# AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

## CASE WHERE AIRCRAFT OPERATION IS IMPEDED BY FAILURE IN AIRCRAFT EQUIPMENT PRIVATELY OWNED AGUSTA A109E (ROTORCRAFT), JA02KG OVER YACHIYO TOWN, YUKI COUNTY, IBARAKI PREFECTURE AT ABOUT 14:55 JST, JULY 28, 2024

November 27, 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 SERIOUS INCIDENT INVESTIGATION

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| **1.1 Summary of the Serious Incident** | On Sunday, July 28, 2024, a privately owned Agusta A109E, JA02KG, took off from the Operation Site located in Yuki City, Ibaraki Prefecture for an operational check of the radio communication device. While flying over Yachiyo Town, Yuki County, Ibaraki Prefecture, the helicopter's operation was impeded by a partial failure of the flight control system. After declaring a state of emergency, the helicopter landed in a playground. |
| **1.2 Outline of the Serious Incident Investigation** | The occurrence covered by this report falls under the category of "case where aircraft operation is impeded by failure in aircraft equipment" as stipulated in Article 166-4, item (xiv) of the Regulation for Enforcement of Civil Aeronautics Act of Japan (Order of Ministry of Transport Regulation No. 56, 1952), and is classified as a serious incident.<br>Upon receiving the report on the serious incident, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator to investigate this serious incident on July 30, 2024.<br>An accredited representative and an adviser of the Italian Republic, as the State of Design and Manufacture of the helicopter involved in this serious incident, and an accredited representative of Canada, as the State of Design and Manufacture of the engine involved in this serious incident, participated in the investigation.<br>Comments on the draft Final Report were invited from parties relevant |

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| | to the cause of the serious incident and the relevant States. |

## 2. FACTUAL INFORMATION

**2.1 History of the Flight**

According to the statements of the captain and Mechanic A and the radar track records of Tokyo radar approach control, the history of the flight is summarized as follows:

Figure 1: The helicopter

On July 28, 2024, a privately owned Agusta A109E, JA02KG, was confirmed to be free of anomalies during the pre-flight inspection. It then took off from the Yuki Operation Site in Yuki City, Ibaraki Prefecture, for an operational check of the radio communication device. There were two people on board the helicopter: the captain and Mechanic A. After conducting an operational check on the radio communication device in the vicinity of Sekiyado, the helicopter was flying at an altitude of about 2,000 ft over Yachiyo Town, Yuki County, Ibaraki Prefecture while descending to return to the Operation Site. A banging sound was suddenly heard, and the torque values of both engines (output) suddenly dropped to 1%. Despite moving the collective pitch lever*1 (CPL), the torque did not respond to the movement of CPL, and the helicopter was unable to maintain altitude. Both engines operating normally and the cyclic stick*2 (CYS) and rudder pedals*3 were functioning. At 14:55:39 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), the captain made a distress call to the Tower control position at Narita airport traffic control tower (Narita Tower), saying, "MAYDAY, MAYDAY, MAYDAY, JA01KG (as stated), 01KG (as stated), POWER LOSS, POWER LOSS, POWER LOSS". The helicopter was unable to stop the steep descending and performed a left descending turn to avoid high-voltage power lines. It then made a forced landing in the unused playground (Higashi Fukita Sports Park). The captain was exerting the utmost effort to control the helicopter and forgot to extend the landing gear. There was almost no wind at the time. After the forced landing, Mechanic A disembarked from the helicopter and inspected the helicopter and its surrounding area. Mechanic A thought that the helicopter had knocked down the outer fence of the playground during the forced landing, but that there was no other major damage to the site or the helicopter itself. The captain stopped the engine and main rotor (MR), shut down the power source and got out of the helicopter.

No persons on board the helicopter sustained any injuries, and no fire broke out. Subsequent inspection by Mechanic A revealed that the MR scissors

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＊1 The "collective pitch lever" is a helicopter control system that controls the vertical movement of the helicopter by raising or lowering the lever to increase or decrease MR thrust.

＊2 The "cyclic stick" is a helicopter control system that controls the helicopter, mainly by being moved in the direction of tilting the helicopter's attitude.

