AIRCRAFT ACCIDENT INVESTIGATION REPORT

THE HELICOPTER DAMAGE FROM A FALL DURING HOVERING TAKUMI ENTERPRISE HELICOPTER & AIRPLANE CO., LTD. ROBINSON R44 (ROTORCRAFT), JA01CG AT JPD KYOTO OPERATION SITE KYOTO CITY, KYOTO PREFECTURE AT ABOUT 12:15 JST, DECEMBER 18, 2023

October 30, 2025
Adopted by the Japan Transport Safety Board
Chairperson RINOIE Kenichi
Member TAKANO Shigeru
Member MARUI Yuichi
Member SODA Hisako
Member TSUDA Hiroka
Member MATSUI Yuko

1. PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	On Monday, December 18, 2023, a Robinson R44, JA01CG, operated by Takumi Enterprise Helicopter & Airplane Co., Ltd., fell while conducting hover training at JPD Kyoto Operation Site in Kyoto City, Kyoto Prefecture, causing damage to the helicopter. Neither the pilot, who was acting as a flight instructor, nor the student pilot on board sustained any injuries. The helicopter was destroyed, but there was no outbreak of fire.
1.2 Outline of the Accident Investigation	Upon receiving the occurrence of the accident, on December 19, 2023, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this accident. An accredited representative and an advisor of the United States of America, as the state of design and manufacture of the helicopter in this accident, participated in the investigation. Comments on the draft Final Report were invited from the parties relevant to the cause of the accident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of the captain, who was the flight instructor, (hereinafter referred to as "the Instructor"), the student pilot (hereinafter referred to as "the Trainee"), and an employee of Takumi Enterprise Helicopter & Airplane Co., Ltd. responsible for monitoring surface traffic to ensure that personnel and vehicles would not enter the training area inadvertently during

hover training (hereinafter referred to as “the Witness”), the history of the flight is summarized below.

At about 11:20 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), a Robinson R44, JA01CG, operated by Takumi Enterprise Helicopter & Airplane Co., Ltd., was took off from JPD Kyoto Operation Site under the control of the Instructor, with the Instructor seated in the left pilot seat and the Trainee in the right pilot seat for the purpose of the Trainee obtaining a private pilot license, and flight training commenced. The flight at the time of the accident was the Trainee's first flight.

The helicopter performed the hover training and vertical take-off and landing training for about 10 minutes at the operation site. During this time, the Instructor had the Trainee experience piloting while the Instructor was putting the hand on the flight control. After that, the helicopter advanced in flight toward the training area near the operation site. After demonstrating basic flight training maneuvers, including level flight, turns and others, the Instructor allowed the Trainee to experience them. The helicopter then returned to the operation site, landing at around 12:10.

The Instructor decided to conduct additional hover training as there was enough time for it. According to the Instructor, the wind was from the northwest at approximately 5 knots. Therefore, the helicopter was oriented with the nose facing north, and hover training was initiated using a skid height of approximately 4 ft above ground level, which is the typical altitude used by the Instructor during takeoff and landing operations.

First, the Instructor demonstrated take-off and hover. For the second time, once the Instructor had stabilized the helicopter near the touchdown zone marker, the Instructor handed over control to the Trainee. Besides, even while the Trainee was flying the helicopter, the Instructor was putting the hand on the flight control. Furthermore, when the helicopter was about to cross the square boundary indicating the helipad at the operation site (hereinafter referred to as “the Boundary”) while the Trainee was flying the helicopter, the Instructor would take over the control and move it to the center of the touchdown zone marker, stabilizing the helicopter before handing control back to the Trainee. This process was repeated (see Figure 1).

