

AA2012-2

**AIRCRAFT ACCIDENT  
INVESTIGATION REPORT**

**Honda Airways Co. Ltd.**

**J A 3 1 T M (Rotorcraft)**

**February 24, 2012**

**Japan Transport Safety Board**

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board and with Annex 13 to the Convention on International Civil Aviation is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

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

SAITAMA PREFECTURAL GOVERNMENT  
(OPERATED BY CONTRACTED HONDA AIRWAYS CO. LTD.)  
EUROCOPTER AS365N3, JA31TM (ROTORCRAFT)  
MOUNTAINOUS AREA IN OTAKI, CHICHIBU CITY  
SAITAMA PREFECTURE  
AROUND 11:03 JST, JULY 25, 2010

February 10, 2012

Adopted by the Japan Transport Safety Board

Chairman	Norihiro Goto
Member	Shinsuke Endoh
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Yuki Shuto
Member	Toshiaki Shinagawa

# 1. PROCESS AND PROGRESS OF AIRCRAFT ACCIDENT INVESTIGATION

## 1.1 Summary of the Accident

On July 25 (Sunday), 2010, a Eurocopter AS365N3, registered JA31TM, owned by Saitama Prefectural Government took off from a temporary helipad in Otaki, Chichibu City, Saitama Prefecture at 10:48 Japan Standard Time (JST, UTC+ 9 hr.) for a rescue operation. The aircraft, while hoisting down two rescuers (one from Saitama Disaster Prevention Aviation Unit and a firefighter from Chichibu Fire Brigade) to a ravine upstream of Takigawa, crashed around 11:03.

Of seven persons on board, two hoisted-down persons survived; however, five persons (a pilot in command, a pilot, two rescuers from Saitama Disaster Prevention Aviation Unit and a firefighter from Chichibu Fire Brigade) sustained fatal injuries.

The aircraft was destroyed; however, no fire broke out.

## 1.2 Outline of the Accident Investigation

### 1.2.1 Investigation Organization

On July 25, 2010, the Japan Transport Safety Board (JTBSB) designated an investigator-in-charge and two investigators to investigate this accident.

### 1.2.2 Representatives From Relevant Authorities

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

### 1.2.3 Cooperation

The Japan Aerospace Exploration Agency (JAXA) supported the JTBSB for the analysis of imagery information retrieved from the aircraft's hoist camera.

### 1.2.4 Implementation of the Investigation

July 25 to 30, 2010	On-site investigation and Interview
August 4, 2010	Interviews
August 18, 2010	Interviews
August 31 to September 3	On-site investigation
September 9 to 11, 201	Aircraft examination
October 8 to February 20, 2011	Examination of electronic control units
November 11, 2010	Hoist examination
November 25, 2010	Interviews
December 15 to June 15, 2011	Analysis of imagery retrieved from the hoist camera
April 21, 2011	Interview, aircraft examination

### 1.2.5 Interim Report

On July 29, 2011, based on the factual information gained until then, an interim report was submitted to the Minister of Land, Infrastructure, Transport and Tourism and was publicized.

### **1.2.6 Comments From the Parties Relevant to the Cause of the Accident**

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

### **1.2.6 Comments From the Relevant States**

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

## 2. FACTUAL INFORMATION

### 2.1 History of the Flight

The Eurocopter AS365N3, registered JA31TM<sup>1</sup>, owned by Saitama Prefectural Government, took off from Honda Airport<sup>2</sup> at 09:42 on July 25, 2010, with a pilot in command (PIC) in the right seat, a pilot who had a pilot license of land-use single turbine engine helicopter (hereinafter referred to as the LST pilot) in the left seat, and three rescuers who belonged to Saitama Disaster Prevention Aviation Unit (hereinafter referred to as “the Air Rescuers”) in the cabin for the rescue operation of a gorge climbing party in upstream of Takigawa, in Otaki, Chichibu City, Saitama Prefecture. The Aircraft, after a recon flight over the would-be rescue operation area, landed at Deai-no-oka temporary helipad in Otaki (hereinafter referred to as “the Helipad”) at 10:25. After the meeting on rescue strategy with the attendance of Chichibu Fire Brigade (hereinafter referred to as “the Firefighters”) and others, the aircraft took off at 10:48 with two additional Firefighters – seven persons in total onboard.

The flight plan for the aircraft was outlined below:

Flight rules:	Visual flight rules (VFR)
Departure aerodrome:	Chichibu City, Saitama Prefecture
Estimated off-block time:	11:00
Cruising speed:	120 kt
Cruising altitude:	VFR
Destination aerodrome:	Chichibu City, Saitama Prefecture
Total estimated elapsed time:	1 hr. 30 min.
Persons on board:	5

#### 2.1.1 Situational Development from Reception of Official Rescue Request to Confirmation of Aircraft Crash

The event developed roughly as follows according to the statements of Air Rescuer A and Firefighter A, who were hoisted down and survived, imagery information retrieved from the hoist-mounted camera and information provided by Saitama Prefecture Disaster Prevention Aviation Center (hereinafter referred to as “the Center”) and the police.

Around 09:18	The Center received an official rescue request from Chichibu Fire Brigade Headquarters, in which one of the female member of the gorge climbing party (nine members) slipped into a waterfall plunge pool near the confluence of Suishodani and Budosawa and was receiving resuscitation on site.
Around 09:42	The aircraft took off from Honda Airport with five persons on board – the PIC, the LST pilot and three Air Rescuers.

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<sup>1</sup> The aircraft was operated by Honda Airways Co. Ltd. under the flight operation contract with Saitama Prefectural Government. The PIC and the LST pilot were employees of the company.

<sup>2</sup> Saitama Disaster Prevention Aviation Center is stationed at Honda Airport

Around 09:58	The aircraft arrived at the would-be rescue area; however, it could not spot the party.
Around 10:20	The aircraft left the area and headed for the Helipad.
10:25	The aircraft landed at the Helipad and the Firefighters joined the meeting with the Air Rescuers.
10:48	The aircraft took off from the Helipad with two additional Firefighters. After reaching the would-be rescue area and a recon flight, it located the party and chose the hovering point for the hoist descent.
11:02	Two rescuers (the Air Rescuer A and the Firefighter A) began the hoist descent. Their descent was witnessed by some of the party members.
11:04	A helicopter operated by the Saitama Police Aviation Unit nicknamed Musashi (hereinafter referred to as “the Police Helicopter”) took off from the Helipad for the same rescue mission.
11:06	The Police Helicopter spotted a plume of smoke rising from the would-be rescue area.
11:08	The Police Helicopter confirmed the crash of the aircraft.

## 2.1.2 Statements of Air Rescuer A, Firefighter A and Eyewitness

### (1) Air Rescuer A

The aircraft took off from the Center at 09:42 and flew to the area near the confluence of Suishodani and Budosawa around 09:58; however, it could not spot the party. It left the area around 10:20 and flew to the Helipad to join firefighters. After the landing, information exchange and coordination were made with mountain rescuers from Saitama Prefectural Police (hereinafter referred to as “the Mountain Rescuers”). They agreed to insert two firefighters first to collect information and they would decide the follow-on procedures.

When the aircraft arrived over the area of rescue operation, the Air Rescuer A opened the right sliding door to confirm the location of the party. The foliage was dense but the stream of the ravine was visible. Both sides of ravine were almost precipitous cliffs. As he spotted a seemingly flat place near the stream, he, after consulting the hoist operator (vice commander) and the Firefighter A on its feasibility, decided it as the target of hoist descent. The Air Rescuer A closed the door and started the final preparation for the descent while the aircraft was either circling the area or hovering there. When they're ready the aircraft hovered in from downstream and occupied the hovering point a little downstream from the target of descent. He opened the door and the hoist operator guided the aircraft to the target of descent; however, as the aircraft was away from the target the Air Rescuer A guided the aircraft to the left by about 5 m. Both the Air Rescuer A and the Firefighter A being suspended from the hoist hook facing with each other, the former a little bit higher than the latter, started the descent. The aircraft at this moment was orienting to the

waterfall (west).

When they were downed to the point about 3 m above the ground, the Air Rescuer A sent a hand signal of “landing soon.” But as their position was off the target to downstream he sent signals to move the aircraft upstream by about 2 m and lower them.

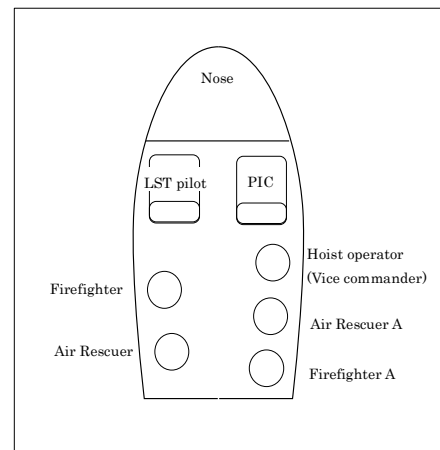
When they reached about 1 m above the ground, they were dropped and landed on the ground and tumbled. The Air Rescuer A tumbled to the right while the Firefighter A to the left. Because the hoist cable was sagging just after the landing, the Air Rescuer A looked up and saw the aircraft beyond the foliage in an unusual attitude. He thought the altitude of the aircraft was about 30 m. He judged that it would crash and with his quick wits he unhooked the combined karabiner (for the two) from the hoist hook and heard the crashing sound. He did not see how it crashed. The hoist hook escaped from his hands right away.

Later he rushed to the aircraft and called the occupants’ names; however, there were no replies. As a plume of smoke was coming from an engine he doused it with stream water. Oily smell was wafting and he moved away from the aircraft feeling a danger.

