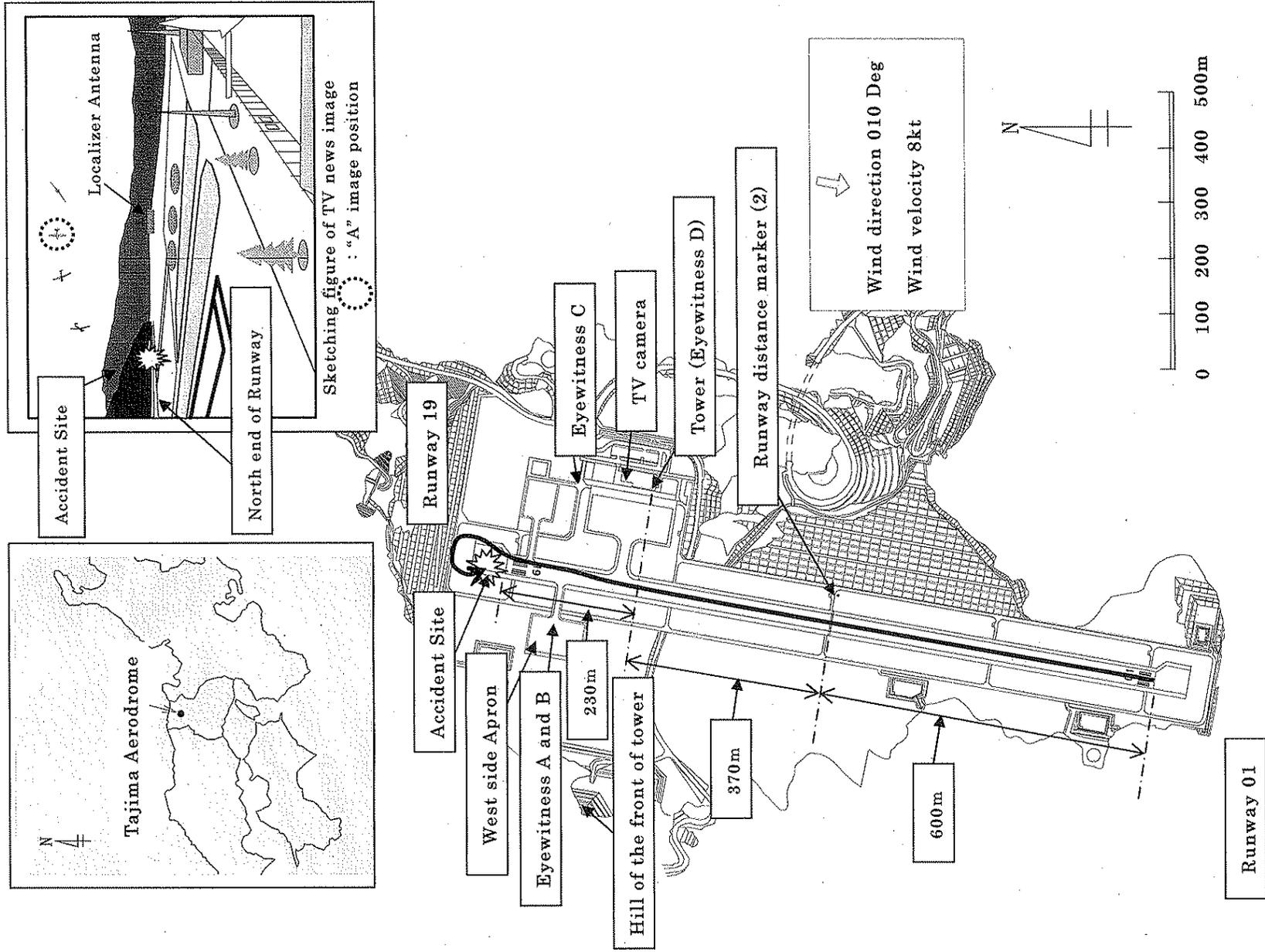


Figure 2 Three angle view of AMT-200