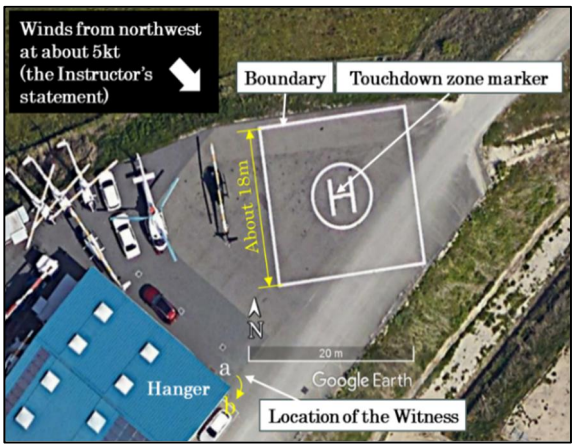
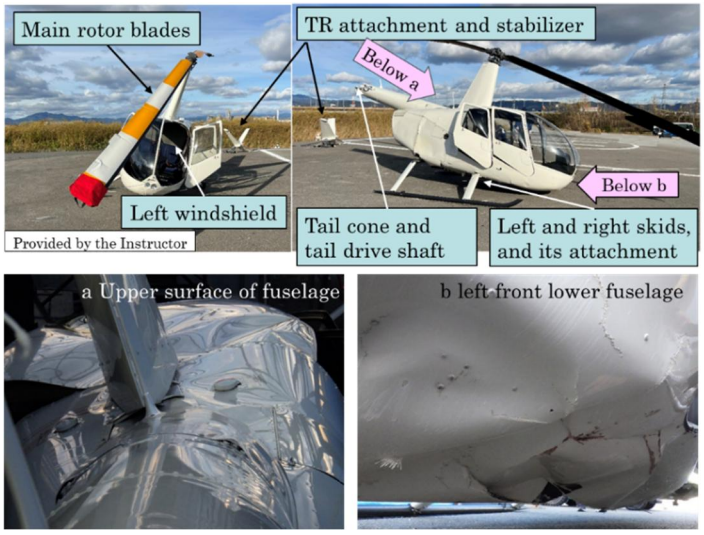


Figure 1: Situation at the Operation Site

According to the Instructor, while the Trainee was manipulating the controls, the helicopter tended to be unstable, moving backward after becoming airborne and shifting in all directions during hovering.

	At the time of the accident, when control was handed over from the Instructor to the Trainee, the helicopter began to move significantly in a rearward direction. Accordingly, when the Instructor advised, "The helicopter is backing up again," the Trainee attempted to correct by moving forward. However, due to the abrupt and excessive control input, the helicopter transitioned from a stopped rearward motion to forward movement, approaching the northern boundary at a high speed. Believing that the helicopter was about to cross the Boundary, the Instructor took over control and applied a nose-up input. Immediately afterward, a loud impact sound was heard from the rear, followed by a sudden right yaw and airframe oscillation. The Instructor applied rudder pedal input to stop the right yaw, but was unable to regain directional control. Based on this, the Instructor determined that the tail rotor (hereinafter referred to as "TR") had been damaged due to contact with the ground. The Instructor determined that a normal landing was not possible and maneuvered the helicopter, which was in a yawing state, toward the center of the touchdown zone marker. After about two right yaws, the Instructor executed a landing on the asphalt surface. The Instructor pulled the collective pitch lever to mitigate the impact upon landing. However, the helicopter fell and made a hard touchdown on the forward part of skids. After ground contact, it continued to yaw to the right and eventually came to rest with the nose oriented south. According to the Instructor, approximately three to four seconds elapsed from the moment the aft fuselage of the helicopter made contact until it completed its yawing motion and touched down. The engine had shut down due to the impact at the time of touchdown. The Witness, who held a commercial pilot certificate for the Robinson R44 helicopter, was watching the helicopter from the front (Figure 1 a.) of the company's hanger, which was located next to the operation site. The helicopter was making relatively large movements while hover, but the Witness did not consider this to be abnormal as it was quite common for a trainee's first attempt at hover. However, when the helicopter moved forward and raised its nose, the Witness felt a sense of danger and began to evacuate from the front of the hangar to the side (Figure b.). The Witness observed that as the helicopter pitched up, it began to climb while yawing to the right, spinning rapidly. At that moment, he recognized that the situation was serious. After that, the Witness heard a loud thud as the helicopter fell, but since the Witness had already moved to a retreat point, the Witness did not see the moment of impact. After the helicopter had fallen, the Witness checked it and found that the helicopter's engine had shut down and no fire broke out, and the main rotor was rotating slowly. Both the Instructor and the Trainee had escaped from the helicopter themselves and were just right next to the cockpit. At this time, the Instructor was crouched down, while the Trainee was going to move away from the helicopter. The Witness instructed the Trainee to wait until