## (2) Firefighter A

Around 9 o’clock Chichibu Fire Brigade Headquarters received an official rescue request from Saitama Prefectural Police Headquarters saying that a woman had slipped into a waterfall plunge pool and had been in cardio pulmonary arrest condition. As the accident site was located in a mountainous rugged area and rescue operations from the ground would take time, they decided to employ a helicopter. With the forecast of deteriorating weather in the afternoon the headquarters made an arrangement with the Center and they decided to dispatch a helicopter. The Firefighter A drove a rescue fire engine to the Helipad to join the helicopter crew members and some Mountain Rescuers. He joined them around 10:25. They had a meeting on rescue strategy and rechecked rescue gears for the mission.

The aircraft took off from the Helipad at 10:48, flew to the would-be rescue area, spotted the party, and flew upstream to occupy the hovering position. The cabin layout then is depicted as shown on the right. The hoist operator took the position in the right forward cabin, two persons who descend first sat next to him, and the remaining two persons who would descend next sat in the left aft cabin preparing the descent.



The Firefighter A donned a survivor’s sling<sup>3</sup> for two- man descent, suspended himself with the Air Rescuer A facing with each other and they began descent. Being suspended from the hoist hook with the sling, the Firefighter A’s posture faced upward so that he could not see below. About 1 m away from the ground, he felt a sudden drop and landed on the ground slipping and tumbling to the left, hitting his head. Altitude fluctuation of 30 cm or so was common, so that he did not worry about the 1 m drop. He heard strange low-pitched tearing sound coming from above. It sounded like a troubled main rotor blades,

<sup>3</sup> A survivor’s sling is a harness used to hoist up a rescue requiring person by placing it under his/her armpits.



the one he had never heard before. It sounded completely different from the aircraft's typical high-pitched tail rotor sound. When he looked up he saw the aircraft diving with its nose about 45° down toward left bank cliff. It crashed into it with its nose section, slid down to the stream and came to a halt orienting downstream. The main rotor was turning until the aircraft crashed into the cliff.

After the landing the Firefighter A took off the survivor's sling and rushed to the Aircraft.

As he felt main rotor downwash coming from above not being deflected during the descent he thought the wind was calm. The hovering was smooth and there was no jolt. Visibility was good and temperature was not high.

### (3) Eyewitness

The eyewitness and his members, orienting to the east, were on the south side of the waterfall plunge pool which is above the waterfall plunge pool upstream of the accident site. When a helicopter came, it circled above them and flew away.

The helicopter came again and hovered above the ridge just in front of them and rescuers began a hoist descent being suspended from the helicopter. They landed on the flat stony spot next to the lower waterfall plunge pool. They did not land after a straight simple descent. During their descent their suspended position drifted downstream, then upstream. When they started descent water flow into the lower plunge pool was normal; however, some time later water splashes blew upward.

The eyewitness heard a tearing sound and looked up to see the helicopter with its main rotors slowly turning, moved downstream with its nose about 45° down and crashed into the left bank cliff and tumbled down into the stream, although he did not observe the whole process.

The accident occurred around 11:03 in an upstream of Takigawa, Otaki, Chichibu City, Saitama Prefecture (35° 52' 02"N, 138° 49' 37"E).

(See Figure 1 – Estimated Flight Route and Accident Site, Figure 2 – Detailed Accident Site, and Photo 1 – Situation Just after Crash)

## **2.2 Injuries to Persons**

PIC, LST pilot, two Air Rescuers and one Firefighter sustained fatal injuries.

## **2.3 Damage to the Aircraft**

### **2.3.1 Degree of Damage**

Destroyed

### **2.3.2 Damage of Major Aircraft Components**

Fuselage:	Destroyed
Main rotor blades:	One blade was fractured and the remaining three were damaged.
Engine:	Damaged
Tailboom:	Damaged

Tail rotor assembly: Fractured

## 2.4 Personnel Information

(1) PIC: Male, Age 54

a. Certificates

Commercial Pilot Certificate (Rotorcraft)	March 28, 1988
Type rating for land-use multi turbine engines	
Aerospacial AS365	June 20, 1996
Class 1 Aviation Medical Certificate	
Validity	April 14, 2011
Total flight time	5,255 hr. 11 min.
Flight time in the last 30 days	2 hr. 53 min.
Total flight time on the type of aircraft	1,274 hr. 30 min.
Flight time in the last 30 days	2 hr. 15 min.

b. Emergency flight missions experienced in the vicinity of the accident site

He had flown five rescue missions in the area since 2009.

(2) LST pilot: Male, Age 32

a. Certificates

Commercial Pilot Certificate (Rotorcraft)	June 7, 2006
Type rating for land-use single turbine engine	June 7, 2006
Class 1 Aviation Medical Certificate	
Validity	June 22, 2011
Total flight time	572 hr. 29 min.
Flight time in the last 30 days	4 hr. 53 min.
Total flight time on the type of aircraft	4 hr. 53 min.
Flight time in the last 30 days	4 hr. 53 min.

b. Emergency flight missions experienced in the vicinity of the accident site

The accident flight was his first flight in the area.

## 2.5 Aircraft Information

### 2.5.1 Aircraft

Type	Eurocopter AS365N3
Serial number	6729
Date of manufacture	December 19, 2005
Certificate of airworthiness	DAI TO-21-429-GO
Validity	December 9, 2010
Category of airworthiness	Rotorcraft, Transport TA, TB or Special X
Total flight time	1,273 hr. 16 min.
Flight time since last periodical check	93 hr. 53 min.

(600 hr. check on April 29, 2010)

(See Figure 3 – Three Angle View of Eurocopter AS365N3)

## 2.5.2 Engines

	#1 Engine	#2 Engine
Type	Turbomecha ARRIEL2C	
Serial number	24283	24288
Date of manufacture	14-Sep-05	29-Sep-05
Total time in service	1,273 hr. 16 min.	1,273 hr. 16 min.
Flight time since last periodical check	5 hr. 28 min. (30 hr. Engine check done on July 21, 2010)	

## 2.5.3 Weight and Balance

The Aircraft weight at the time of the accident was estimated to have been 3,600 kg and its center of gravity (CG) 3.9 m aft of the datum line and 4.2 cm right of the center line. These figures indicate that the aircraft was within the allowable range (4,100 kg – maximum out-of-ground-effect (OGE) hovering weight at 30 °C outside air temperature (OAT) and pressure altitude 4,000 ft, and longitudinal CG range of 3.8 - 4.0 m and lateral CG range of 5.0 cm left - 5.0 cm right corresponding to aircraft weight at the time of the accident ).

## 2.5.4 Fuel and Lubricating Oil

The fuel loaded on the aircraft was aviation fuel Jet A-1. The lubricating oil was Mobile Jet II.

## 2.6 Meteorological Information

The Firefighter A mentioned the day's weather condition as saying "Visibility was good and temperature was not high."

The retrieved video imagery did not reveal any meteorological conditions which might have affected the operation of the aircraft.

## 2.7 Information on Accident Site

### 2.7.1 Accident Site

The accident site was in a gorge about 50 m downstream where Takigawa and Budosawa meet in Otaki, Chichibu City, Saitama Prefecture. The elevation of the accident site is about 1,150m. Both banks of accident site are almost vertical cliffs. The east side cliff rises about 30 m to form a ridge and this becomes higher as it stretches to the south. On the ridge grows trees of more than 10 m high.

The gorge meanders from the south-east to the north-west at the accident site and the width of the stream is about 5 m. About 25 m upstream sits a plunge pool of a roughly 8 m high waterfall orienting to the west. At the time of the accident two out of nine climbers were hiking up to the nearest ridge to get cell phone reception for rescue and remaining seven stayed south side of the upper plunge pool that sits next to the plunge pool.

The aircraft was lying in the stream half submerged up to its cabin floor, somewhat banking to the left and orienting downstream (north-north-west). Most of its debris scattered in the vicinity of the aircraft.

On the left bank cliff about 10 m above from the aircraft nose, a small ledge covered with red paint flakes was found. About 7 m upward from there hit marks were found. About 8 m upstream from the ledge, on the cliff about 5 m above the stream part of left horizontal wing stuck

into a crevice.

About 23 m above the rescuers' landing point (about 20 m upstream from the accident site) on the right bank cliff, there were chopped trees and about 10 m beneath them there were a tree whose branches were also chopped. Tree branches on the right bank cliff about 50 m above the aircraft were slashed as wide as about 7 m. Tree trunks and branches found in the plunge pool were damaged with scratch marks.

The full length of the aircraft's hoist cable was about 90 m and 52.8 m of it was drown out. It was not severed. The cable hanged on a right bank tree about 25 m above the stream with its hook near the landing point of the rescuers.

(See Figure 1 Estimated Flight Route and Accident Site, Figure 2 Detailed Accident Site, Photo 1 Situation just after Crash.)

## 2.7.2 Detailed Damage Description

### (1) Fuselage

Nose section was crushed and left half of the front fuselage including left cockpit was severely damaged more than the right half. Frame aft of cockpit kept most of its integrities; however, the left cabin ceiling sagged. Outer skin of under fuselage and fuel tank cells were not damaged.

### (2) Main rotor

Main rotor system consists of four 530 cm long blades which are color-coded in black, red, blue and white. The rotor turns clockwise when viewed from above, and blades are sequenced as the color-coded order. Black blade had a large crack about 80 cm from its root and the section about 240 cm from its tip was almost destroyed. Outer sections about 370 cm from the roots of red and blue blades were smashed. White blade had minor damage: the section about 430 cm from its root on the trailing edge was the sole damaged area. The blade kept most of its integrity.