Unit : m

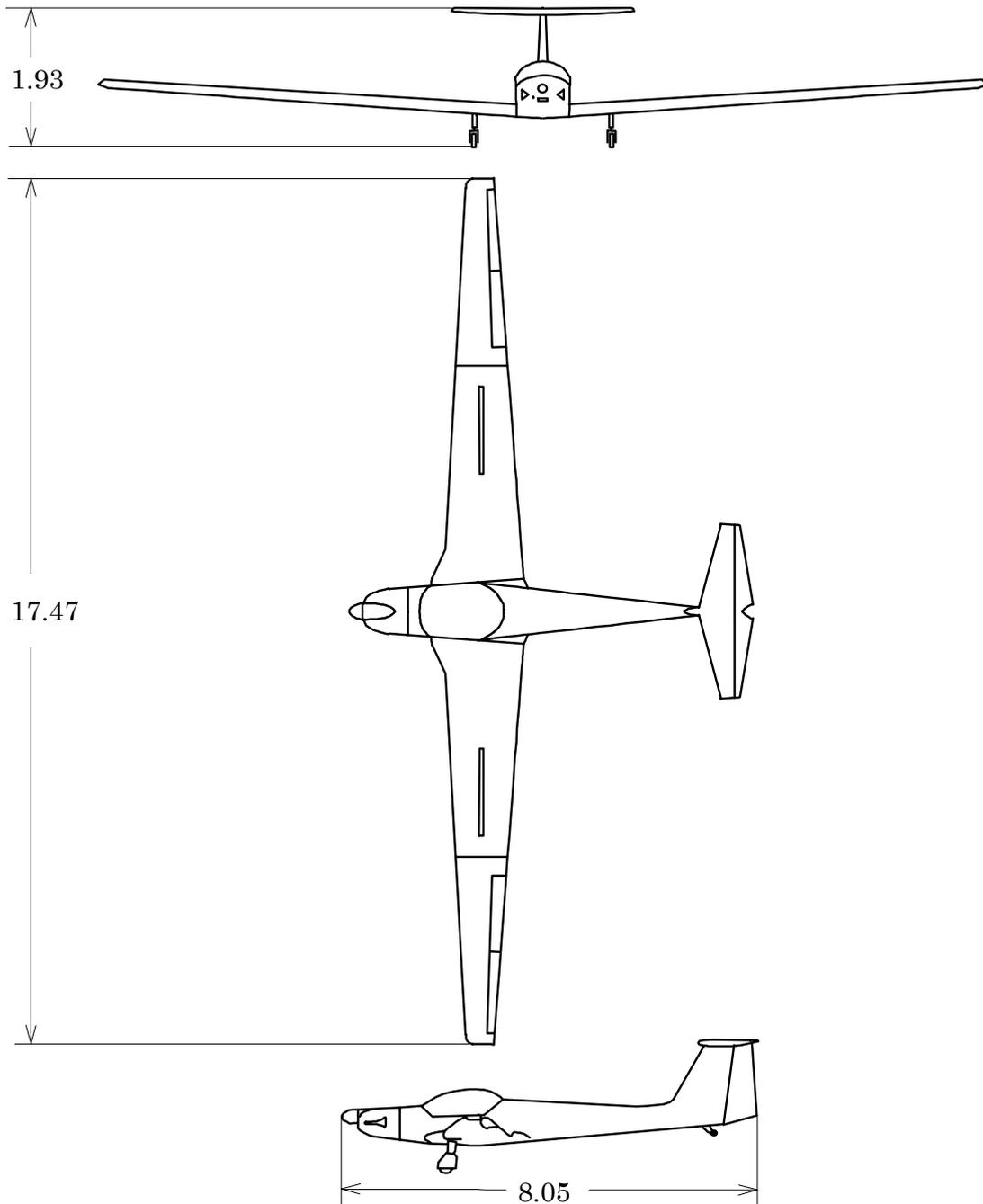


Figure 3 Around the Accident Site