	the main rotor had stopped rotating before moving, as there was a risk of being struck by the rotating main rotor blades. After the main rotor had stopped rotating completely, the Witness moved towards the helicopter, disconnected the fuel supply, and shut down the battery power, and moved the instructor and the Trainee to a safe location. In addition, the company's pilot in the hanger confirmed that the helicopter's Emergency Locator Transmitter (ELT*1) had been activated following the accident. The company's pilot went to the helicopter, then turned off its ELT's power supply. The accident occurred at about 12:15 on December 18, 2023, at JPD Kyoto Operation Site in Kyoto City, Kyoto Prefecture (34° 54' 55" N and 135° 44' 38" E).
2.2 Injuries to Persons	None
2.3 Damage to the Aircraft	(1) Extent of Damage of Helicopter: Destroyed (2) Damage Situation of the Accident Helicopter (See Figure 2 and Figure 3) Fuselage outer skin and structural component: Deformed and damaged Main rotor blades: All two blades damaged TR blades: All two blades broken Tail cone and tail drive shaft: Fractured at two points TR attachment and stabilizer: Broken and deformed Left and right skids, and its attachment: Buckled Left windshield: Detached and damaged  Figure 2: The Helicopter after the Accident

*1 An "ELT" is a device that automatically transmits a distress signal when an aircraft experiences a crash or severe impact.

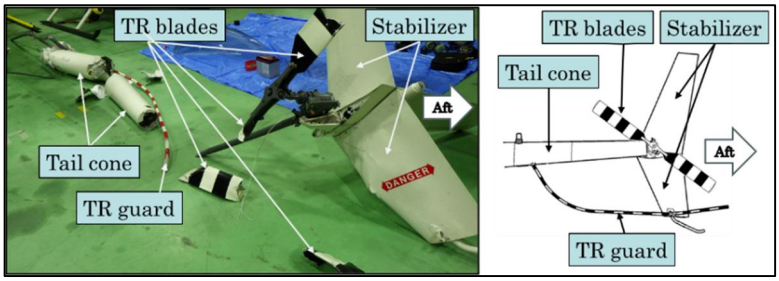


Figure 3: Damage to the Aft Portion of the Helicopter

(3) Situation after the Accident at the Operation Site

On the ground surface about 9 m northwest of the center of the touchdown zone marker, there were three Scratch marks made by the TR blades of the helicopter. The maximum depth of these marks was about 1 cm. Judging by the shape of these TR blade contact marks, the heading of the helicopter when the TR blades contacted with the ground was about 340° (see Figure 4, a, and Figure 5).

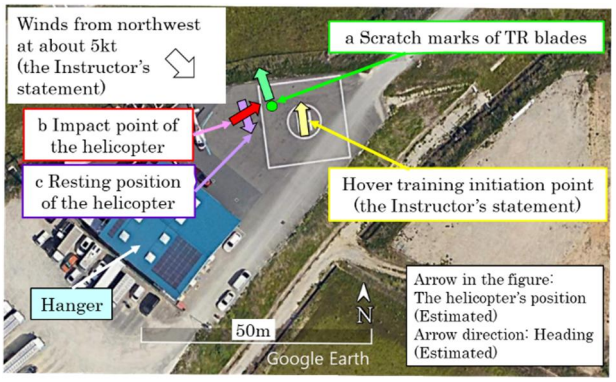


Figure 4: Situation at the Operation Site after the Accident

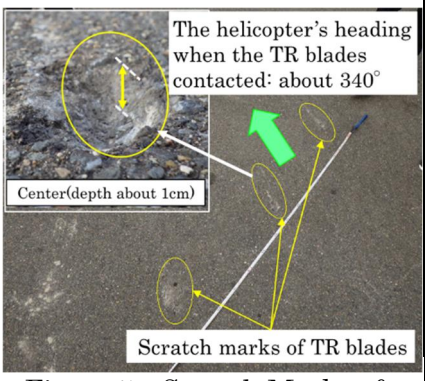


Figure 5: Scratch Marks of TR Blades

On the paved surface outside the western Boundary, there were contact marks left by the helicopter upon touchdown, as well as scratch marks caused by its right yaw after landing, were observed. Based on the condition of the contact marks observed at the time of touchdown, the helicopter's heading upon ground contact was approximately northeast. After coming to rest, the heading was approximately 170°, as indicated by the helicopter's directional gyro checked after the accident (see Figure 4 b. and 4 c.).