Leading edge of black blade was found near the root of the right bank tree about 23 m above the landing point of the rescuers.

### (3) Main Gearbox

Although the main gearbox (MGB) was attached to the fuselage with four MGB supports and MGB bottom suspension, they were all fractured. MGB bottom suspension attaching points to the fuselage remained on the fuselage; however, attaching points were fractured by counterclockwise twisting force. All the drive shafts connected to the MGB were fractured at their connecting points.

### (4) Engines

Visual inspection did not detect any trace of fire.

Both engines' compressor turbines were turned by hand; however, power turbines were stuck. Many turbine blades of both engines had damage caused by induced tree branches and other foreign object damages (FODs).

Both main drive shafts were fractured at connecting points to the MBG. Both engines were dislocated and suspended on the fuselage side.

## (5) Tailboom and Fenestron<sup>4</sup>

The tailboom was fractured at the point about 9 m from the nose. Left horizontal wing was fractured at the point about 40 cm from the root while the right wing at the root. The vertical fin was fractured above the Fenestron.

The tail rotor assy was found submerged right side of the fuselage. Out of the tail rotor assy's ten blades, two of them were fractured at root and another two were fractured at half span length. Remaining blades suffered many scratches. The tail rotor rotating axis was wedged with wood chips.

The Fenestron was shattered. Inside of the Fenestron duct had many scratch marks seemingly caused by trapped FODs and had cracks aligned with the direction of blade rotation.

(See Photo 2 Fuselage Damage, Photo 3 Damaged Fenestron, and Photo 4, Damaged Main Rotor Blades)

## 2.8 Medical Information

- (1) According to the written appraisal compiled by the Saitama Prefectural Police Headquarters, the cause of the death of the PIC was damaged circulatory organs; the LST pilot, combined damage on ruptured arteries and brain stem. Both pilot tested negative for alcohol and addictive drugs.
- (2) The cause of the death of the other three occupants was blows on the whole body.

## 2.9 Information on Fire and Firefighting

When the Air Rescuer A rushed to the aircraft, he found white smoke coming out of the right engine, and he splashed water on it.

## 2.10 Information on Search and Rescue

The information provided by the Saitama Prefectural Police Headquarters summarizes the development of the post-accident rescue operations as follows:

The Police helicopter spotted a plume of white smoke at 11:04 when it was flying to the would-be rescue area after taking off from the Helipad and confirmed the positive crash at 11:08.

At 11:13 four Mountain Rescuers started hoist descent. Other Mountain Rescuers who arrived at the site on foot joined the four around 12:20 and started the rescue work.

Around 14:10 rescuers of Tokyo Fire Department joined the work after the hoist descent. The first victim was rescued at 15:02. After the continued efforts the last victim was hospitalized at 16:45.

The aviation assets mobilized for this operation were as follows.

Saitama Prefectural Police: two helicopters

Tokyo Fire Department: one helicopter

Japan Air Self Defense Force (JASDF): two helicopters and one airplane

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<sup>4</sup> Fenestron is a type of helicopter anti-torque system in which a ducted fans act as tail rotor, and its housing is integrated into the vertical tail fin.

Tochigi Prefectural Fire and Disaster Prevention Aviation Unit: one helicopter  
Ibaraki Prefectural Disaster Prevention Aviation Unit: one helicopter  
Gunma Prefectural Disaster Prevention Aviation Unit: one helicopter

## 2.11 Test and Video Imagery Analysis

### 2.11.1 Blind Area in Aft Section of Aircraft

The blind area from the left pilot seat and left rear cabin was studied on the same type of aircraft. With the left cockpit door opened and looking back with the head pushed outward a left seat occupant can see the tail rotor. Otherwise he has blind area in 6 to 7 o'clock segment when the aircraft nose is aligned to 12 o'clock.

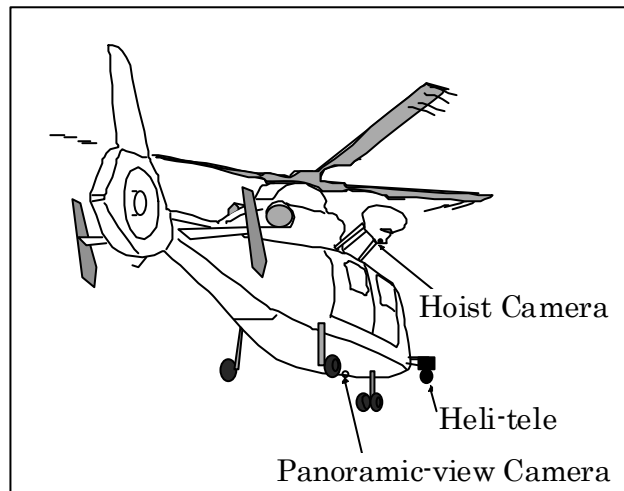
(See Figure 4 Blind Area in Left Aft Section of Aircraft)

### 2.11.2 Analysis of Video Imagery Retrieved From Aircraft

The video imagery retrieved from the onboard recorder and the video footage featuring the progress of rescue operation provided by the JASDF were analyzed to determine the hovering height of the aircraft.

From the size of the aircraft in the JASDF video footage, the size of boulders near the landing point of the rescuers was calculated. Then with the size of an actual object and that of corresponding image, and focal length of the video camera, an approximate aircraft height was calculated.

The aircraft was equipped with three cameras: a turret mounted camera on the right nose for telecasting (hereinafter referred to as “Heli-tele”); a look-down fixed camera (hereinafter referred to as the “Hoist Camera”) on the arm-mounted hoist; and panoramic-view camera mounted on the belly of the fuselage. A camera operator selects one of the cameras and record imagery with corresponding global positioning system (GPS) information. The last GPS time recorded was 11:03:46.



The video imagery covered on and after 10:53:38 until the termination of the system.

The stored imagery data comprised of Heli-tele and hoist camera footage. The former covered the flight along the right bank of Takigawa, circling flight over the confluence of Suishodani and Budosawa, the plunge pool then terminating into a hovering for the hoist descent. The latter covered the subsequent activities which developed into the accident.

The hoist camera imagery illustrated the events developed on and after 11:00:10. (The above ground level (AGL) altitude mentioned thereafter means the altitude of the Hoist Camera because it is the product of imagery analysis.)

11:00:10

The shadow of the aircraft was cast on the tree canopy. The aircraft was orienting to the west with the estimated height of about 46 m above the tree canopy. At this moment as the hoist support arms were unloaded, the

hoist camera coverage was away from the aircraft so that, as shown by the still image, it captured the outer portion of the right cabin step. Soon the rescuers started preparations for the descent while the aircraft moved slowly to the left.

- 11:02:08 The rescuers started to descend. With the load applied on the hoist support arms, the camera coverage was shifted inward to cover larger part of the step.
- 11:02:16 The rescuers were descending. The aircraft was about 60 m above the stream.
- 11:02:49 A rescuer's helmet was visible in the left under corner of the picture. The rescuers were descending toward a seemingly flat ledge.
- 11:03:33 The Air Rescuer A signaled to move the aircraft to the left with his right hand.
- 11:03:43 Small fragments flowed in from the aft side of the aircraft. The aircraft was about 51 m above the stream.
- 11:03:44 The aircraft started to spin left. Some block noises began to emerge.
- 11:03:46 The aircraft span left by about 90°. The camera coverage of the step became narrow.
- 11:03:48 Almost all of the block noises became greenish.
- 11:03:57 The recording terminated.

The camera manufacturer commented on the block noises as follows:

The possible reasons for block noises were contaminated recording head or excessive aircraft vibration. With the fact that until that time the recording was normal, the reason should be the latter.

(See Figure 5-1 to 5-3 Imagery Analyses)

### **2.11.3 Examination of Malfunction Annunciator Unit and Electronic Engine Control Unit**

The aircraft has an onboard malfunction annunciator unit called BAP which monitors and notifies aircraft malfunction to pilots, and two engine control units called DECU. They can record the aircraft system and engine anomalies. They were sent to the State of manufactures and revealed that these units contained no records of aircraft system or engine anomalies.

## **2.12 Information on Organization and Management**

### **(1) Aircraft flight management at the Center**

The Center belongs to the Department of Disaster Control and Prevention, Saitama Prefectural Government, and is stationed in the building of Honda Airways Co. located in Kawashima-cho, Hiki-gun, Saitama Prefecture. Under the command of the Director of the Center (prefectural employee) was an aviation unit with the total strength of 22 personnel and two (at the time of the accident) helicopters. 22 personnel consist of prefectural employees, and municipal firefighters who have additional status of prefectural employee. The Center is a jointly operated organization with the commitment

of the prefectural government, the municipal firefighters and a private company who has a flight operation contract with the prefectural government. Their area of responsibility is as follows:

Saitama Prefectural Government: purchases helicopters, finances operational cost and manages operation and training of the aviation unit.

The municipal government: provides firefighters as air rescuers.

The flight operation company: flies and maintains helicopters and provides base facilities for the Center per contract with the prefectural government.

The Operation Management Rule of Disaster Prevention Aviation Unit of Saitama Prefecture stipulates that the Director is responsible for operational management and in case of his absence the director of the prefectural Firefighting/Disaster Prevention Division assumes the responsibility. The aviation unit is manned by a commander, assistant commanders, vice commanders and rescuers. The number of rescue operations done in Otaki since the inauguration of the unit was 110.