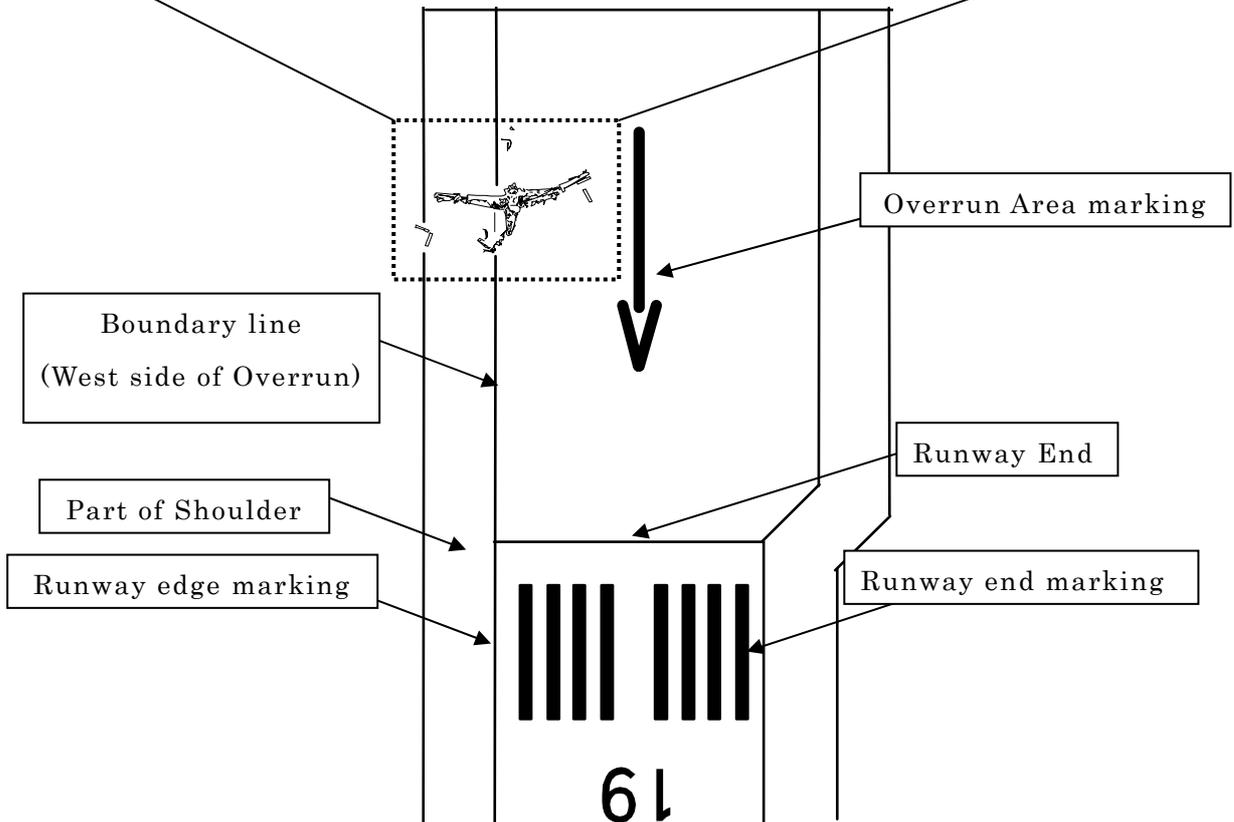
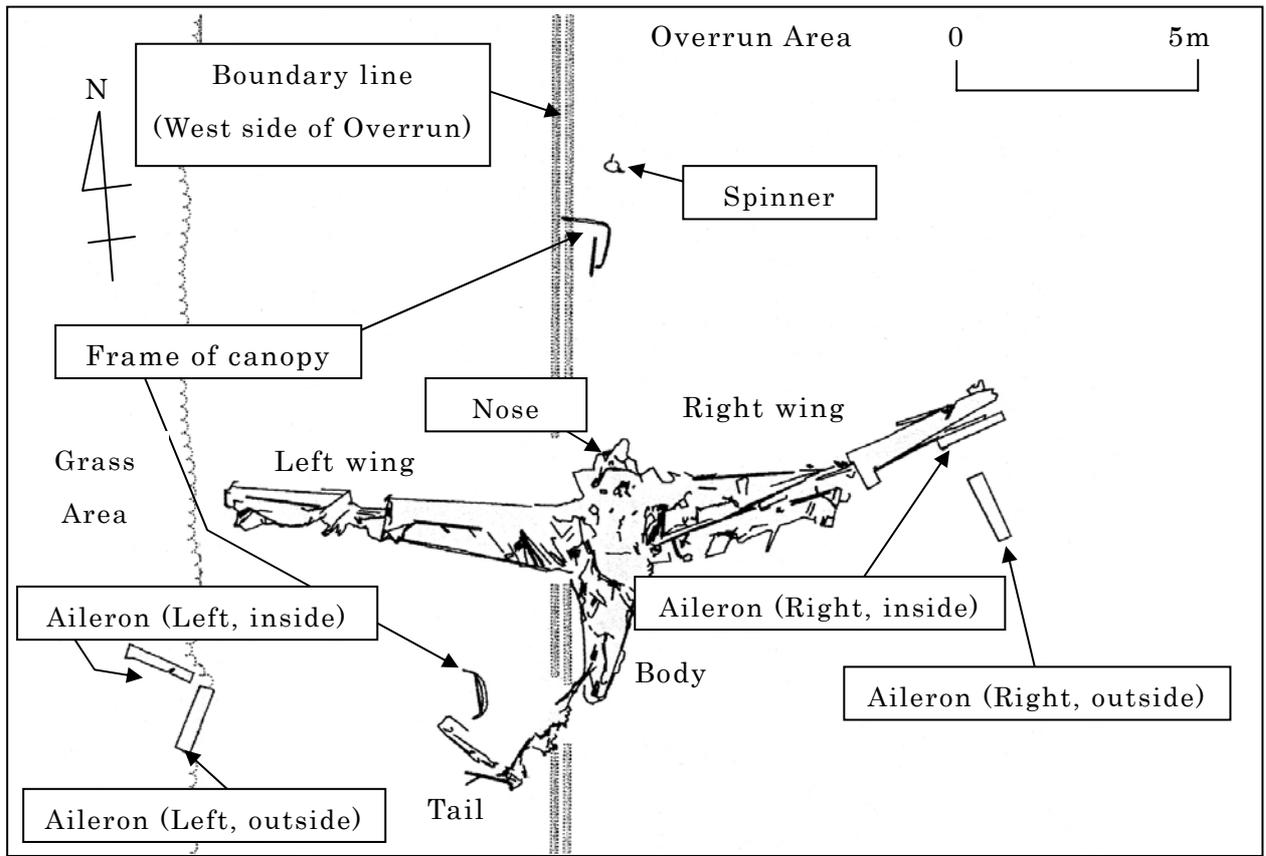