The main sites at which the helicopter wreckage was found are listed below:

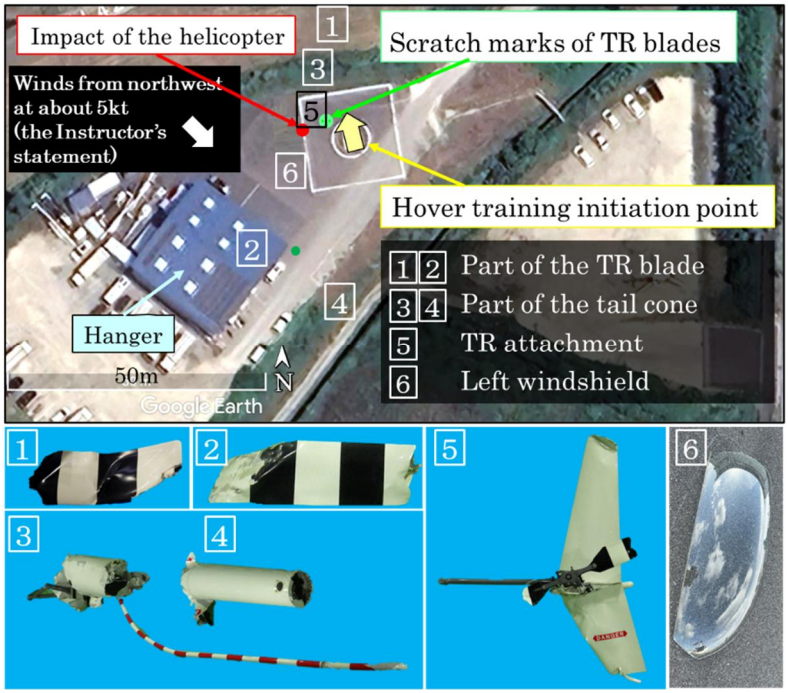
a. Part of the TR blade

On the bank on the north side of the operation site (Figure 6 [1])and on the roof of hanger located next to the operation site (Figure 6 [2])

b. Part of the tail cone

In the grass area on the northern edge of the operation site (Figure 6 [3]) and on the bank on the south side of the operation site (Figure 6 [4])

c. TR attachment and stabilizer

	Near the northwestern Boundary (Figure 6 [5]) d. Left windshield Outside the southwestern Boundary (Figure 6 [6])  Figure 6: Scattering Condition of the Main Wreckage of the Helicopter
2.4 Personnel Information	(1) Instructor: Age 31 Commercial pilot certificate (Rotorcraft) May 19, 2020 Ratings and limitations: Type rating for land-single piston: May 23, 2019 Pilot competence assessment Expiration date of piloting capable period: February 3, 2024 Flight instructor rating (Rotorcraft) October 18, 2023 Class 1 aviation medical certificate Validity: June 1, 2024 Total flight time 1,380 hours 21 minutes Total flight time on the type of aircraft 948 hours 58 minutes Flight time in the last 30 days 13 hours 03 minutes (2) Trainee: Age 25 Student pilot permission Validity March 9, 2024 Total flight time 0 hour 0 minute
2.5 Aircraft Information	Aircraft Type: Robinson R44 Serial Number: 1076 Date of Manufacture: June 13, 2001 Airworthiness: No. DAI-2023-083, Validity: May 11, 2024 Total Flight Time: 943 hours 00 minute When the accident occurred, the weight and the position of the center of gravity of the helicopter were each within the allowable range.
2.6 Meteorological Information	(1) According to the Instructor's statement, the weather conditions in the vicinity of the accident site were as follows: Weather: Fine, Wind direction: Northwest, Wind velocity: about 5 kt