(2) Dispatch acknowledgement on the day of the accident

The Director of the Center stated as follows:

Because it was a day off he received the initial report on a rescue request from the aviation unit by phone. It was a rescue request from Chichibu Fire Brigade Headquarters saying that a climber had been in trouble near the confluence of ravines in Otaki, Chichibu City. Because this request met the dispatch criterion with favorable pilot comments on weather condition, he authorized the dispatch.

(3) Hoist descent

Aviation unit personnel mentioned each member's assignment and whether they open the left doors during a hoist descent as follows:

a. Assignment

PIC: aircraft control (steady hovering on a target)

Co-pilot: looking out to the left, engine instrument monitoring and communication

Hoist operator: hoist operation, aircraft guidance and looking out to the aft right

Standby rescuers: preparation for their part of descent, confirmation of the target

b. Left cabin door

The left cockpit door is opened to confirm the left aft depending on a situation, while the left cabin door is kept shut under normal circumstance to prevent onboard equipment from dropping.

(4) Call-out procedures for rescue missions

Voice Procedures and Training Guideline (Established in January, 2000, latest revision in February, 2008) did not include the call-out procedures for looking out during the hoist descent.

## 2.13 Other Information

### 2.13.1 The Pilot Flying on Day of Accident



The aircraft's minimum operating crew number is one and the aircraft was flown by the PIC.

### **2.13.2 Flight Crew Requirement Stipulated in Flight Operation Contract**

Honda Airways Co. Ltd. was required to provide pilots for the Center as follows; however, the required qualification for a co-pilot was not specified.

(1) *08:30 – 17:15 two pilots (as PIC), two co-pilots and two mechanics*

(2) *17:15 – 08:30 and in case where one aircraft is flyable (the other aircraft is grounded due to maintenance work or other reasons)*

*one pilot (as PIC), one co-pilot and one mechanic*

### **2.13.3 Hoist, Its Operation and Hoist Training Altitude**

- (1) The hoist cable length was 90 m and the unwinding speed was 0.7m/sec. The hoist was examined and had no anomalies.
- (2) Usual AGL hovering altitude was 80 - 100 ft (about 24 - 30 m). High AGL hovering training for expected rescue missions in mountainous area was carried out with AGL hovering altitude of 150 - 200 ft (about 45 - 60 m).
- (3) The following difficulties arise when a hoist cable is unwound long.
  - a. Keeping visual contact with the descending rescuers from the aircraft becomes difficult.
  - b. Descending rescuers are easily wind-blown and getting them on the target becomes difficult.
  - c. In order to pick up the rescuers/survivors from the ground the aircraft should be right above them, however, placing the aircraft there becomes difficult.
  - d. Winding/unwinding cable takes time thus increasing the workload of a pilot who hovers the aircraft.

### **2.13.4 Aircraft Coloring and Direction of Air Flow Which Passes Through Fenestron.**

- (1) Coloring

Nosesection, both sides of fuselage and forward edge of the vertical fin were painted red.

(See Photo 2 Damaged Fuselage)

- (2) Air flow through Fenestron

As aircraft's main rotor turns clockwise when viewed from above, anti-torque effect turns the fuselage counterclockwise. In order to counter anti-torque, the Fenestron sucks in air from the left and blows it out to the right.

### **2.13.5 Height of the Ridge on the Right Bank From the Stream.**

Topographical map reads that the ridge above which the aircraft was hovering around 11:00 rises up from the stream by about 35 m.

### **2.13.6 Settling With Power**

The condition where a helicopter sinks in its downwash is called "Settling with power." FAA's Rotorcraft Flying Handbook (FAA-H-8083-21) describes the conditions which causes this

phenomenon as follows:

*The following combination of conditions are likely to cause settling in a vortex ring state.*

- 1. A vertical or nearly vertical descent of at least 300 feet per minute. (Actual critical rate depends on the gross weight, r.p.m., density altitude, and other pertinent factors.)*
- 2. (Omitted)*
- 3. The horizontal velocity must be slower than effective translational lift.*

*(Skipped)*

*To enter the maneuver, reduce power below hover power. Hold altitude with aft cyclic until the airspeed approaches 20 knots. Then allow the sink rate to increase to 300 feet per minute or more as the attitude is adjusted to obtain an airspeed of less than 10 knots. When the aircraft begins to shudder, the application of additional up collective increases the vibration and sink rate.*

## **3 ANALYSIS**

### **3.1 Certificates**

The PIC held both a valid airman competence certificate and a valid aviation medical certificate.

It was unlawful for the LST pilot to fly the aircraft because his type rating was limited to land-use single turbine engine rotorcraft; however it was not for him to handle radio transmissions with his aeronautical radio operator's license. (As stated in 2.13.2 the contract did not specify necessary qualification for a co-pilot. The aircraft was operable with one pilot (PIC in this case) per the Civil Aeronautics Act. )

### **3.2 Airworthiness Certificate of the Aircraft**

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

### **3.3 Relevance of Weather Conditions to Accident**

It is very likely that the weather conditions at the time of the accident had no bearing on the occurrence of the accident judging from the hoist-descended rescuers statements and recovered video imagery analysis.

### **3.4 Possibilities of Settling With Power**

Due to the absence of the following indications recorded in the hoist camera imagery, it is very likely that the aircraft did not fall into the settling with power condition as described in 2.13.6.

- a. Aircraft vibration which depicts clear occurrence of settling with power.
- b. Hovering descent with more than 300 fpm descent rate
- c. Blurred video imagery

### **3.5 Confirmation of Obstacles Before Taking Up the Hovering Position for a Rescue Operation**

As stated in 2.11.2, the aircraft made a right circling flight to the accident area and occupied the hovering position downstream of the plunge pool around 11:00 for the preparation of the rescue operation. It is probable that the PIC had general picture of geographical features because he made a recon during the above mentioned circling flight and about one hour prior when he did a recon flight.

With the assumption of tree height to be about 10 m, the aircraft at this time was hovering about 90 m above the stream (tree stands about 35 m above the stream + tree height about 10 m + aircraft altitude above the tree canopy about 46 m). The more the ridge extends to the south the higher it becomes. Given this fact the aircraft had to hover below the tree canopy height at the hoist descent area, the PIC had to confirm the obstacle situation to the left aft and how trees pose threat the aircraft. However, as the video imagery shows in 2.11.2, the aircraft heading remained to the west. It is very likely that the PIC did not turn the aircraft to the left (south to south-east) to have the visual confirmation of the obstacle above the right bank and plunge pool as his future hoist

operation area.

As the aircraft hovered to the left (to the south) without changing its heading until it occupied the hoist descent position, it is probable that the PIC did not have the sufficient confirmation of the obstacles to the left and the LST pilot did the left-side watch.

### **3.6 Healthiness of Aircraft and Engine**

As described in 2.11.3, the BAP and the DECU's registered no anomalies until the crash. The video imagery of hoist camera contained no unusual flight until the onset of left spinning of the aircraft.

As described in 2.11.2, the spinning to the left started on and after the small fragments were recorded on the video, it is very likely that the aircraft had been in sound condition until then.

### **3.7 Tree Contact by Aircraft**

With the following facts it is very likely that the first abnormal condition took place upon contact of the tail rotor with the trees.

- a. The small fragments recorded by the hoist camera was not considered to be the product of tree contact by the main rotors considering their flight paths and shapes.
- b. As described in 2.7.2 (5), the Fenestron duct had many scratch marks made by induced FODs and the axis was wedged by wood chips.
- c. As described in 2.11.2, hoist camera imagery shows that the spinning to the left started after the small fragments flowed in from the aft side of the aircraft.

As described in 2.7.1, with the following facts considered it is very likely that the main rotors had contacts with trees while the aircraft started spinning.

- a. Some tree trunks on the right bank were broken.
- b. There was a fragment of black blade left at the root of the tree which grew on the right bank about 23 m above the hoist landing site.
- c. There were damaged tree trunks in the plunge pool.
- d. There were trees on the right bank whose branches were slashed.

Given the statements made by the manufacturer of the recording device as described in 2.11.2, it is very likely that the block noises were generated due to the aircraft vibration. As its onset was after the start of the spinning to the left, it is very likely that the main rotor's contact with the trees made each rotor blade out of balance generating vibrations.

### **3.8 AGL Altitude for Hoist Descent**

As described in 2.11.2 the aircraft's AGL altitude was reduced from about 60 m to about 51 m during its hoist operation. Reduction of AGL altitude means increased proximity to the obstacles (reduction of safe distance) considering the geographical features near the accident site.

As the weather condition then was not the one which affected the visibility, it was easy to establish supplementary hovering reference points. A PIC would not let go of the collective lever during a hoist operation. Even under hands-off situation, from the mechanical point of view, the collective lever does not move up or down. Given these facts, it is probable that the PIC lowered the collective lever, after consulting the hoist operator, in order to avoid difficulties associated with long

hoist cable operation described in 2.13.3 (3) when he hovered the aircraft at high AGL altitude mentioned in 2.13.2 (2).

### **3.9 Events After Opening of Right Cargo Door Until Crash**

It is very likely that the following situation developed judging from the eyewitness statement described in 2.1.2 (3) and imagery analysis in 2.11.2.