＊3 The "rudder pedals" are one of helicopter control systems that control the nose direction by increasing or decreasing tail rotor thrust.

lower link had become detached from the stud bolts of the upper swashplate (see 2.7(2) below).

According to the radar track records, the helicopter started the steep descent at 14:55:13, at an altitude of 2,340 ft. The helicopter was last captured by radar at 14:55:45 at an altitude of 1,280 ft.

Narita Tower called the helicopter at 14:56:05, 14:57:36 and 15:00:55, but there was no reply from the helicopter.

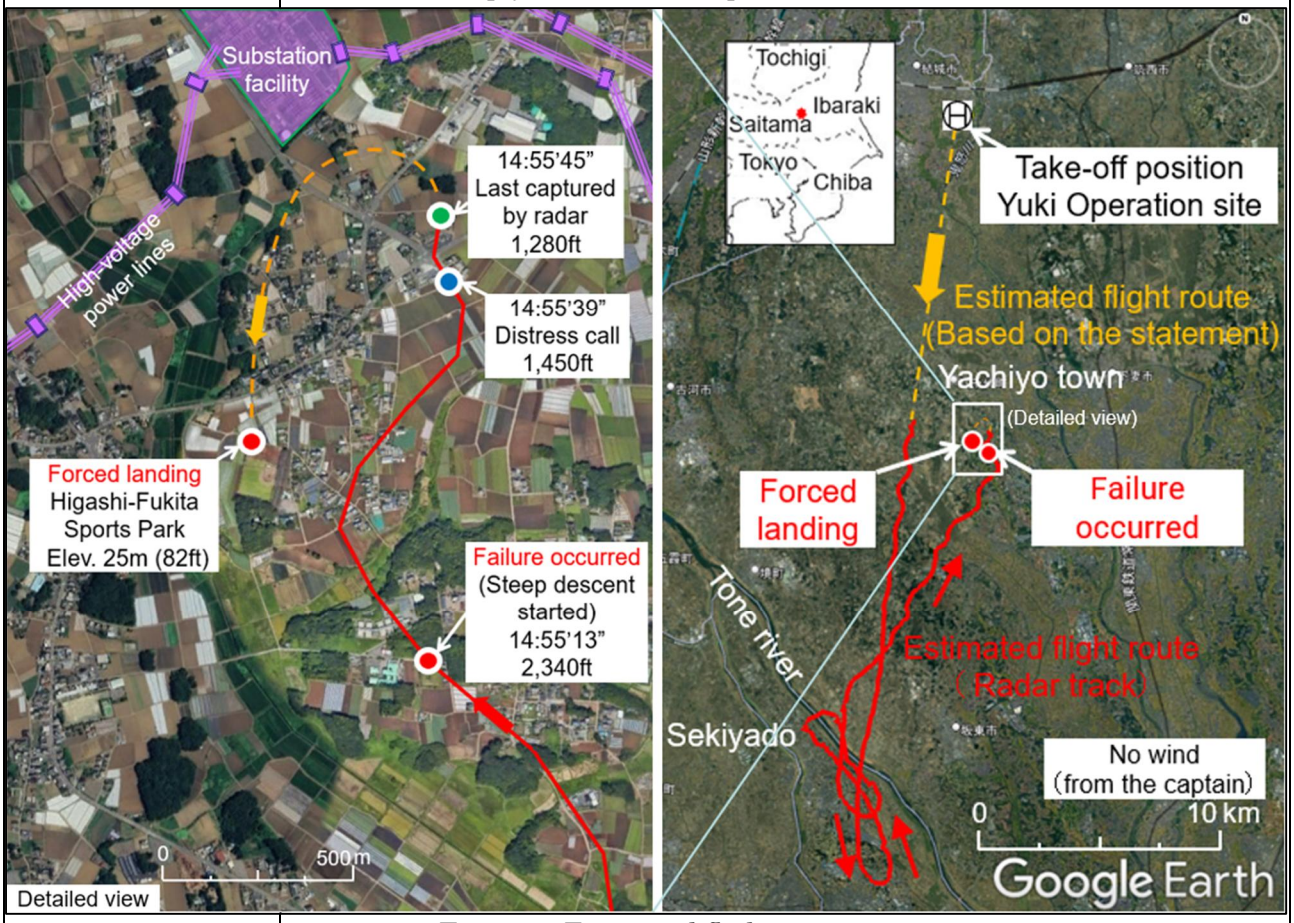


Figure 2: Estimated flight route

The serious incident occurred at an altitude of about 2,340 ft over Yachiyo Town, Yuki County, Ibaraki Prefecture (36° 09' 09" N, 139° 54' 24" E) at about 14:55 on July 28, 2024.

**2.2 Injuries to Persons**

None

**2.3 Damage to the Aircraft**

(1) Helicopter Damage: Minor damage

(2) Damage to parts of the Helicopter

Lower surface of the fuselage and outer panel of the right side of aft fuselage: Scratch marks

One MR blade (MRB) (Red: All four MRBs are color-coded into Red, Blue, White and Yellow, respectively.) Hole and deformed

Two tail rotor blades (TRB) (All two blades): Dents on the leading edge

Tail rotor drive shaft (TRDS): Broken

Loudspeaker (Lower surface of the fuselage) Detached

The lower link of scissors had become detached from the stud bolts of the upper swashplate. The cotter pin, nuts and washers that had been installed

were missing (see Figures 4 and 8).