	(2) The values observed by Kyoto AMeDAS, located about 11 km north of the accident site, at around the time of the accident are as follows: (Extract) 12:10 Wind direction: Northwest, Wind velocity: 4.7 m/s (about 10 kt) 12:20 Wind direction: West-northwest, Wind velocity: 5.4 m/s (about 11 kt)
2.7 Additional Information	(1) Instructor's Experience The Instructor obtained a Flight Instructor Certification in October 2023 and has since conducted around 20 training flights with four trainees and others. However, having only recently acquired the certification, the instructor has been teaching experienced helicopter pilots (trainees requiring training for a type rating change, and the student pilots on an advanced curriculum). At the time of the accident, the company had deemed that the instructor had gained sufficient instruction experience, and had decided the Instructor should provide flight training to a trainee with no prior helicopter flying experience. (2) Trainee Training Status To obtain a helicopter pilot certification, the Trainee searched for helicopter pilot training schools online and applied to the company. After signing the school enrolment contract to obtain a private pilot certification in rotorcraft, from June 10, 2023, the Trainee started attending classroom lectures in the company's hangar. The company's flight instructors took it in turns to deliver these lectures. According to the training syllabuses for the classroom lectures included in the company's flight training manual (hereinafter referred to as "the Manual"), the classroom lectures consist of three stages. According to the flight training syllabuses in the Manual, the prerequisite for progressing to the first flight training was to complete stage 1 of the classroom lecture training syllabus. The Trainee had met this requirement. On the day of the accident, the Trainee started flight training for the first time. Prior to this, the Trainee had no prior experience in piloting any aircraft, including helicopters. (3) Flight Training Lesson 1 in the flight training lesson plan in the Manual, which was submitted by the Instructor states the following: (Extract) *Training hour : 1 hour* *Objectives: To learn how to operate the flight control by referring to the pre-flight inspection procedures manual and carrying out familiarization flights.* *Introductory Subjects: Engine starting, Vertical take-off and landing, Hovering, Normal take-off and landing, Straight-and-level flight, Gentle turning, Climbs and descents, Speed control, and Engine shutdown procedure* *Implementation plan:* *(1) Pre-flight briefing* (text omitted)

(4) Fly the traffic pattern at Kohnan Aerodrome, and flying over Okayama City or the Seto Inland Sea. Operate the controls together with the instructor. Conduct straight and level flight with the instructor's assistance.

(text omitted)

(7) Fly back to Kohnan Aerodrome, land at the spot, and shut down the engine.

(ellipsis)

As the company's headquarters (head office) are located at Kohnan Aerodrome, in the lesson plan, the flight procedures and others in case of using Kohnan Aerodrome were described. However, this investigation confirmed that as for the flight procedures and others on the traffic pattern, the Instructor had provided education by using the training materials appropriate for the operation site.

(4) The "Hovering" section in the company's "Training Procedures for Private Pilots for Robinson R44II/I Helicopters", which was submitted by the Instructor, states as follows: (Extract):

3-1 Hovering

(1) Objectives: To understand how the three flight controls (Cyclic, Collective, and Pedals) work, and master the relationship between control input and helicopter displacement. To be able to achieve automatic control of the hover attitude without conscious effort. To understand the effect of wind on helicopters.

(2) Specifications: Altitude・・Skid height 5 ft above ground level

(Omitted)

(4) Cautions and Notes

Making corrections without looking at the target ahead can lead to overcontrol, as it is difficult to recognize the amount of correction.

(Omitted)

(5) Precautions to Take during the Initial Training Flights

An excerpt from Safety Notice SN-20 in the Pilot's Operating Handbook (POH) for the Robinson R44.

Beware of Initial Training Flights

A disproportionate number of fatal and non-fatal accidents occur during initial training flights. If a student begins to lose control of the aircraft, an experienced flight instructor can easily regain control provided the student does not make any large or abrupt control movements. If, however, the student becomes momentarily confused and makes a sudden large control input in the wrong direction, even the most experienced instructor may not be able to recover control. Before allowing someone to touch the controls of the aircraft, instructors must thoroughly indoctrinate them concerning the extreme sensitivity of the controls in a light helicopter. Instructor

must firmly instruct them to never make a large or sudden movement with the controls. And, the pilot-in-command must be prepared to instantly grip the controls should the student start to make a wrong move.

(6) The Helicopter's Nose-up Characteristics

a. Characteristics when the nose pitch position changes

The center of gravity of the helicopter is located near the main rotor mast, and the tail section is positioned farther from the center of gravity compared to the front of the helicopter. Therefore, when pitch attitude changes around the center of gravity, even with the same angle of change, the clearance between the lowest part of the helicopter and the ground becomes narrower during nose-up attitude than during nose-down attitude. (see Figure 7). Additionally, during a nose-up attitude, the cockpit position becomes elevated, making it difficult for the pilot to recognize that the clearance between the helicopter and the ground has become narrower.