- (1) The aircraft hovered southward from its preparatory hovering position and occupied the hovering position for the hoist descent. Then it lowered the rescuers toward the “seemingly flat place” mentioned by the Air Rescuer A in 2.1.2 (1). However the place was not at the bottom of the gorge the Air Rescuer A signaled to move them to further south with his hand to land them next to the plunge pool, and the aircraft hovered toward it.
- (2) The eyewitness stated that when rescuers started descent water flow into the lower plunge pool was normal; however, water splashes blew upward shortly afterwards. It was because the helicopter downwash became stronger as the aircraft moved toward the plunge pool while its hovering altitude became small. This corresponds to the imagery analysis result that the hovering altitude became smaller by 10 m compared with that of the hoist descent commencement.
- (3) Hoist camera imagery showed small fragments followed by the emergence of block noises. This corresponds to the fact that the tree branches were sucked into the Fenestron and the aircraft lost yaw control due to the damaged tail rotor and the spinning to the left started.
- (4) After the commencement of the left spinning, main rotors contacted with trees located left aft side of the aircraft. Then the aircraft lost horizontal stability due to spinning and moved to north-westward slashing tree branches and crashed into the left bank cliff from the nose as the eyewitness mentioned in his statement that the aircraft moved downstream with its nose about 45° down. As the video recording was terminated at 11:03:57 the crash took place around then.

The recording of GPS time signal probably stopped at 11:03:46 due to poor satellite reception caused by the unusual aircraft attitude during the course of crash.

The narrow step in the picture labeled 11:03:46 in Figure 5-3 shows the landing of the two rescuers at that moment judging from the unloaded hoist arms.

### **3.10 Looking Out During a Hovering Operation**

When a helicopter hovers in a small confined area it is imperative to keep close watch against obstacles for keeping safe distance for main rotor and Fenestron.

The aviation unit maintains that they did looking out per duty assignment as described in 2.12 (3) a. However, as described in 2.12 (3) b., usually the left cabin door is closed during a hoist operation therefore blind area exists near the Fenestron as depicted in Figure 4, unable to see from the aircraft interior.

It is not certain whether the PIC confirmed the left side of the aircraft or gave instructions to watch that section, it is very likely that the looking out to the left aft was inappropriate.

Although the voice procedures did not include looking out the JTSCB considers it desirable for the Center to include them in the procedure.

### **3.11 Actions for the Recurrence Prevention**

When a helicopter hovers in a small confined area it is imperative to keep close watch against obstacles for keeping safe distance for main rotor and Fenestron.

Inappropriate looking out to the left aft most likely lead to the aircraft's tree contact consequently developed into the accident. The JTSB believes that the necessary training should be repeated to train aircraft occupants to do proper looking out responding to the rescue site circumstances.

On the other hand, as described in 2.11.2 the hoist camera's AGL altitude just after the occupation of the hovering point for a hoist descent was about 60 m, the altitude gradually diminished as the time passed. It is very likely that the allowable length of hoist cable was about 90 m and the aircraft was able to hoist down rescuers by unwinding the cable without lowering its altitude; however, the aircraft chose to lower its altitude leading to the proximity with the obstacles.

The difficulties of high AGL altitude hovering for the rescue mission are understandable; however, there may be situations where no other alternatives exist. Assuming tough situations it is important to be prepared by periodical rescue training under the high AGL hovering circumstance. It is also important to make a brave decision to abort an ongoing rescue mission if need be.

## 4 PROBABLE CAUSES

It is very likely that the aircraft crashed when it hovered to the left to adjust the hoist descent position without appropriate looking out, the Fenestron's tree contact developed into a loss of yaw control followed by main rotor tree strike.

The fact that the aircraft, without taking full advantage of long hoist cable, lowered its AGL altitude very likely contributed to the Fenestron's tree contact.

## 5 REMARKS

This accident occurred during a rescue operation in a close confined area. Investigation result points to the following defects of the aircraft operation.

- The Fenestron's tree contact most likely took place when the aircraft hovered to the left to adjust the hoist descent position without keeping appropriate looking out.
- It is very likely that he could lower the rescuers to the bottom of the gorge if the PIC chose to take full advantage of 90 m hoist cable; however, he chose to lower the AGL altitude of the aircraft and his decision lead to a proximity to the obstacles.

In general, a rescue hoist operation is carried out under difficult circumstances so that there are cases where hoist and other equipment capability has to be used to its maximum extent while all the aircraft occupants keep looking out in order to accomplish its mission safely. Whereas the difficulties of high AGL altitude hovering for the rescue mission are commonly shared by pilots in general; however, there may be situations where no other alternatives exist. Assuming the challenging situation where high AGL hovering is required, it is important to keep prepared by periodical rescue training under the high AGL hovering circumstance.

Therefore the JTSC considers it desirable that the local governments who fly helicopter rescue missions reexamine their looking out procedures and high AGL hoist training in order to ensure safe operations. The JTSC assumes desirable that the Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications, who has provided advise to local governments on safe operations of helicopters, it will provides additional advice on the local governments' reexamination thereof .



## 6 ACTIONS TAKEN

Following this accident Saitama Prefectural Government (Saitama Prefecture Disaster Prevention Aviation Center) has taken following corrective measures to prevent similar accidents from recurrence.

(1) New rules

a. Comprehensive Operational Rules for Saitama Prefecture Disaster Prevention Aviation Unit

Based on clause 1, article 3, ordinance 53 ( The Ordinance on Emergency Operation of Saitama Prefecture Disaster Prevention Aviation Unit) of Saitama Prefecture, Comprehensive Operational Rules for Saitama Prefecture Disaster Prevention Aviation Unit was established on March 23, 2011 in order to secure safe and effective flight operation of disaster prevention helicopter. (excerpts)

*(Mission abort or termination of specific operation)*

*Article 30*

*1. (omitted)*

*2. A PIC shall terminate flight operation when he considers it impossible to secure flight safety upon considering weather condition, geographical features, required operations and aircraft performance.*

*3. The operation manager shall, on the other hand, issues mission abort order or termination of specific operation without delay after notifying the party who called for the dispatch, when he considers it impossible to secure operational safety considering the nature of a disaster or other relevant safety factors.*

b. The Mountain Rescue Operations Guideline

After the discussion with the parties concerned about rescue operation such as the police, the fire brigades and the aviation company, the Center has established the Mountain Rescue Operations Guideline on December 24, 2010. Safety standards for flight operation were specified as follows: (excerpts)

*6. Safety standard for flight operation*

*(1) Recon before commencing an approach*

*A PIC shall, without fail, recon the area and notifies the occupants of the following items before reducing altitude for rescue operation or for other purposes.*

*a. Linear obstacles such as power lines and cable ways etc.*

(skipped)

*d. Objects which requires special attention during an operation.*

*(2) Selection of hovering point*

*a. Safety clearance*

*(a) Secure horizontal and vertical clearance from obstacles more than 10 m (33 ft) and 6 m (20 ft) respectively.*

*(b) In general no hovering shall be done with the left side of the aircraft facing a slope.*

(skipped)

*e. Wind limitation*

*A PIC shall terminate hoist rescue operations when the circumstances meet the following criterion.*

*(a) Wind velocity is judged to be exceeding 30 kt (15 m/sec)*

*(b) A stable hovering is difficult regardless of wind velocity.*

(omitted)

(2) Database update

In order to analyze risks and its counter measures, the Center has decided to create a database on expected mission sites in Saitama Prefecture with the help of local fire brigade headquarters, and to update it as appropriate.

Concerning the information on areas outside of the prefecture, new arrangements were made to exchange information with the aviation units with whom the Center has a mutual support agreements.

(3) In-flight communication

In order to secure in-flight information sharing, the Center generated a crew resource management standard and trained personnel with some educational materials.

(4) Launch checklist based on clear criterion

The Center created the Launch Checklist to judge whether expected conditions meet the launch criterion and to clarify its mission objectives. In order to better cope with rescue operations in mountainous area it has also created the Mountain Rescue Operations Checklist.

(5) Improvement of proficiency

In order to increase operational skills in mountainous areas and improve ties with fire brigades in those areas, the number of training in those areas has been increased.