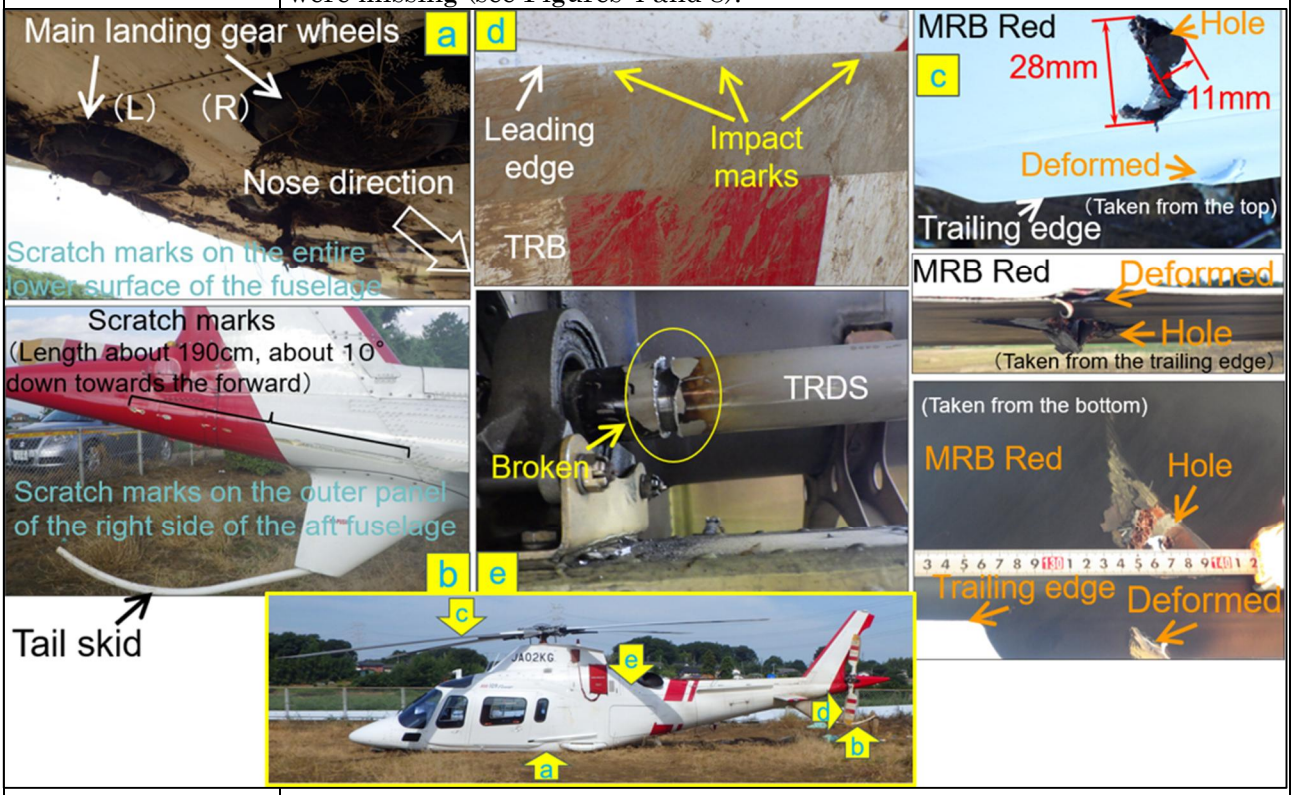


Figure 3: Damage to the helicopter

Mud was on the tail skid, and scratch marks on the outer panel of the right side of aft fuselage extended about 190 cm in a straight line about 10° downward towards the helicopter's forward.

(2) Other Damage

Outer fence of the Sports Park:
Collapsed approx. 7 m wide

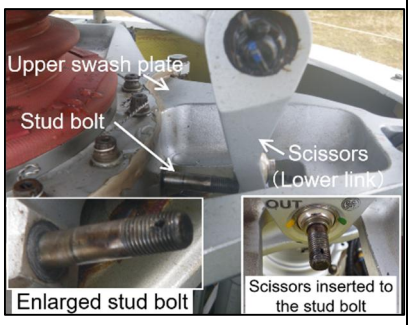


Figure 4: Detached scissors

**2.4 Personnel Information**

Captain: Age 59

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| Commercial pilot certificate (helicopter) | September 20, 1990 |
| Ratings and limitations: | |
| Type rating for land-multi turbine: | April 10, 2018 |
| Pilot competence assessment/confirmation | |
| Expiration date of piloting capable period: | September 1, 2025 |
| Class 1 aviation medical certificate | Validity: February 3, 2025 |
| Total flight time | 7,687 hours 15 minutes |
| Flight time in the last 30 days | 6 hours 27 minutes |
| Total flight time on the type of aircraft | 25 hours 54 minutes |
| Flight time in the last 30 days | 0 hour 10 minutes |

**2.5 Aircraft Information**

Helicopter type: Agusta A109E
Serial number: 11090 Date of manufacture: October 21, 2000
Airworthiness certificate: No. TOU-2024-088 Validity: June 6, 2025
Total flight time 6,036 hours 45 minutes
Flight time since last periodical check (50h/30 days, 100h Check, and 200h

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| | Check, on June 6, 2024): 5 hours 00 minute<br>When the serious incident occurred, the helicopter's weight is estimated to have been 2,406 kg and the center of gravity is estimated to have been 3,416 mm, both of which were within the allowable range (maximum takeoff weight of 2,850 kg, and 3,220 mm to 3,550 mm of range of center gravity corresponding to the weight at the time of the serious incident). |
| **2.6 Meteorological Information** | The values observed by the Automated Meteorological Data Acquisition System (AMeDAS (Shimotsuma)), located about 4 km east-northeast of the site of the forced landing, at around the time of the serious incident are as follows:<br>15:00 Wind direction Southeast, Wind velocity 1.2 m/s,<br>Last 10 minutes of sunshine 10minutes<br>Temperature 34.2°C |
| **2.7 Additional Information** | (1) Information on the Forced Landing Site<br>A linear, narrow trench left on the ground of a field was extending in about 180° direction from the outer fence which was collapsed to the immobile helicopter and located about 3 m behind from the helicopter. The nose of the helicopter pointed in the direction of about 190°.<br>There were several consecutive impact marks on the upper part of the collapsed outer fence, and the same color of paint as that used for the helicopter's outer panel was attached. |