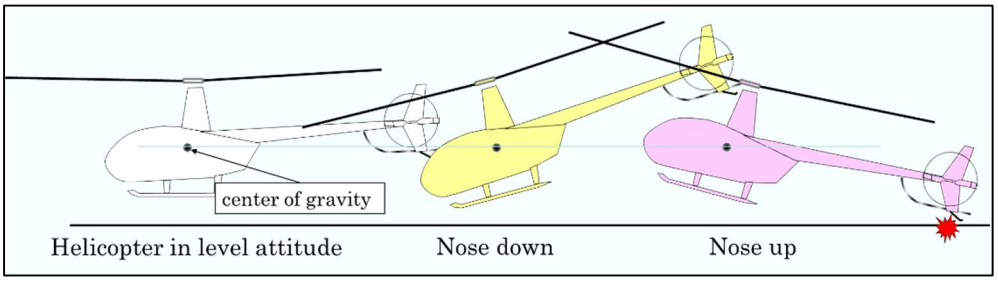


Figure 7: Changes in Clearance from the Ground depending on Differences in Nose Pitch Position

b. Effect of the tilting of the main rotor disc

During hover, the lift generated by the helicopter is equal to the thrust produced by the rotating main rotor. However, when the helicopter enters a nose-up attitude, the rotor disc tilts rearward, causing the thrust vector of the main rotor to also tilt backward. As a result, the vertical component of lift acting perpendicular to the ground decreases, leading to a reduction in altitude (see Figure 8).

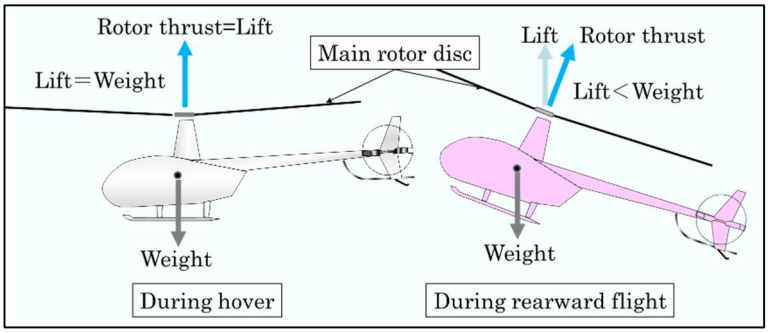


Figure 8: Effect of the Tilting of the Main Rotor Disc

3.ANALYSIS

(1) Regarding the TR Blades' Contact with the Ground

The JTSB concludes that the helicopter had most likely pitched its nose-up excessively causing the TR blades to contact with the ground, based on the statements of the instructor and witness, as well as the scratch marks on the ground.

The helicopter pitched its nose-up excessively because it is highly probable that the Instructor's corrective operation after taking over the control was inappropriate. In addition, the helicopter's nose-up characteristics have possibly affected the TR blades' contact with the ground.

(2) Damage to the Helicopter

The JTSB concludes that that it was highly probable that the helicopter fell while spinning to the right due to damage to the TR blades.

At that time, it is most likely that the aircraft was subjected to a significant vertical load (G), causing deformation and damage to structural components, and, due to inertia upon ground impact, the main rotor blades drooped downward, fracturing the tail cone and tail drive shaft.

(3) Flight Training

The JTSB concludes as follows:

a. The Instructor

It is most likely that, the while allowing the Trainee to operate the controls, the Instructor kept his hands on the controls to remain prepared for a takeover if necessary.

However, at the time of the accident, after being advised by the Instructor that the helicopter was moving backward, the Trainee responded with an abrupt and excessive control input that was disproportionate to the correction required. As a result, the helicopter transitioned from a rearward stop to a forward movement at a speed that more likely exceeded the Instructor's expectations. Consequently, it is more likely that the Instructor was unable to respond appropriately.

As described in Safety Notice SN-20 for the Robinson R44, before allowing student pilots to manipulate the flight control, flight instructors must thoroughly indoctrinate them concerning the extreme sensitivity of the controls in a light helicopter and instructed them not to make any large or abrupt control inputs. However, even after receiving ground instruction, it is reasonably expected that, due to nervousness or other factors, the student pilots may operate the controls with excessive force or perform incorrect inputs during initial training flights. Therefore, flight instructors must be prepared to intervene earlier, for example by taking over the control when signs of overcontrol are evident.

When allowing a student pilot who has not mastered hover operations to touch the controls, flight instructors should consider the helicopter's nose-up characteristics by establishing a sufficient hover altitude and others.