Figure 1 Estimated Flight Route and Accident Site

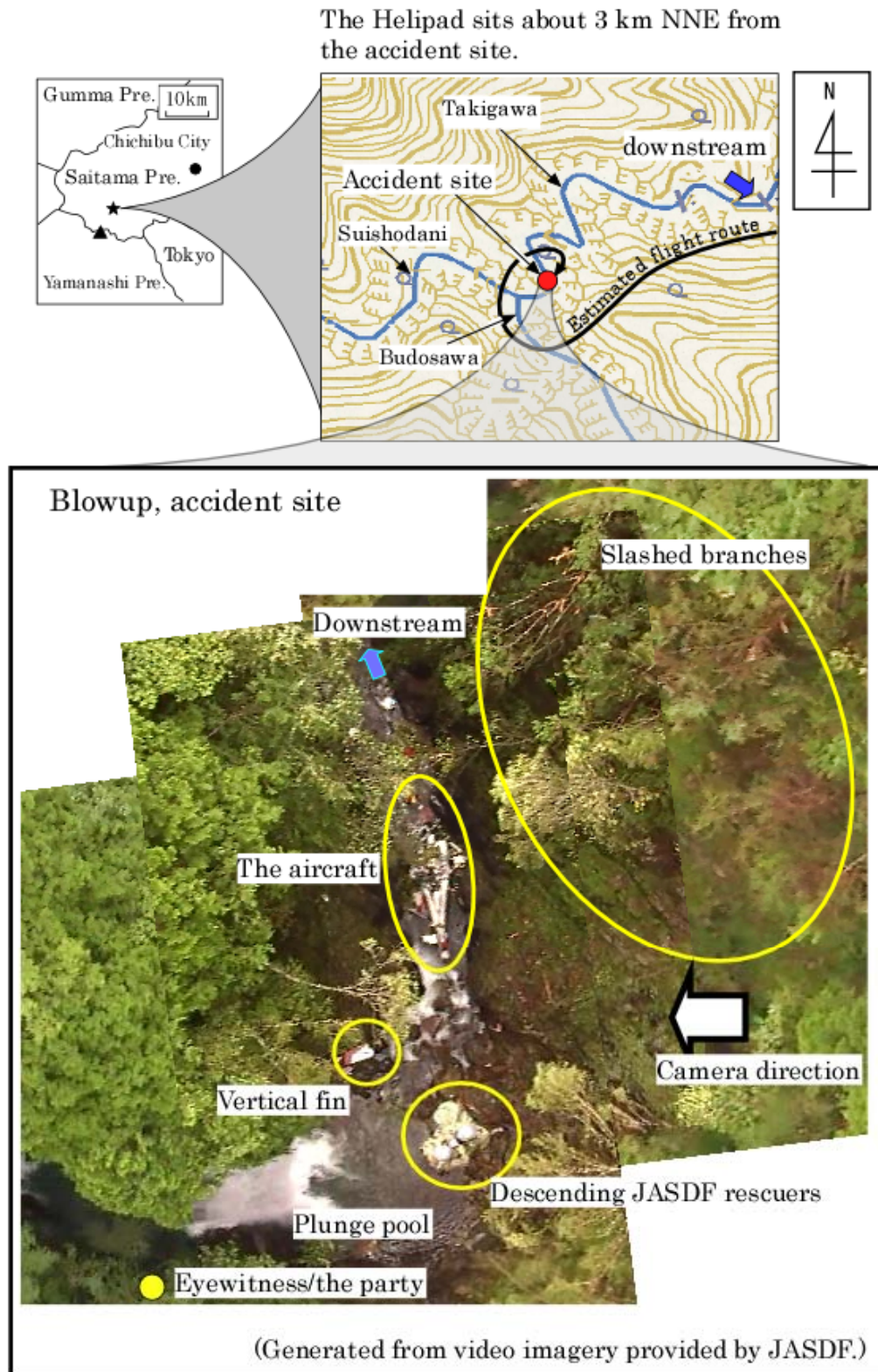
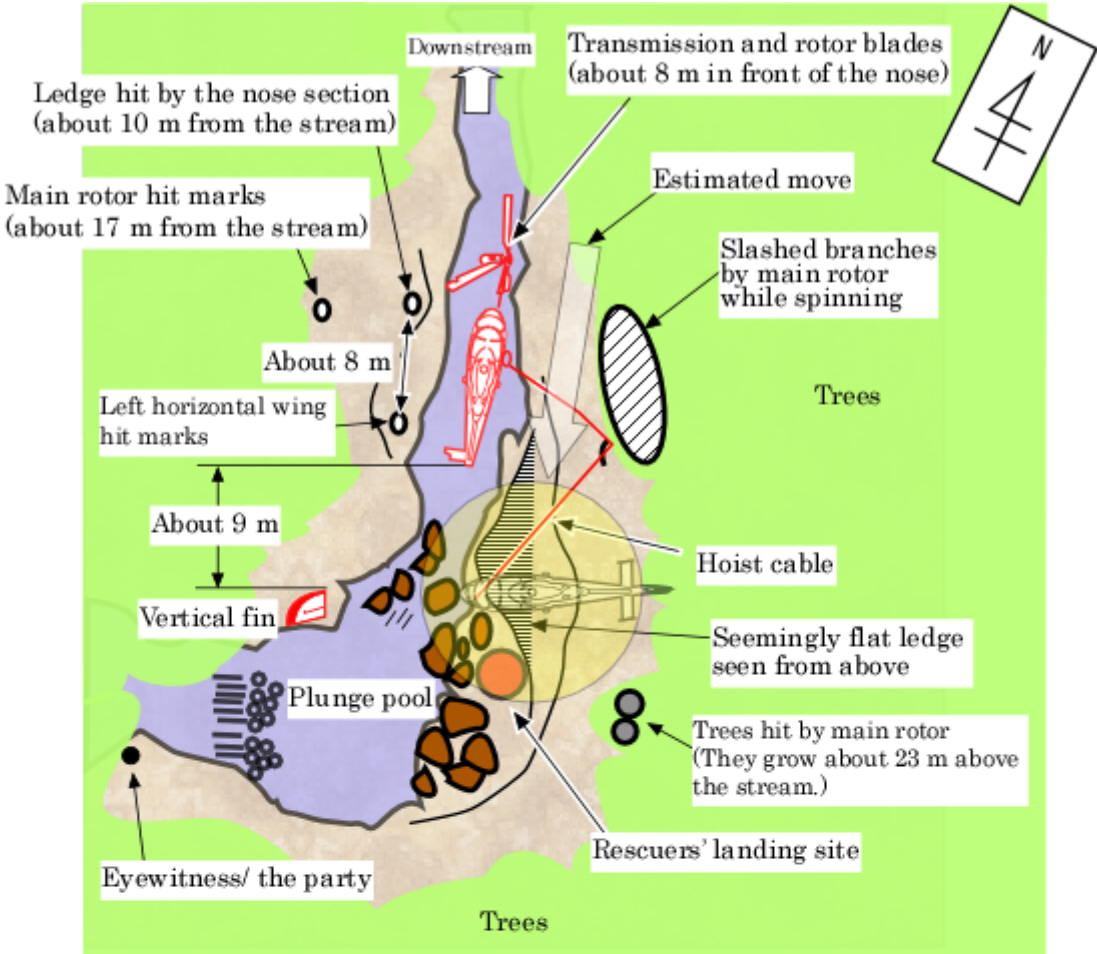


Figure 2 Detailed Accident Site



Left bank



Right bank



Figure 3 Three Angle View of Eurocopter AS365N3

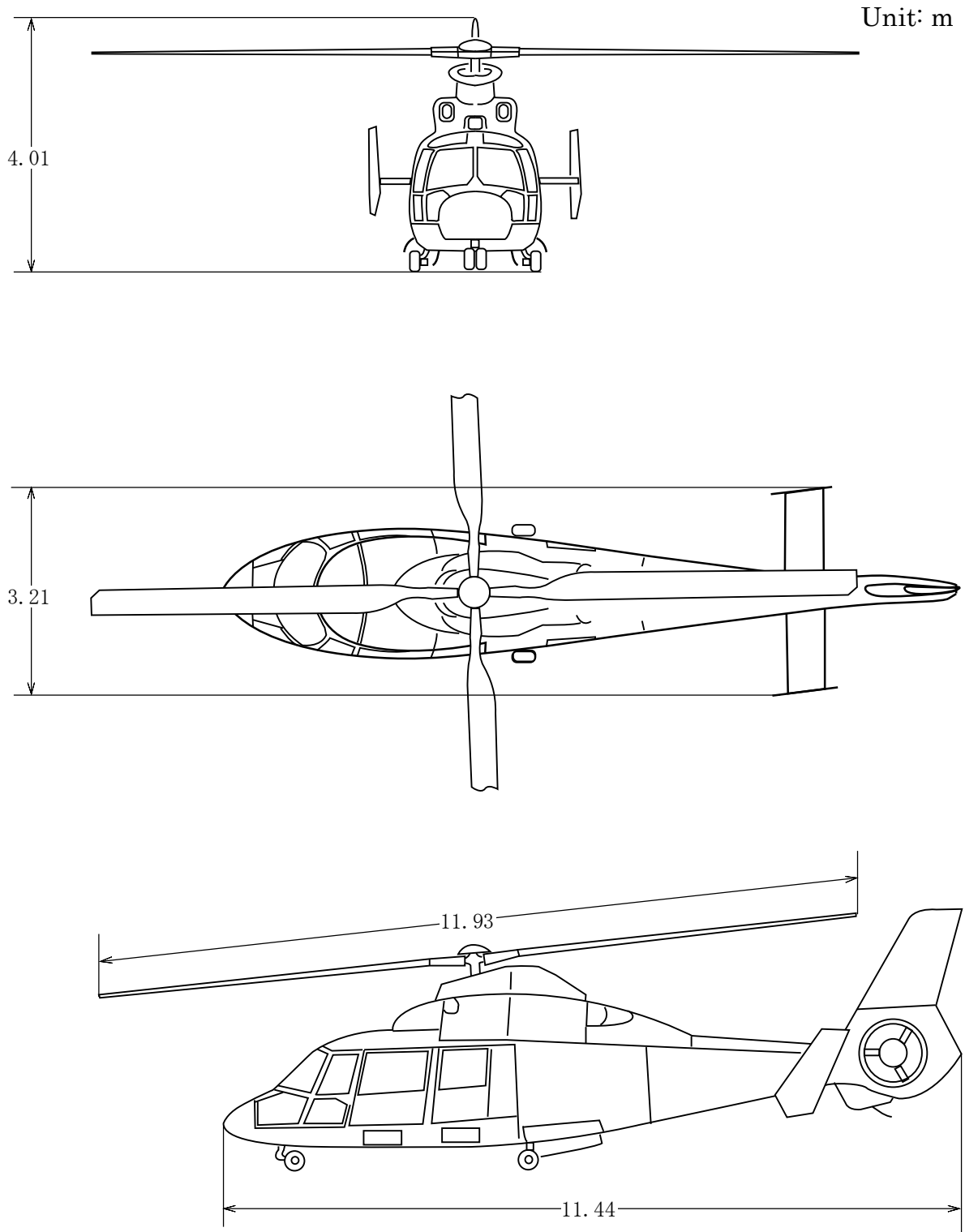
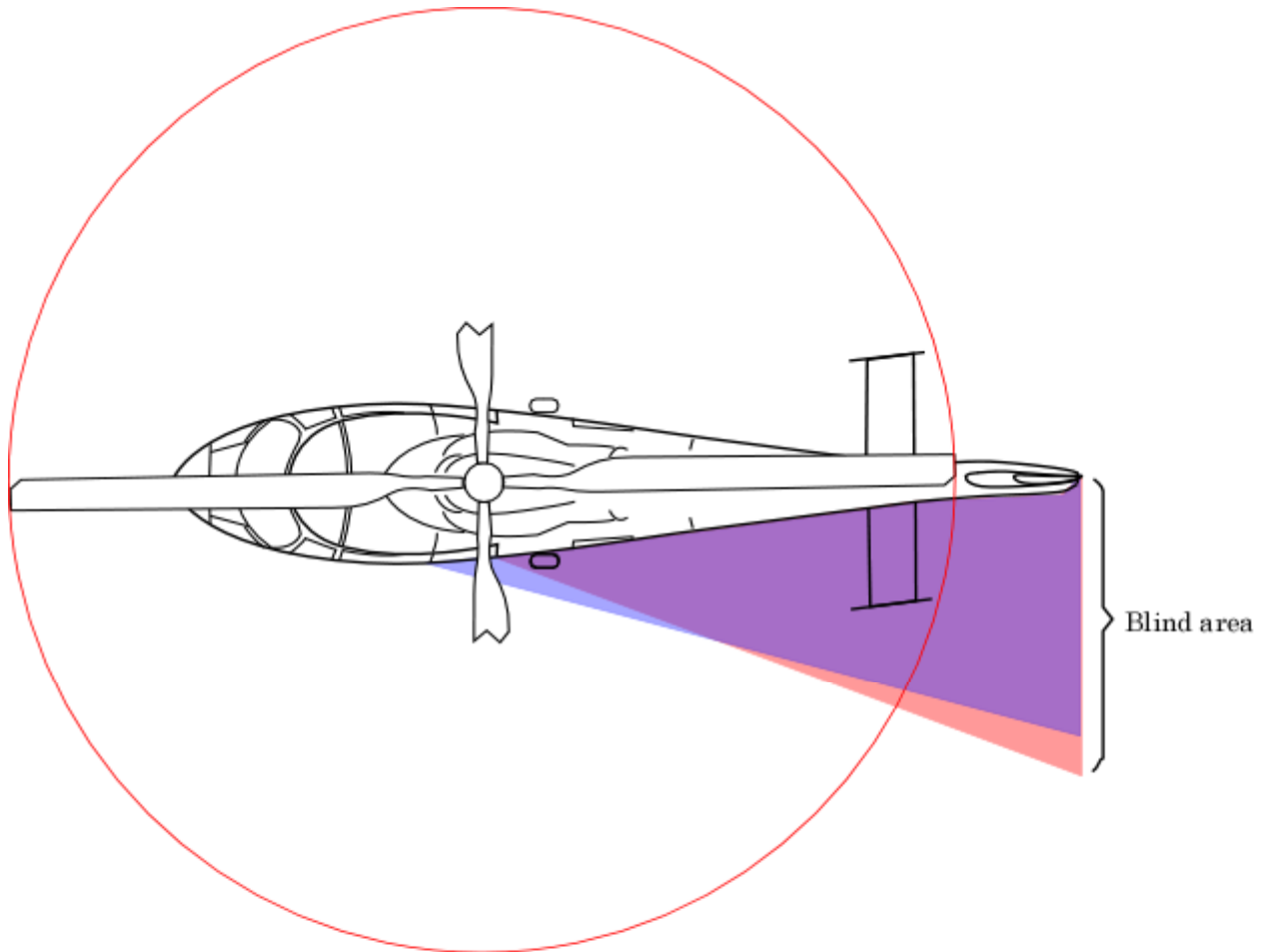