Figure 4 Propeller pitch change mechanism

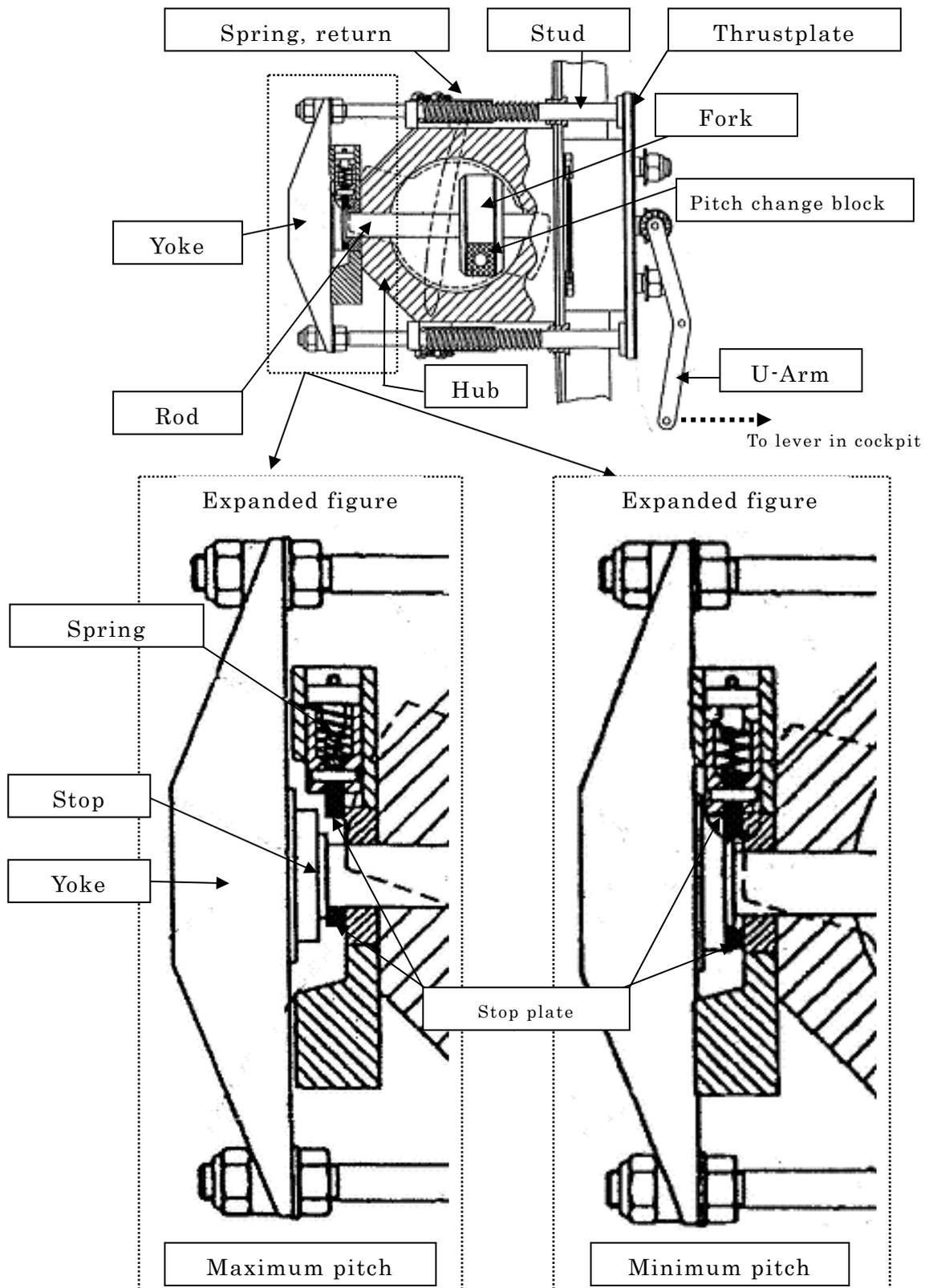


Photo Situation of the switches