The company should inform flight instructors that student pilot may perform unexpected maneuvers and that, even in these circumstances, flight instructors are required to control the situation to ensure that the level of risk remains acceptable.

b. The Trainee

During the Trainee's hover training, the helicopter moved backwards, or forwards almost crossing the Boundary in front of it. Therefore, it is highly probable that the Trainee did not master stable hover operations. As it was the Trainee's first helicopter flight training, the Trainee was most likely under pressure and so nervous that the Trainee was late in noticing the changes in the helicopter's hover position, altitude and heading in time, in addition, the Trainee did not have the skills to correct these problems, resulting in the Trainee's performing overcontrol or excessive force input.

At the time of the accident, it is probable that overreacting to the Instructor's advice that the helicopter was moving backwards, the Trainee made a sudden, large control input that was disproportionate to the required corrections. As described in the flight training procedures in 2.7 (3) above, it is known that student pilots tend to make overcontrol without being unable to recognize the amount of correction during the initial training flights, therefore such maneuvers by student pilots are not unusual.

c. Training Plan

As there was sufficient training time at the time of the accident, it is more likely that the Instructor added hover training that was not listed in the lesson plan.

When the training is going smoothly, flight instructors may add training that is not listed in the lesson plan, as they like to teach student pilots as much as possible. However, unplanned changes to the lesson plan could pose a threat*2, such as placing an increased psychological load on student pilots or increasing their workload.

If the lesson plans change, it is desirable for the company to carefully consider allowing student pilots sufficient time to prepare by coordinating the change during the pre-flight briefing and others.

Although some of the company's lesson plans describe the use of Kohnan Aerodrome, it is most likely that the Instructor used the training materials appropriate for the operation site during the education at the operation site. However, from the perspective of training efficiency, it is desirable to consolidate the training materials that student pilots should refer to. It is also desirable for the company to reflect the contents of the training materials used at the operation site in the lesson plan.

4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this accident was highly probable that during hover training, the helicopter entered an excessive nose-up attitude, causing the TR blades to contact the ground, leading to a right yaw and a subsequent fall, resulting in sustaining damage to the helicopter.

The helicopter pitched its nose-up excessively because the corrective inputs following control takeover were most likely inappropriate.

5. SAFETY ACTIONS

5.1 Safety Actions Required	(1) As student pilots may operate the controls with excessive force or perform incorrect inputs during their initial helicopter flight training, flight instructors must be prepared to take corrective action early on, for example, by taking over the control when signs of overcontrol are evident. The company should inform flight instructors that student pilots may perform unexpected maneuvers and that, even in these circumstances, flight instructors are required to control the situation to ensure that the level of risk remains acceptable.

*2 A "Threat" is one of the risk factors identified in Threat and Error Management (TEM). It refers to an unsafe element that originates outside the pilot's control, complicates flight operations, and requires the pilot's attention or response in order to maintain safety margins. Examples of threats include weather conditions, operational pressure, and air traffic control (ATC).

	(2) As described in the analysis, before allowing student pilots to manipulate the flight control, flight instructors must thoroughly indoctrinate them concerning the extreme sensitivity of the controls in a light helicopter and instructed them never to make any large or abrupt control inputs. (3) If the lesson plans change, it is desirable for the company to carefully consider allowing student pilots sufficient time to prepare. In addition, as some of the company's lesson plans describe the use of Kohnan Aerodrome, it is desirable for the company to reflect the contents of the training materials used at the operation site in the lesson plan.
5.2 Safety Actions Taken after the Accident	Safety Actions Taken the Company after the Accident (1) They will ensure that student pilots flying for the first time experience the flight simulator before their first flight, and also thoroughly indoctrinate student pilots concerning the extreme sensitivity of the controls in a light helicopter, in order to make them aware of the importance of not overcontrolling. (2) The altitude shall be set higher for hover training exercises carried out by student pilots in the initial stage of flight training. (3) When a newly appointed instructor with limited teaching experience conducts flight training with a student pilot for the first time, or when engaging in any new or first-time activity, it is required to report the matter to the Safety Manager. A safety-related discussion shall then be held at the Operational Safety Meeting to facilitate appropriate decision-making. (4) Veteran flight instructors will compile a list of common mistakes that newly appointed instructors are likely to make, and the veteran instructors will provide training to new instructors. (5) Flight instructors were informed that flight training must be conducted in accordance with the training syllabuses. The syllabuses and lesson plans were also reviewed.