Figure 4 Blind Area in Aft Left Section  
of Aircraft

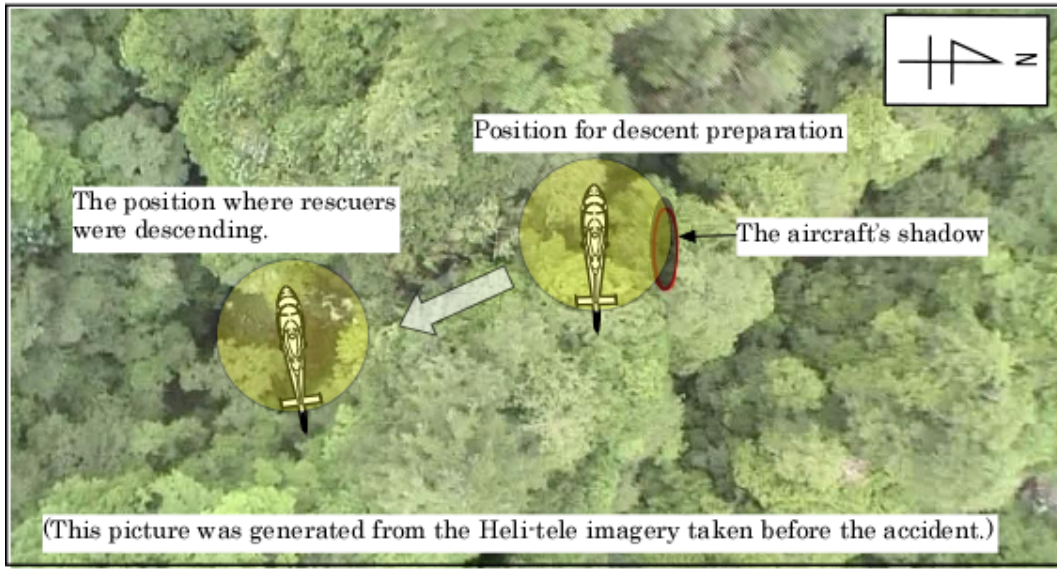


Legend	
	Blind area from the left pilot station seen through the cabin window
	Blind area from the cabin rear seat

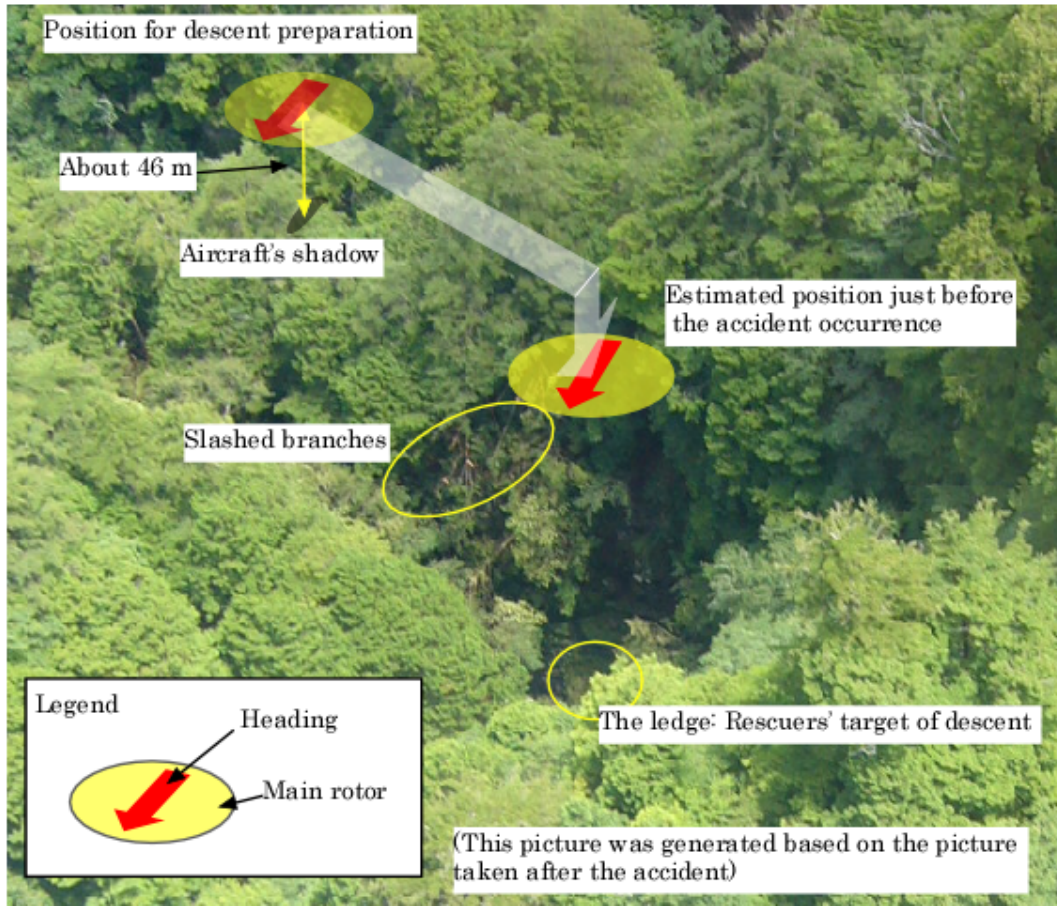
# Figure 5-1 Imagery Analyses

Seen from the above

Note: the aircraft size is not to scale of the background.



Seen from the south-west



## Figure 5-2 Imagery Analyses

(Note: time is shown in hour:minute:second)



Spot where descent preparation was made.

Hoist camera height above the tree canopy: about 46 m.

Outer portion of the step was visible.



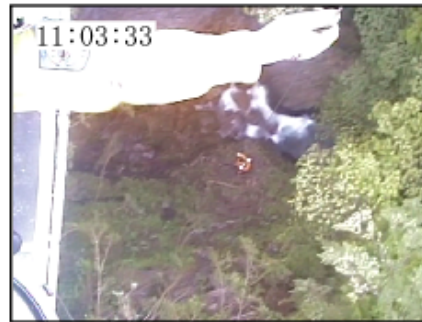
A part of a helmet worn by another rescuer is visible.



Above the hoist descent position

Hoist descent started.

Wider portion of the step was visible.

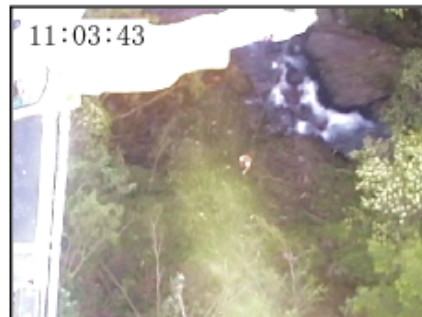


Descending rescuer hand-signaled to move to the left.



Hoist descent in progress (height: about 60 m)

(Height is measured from the stream to the hoist camera. The same applies to the following pictures.)



Small fragments flew in from the aft side of the aircraft (altitude about 51 m).

To top right

(Continued to the next page)



### Figure 5-3 Imagery Analyses



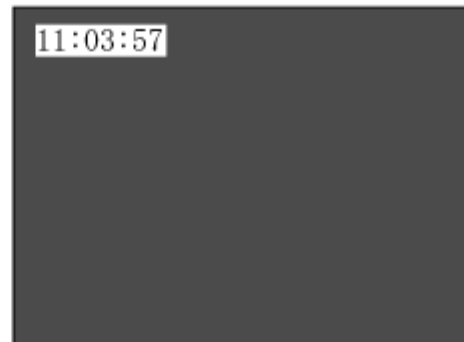
Spinning to the left started. Block noises started to emerge.



Almost all block noises became greenish.



The aircraft span by 90° to the left.  
Narrower portion of the step was visible.



The recording terminated.

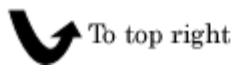


Photo 1 Just After the Occurrence of the Accident

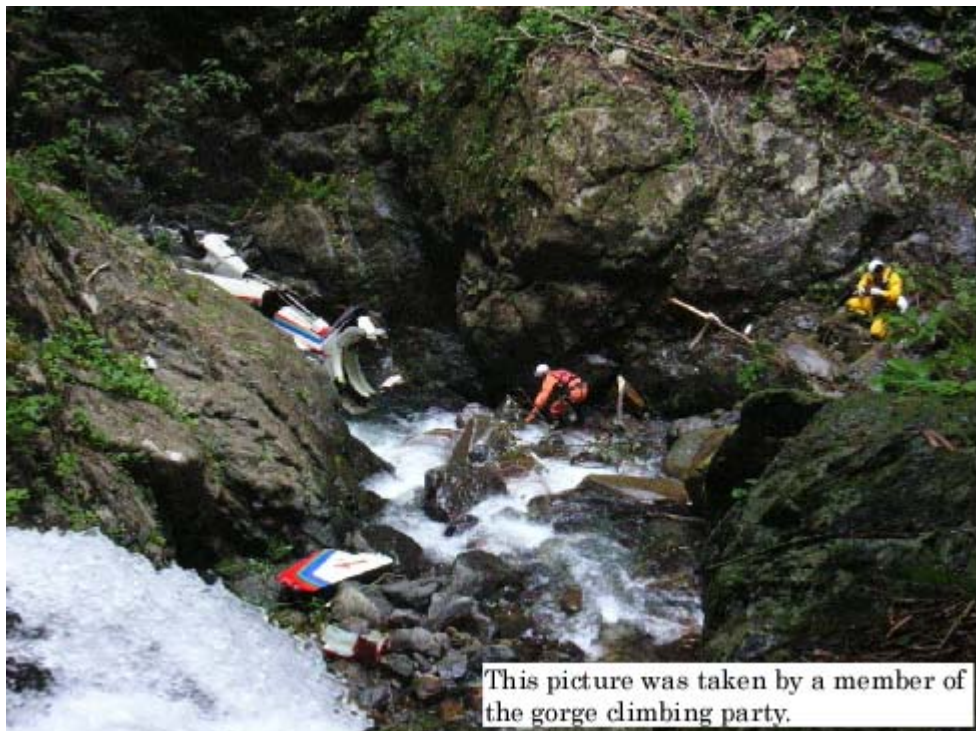


Photo 2 Damaged Fuselage

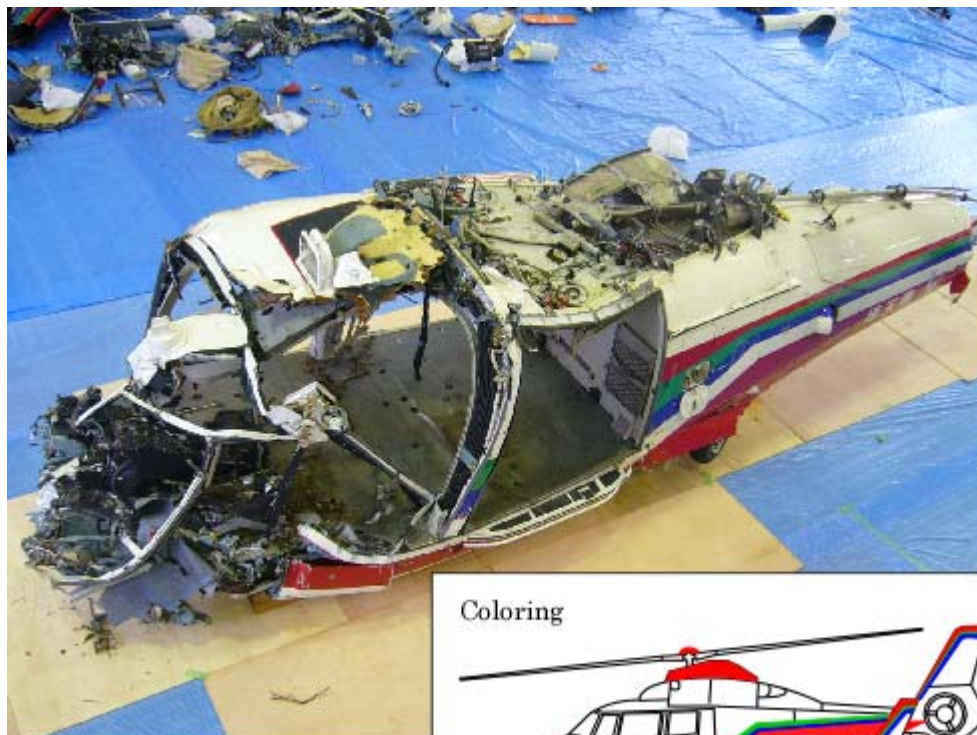


Photo 3 Damaged Fenestron

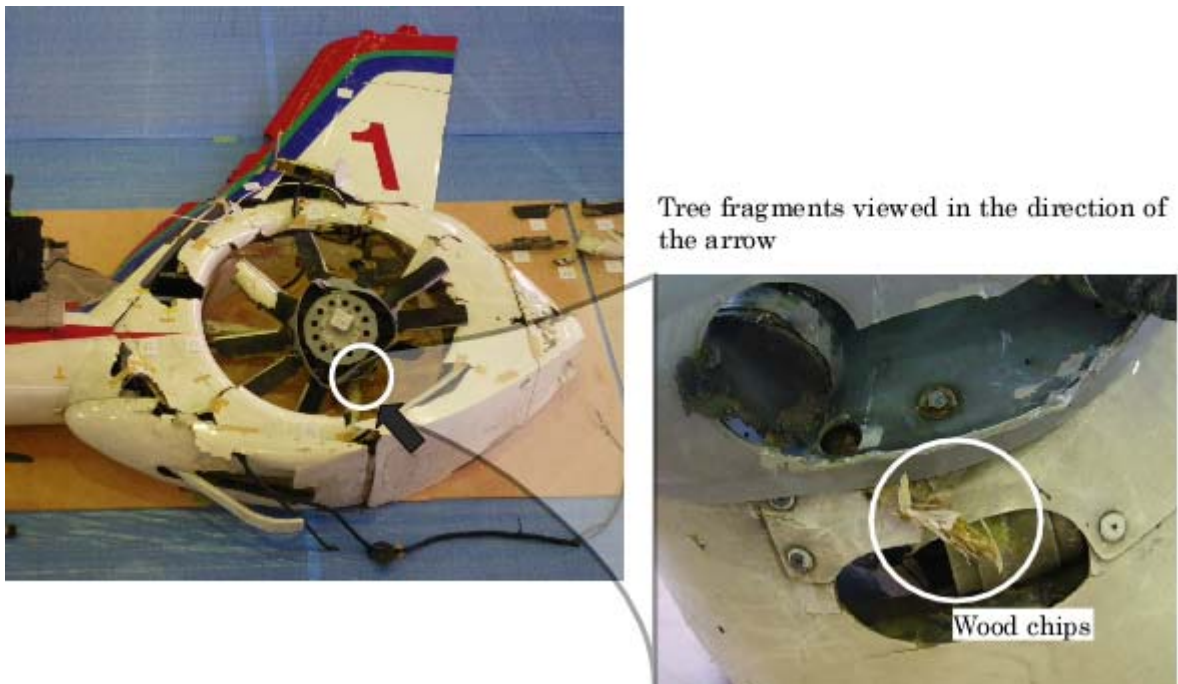


Photo 4 Damaged Main Rotor Blades