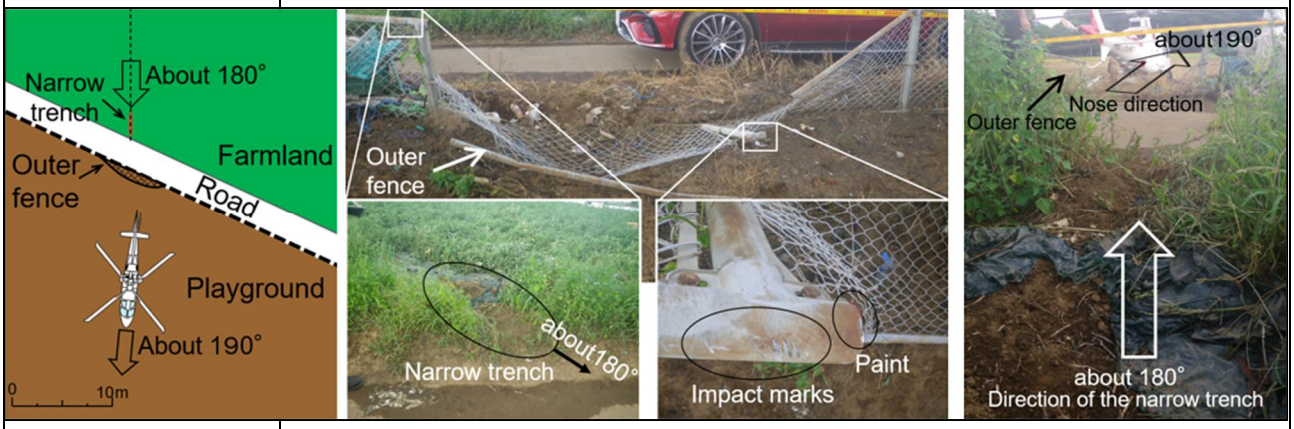


Figure 5: Forced landing site

(2) Information on MR Scissors

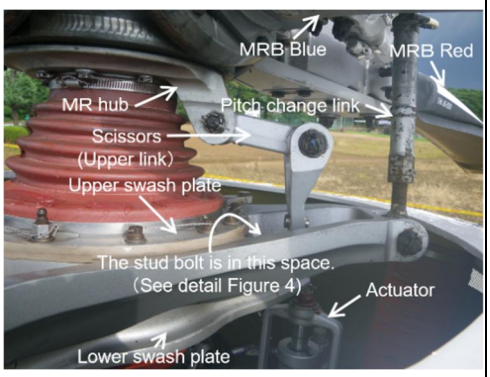


Figure 6: Structure around the helicopter's scissors

The helicopter's MR control system is designed to enable the CPL or CYS inputs made by a pilot to control the vertical or angular movement of the stationary lower swashplate via actuators. According to this movement, the upper swashplate, which rotates with the MR, is driven vertically or angularly. In accordance with the movement of the upper swashplate, the four pitch change links adjust the pitch angle of the MRBs to which they are connected respectively to control the MR. The scissors join the

MR hub installed in the center of the MR which rotates alongside the MRBs and the upper swashplate, and transmit rotation from the MR hub to the upper swashplate. Additionally, the scissors were only one and installed on the MR hub between the MRB Red which had fractured and deformed and the MRB Blue.

The situation where the scissors linkage is detached from the upper swashplate is considered a catastrophic failure as per Leonardo Helicopters Co., Ltd. Design Assessment, and no emergency procedures in place to deal with such an event in the Agusta A109E Helicopter Flight Manual.

(3) Information on the Installation of the Helicopter's Scissors

Between 12 April and 6 June 2024, the periodic checks prior to airworthiness inspections (50 hours/30 days, 100 hours, and 200 hours) were performed on the helicopter at Iwai Heliport (Iwai Operation Site, in Bando City, Ibaraki Prefecture) by Mechanic B. The gap measurement for scissors, conducted in accordance with the maintenance manual during the inspections, revealed that it was not within the allowable range, resulting in the replacement of the scissors linkage. This replacement involved removing both the upper and lower scissors links.

In comparison with the cotter pin installed in the linkage between the upper link (44 in Figure 8) and the lower link (43 in Figure 8) that would not be disassembled during installation of the scissors, the upper cotter pin of the helicopter's scissors was installed in such a way that it was not bent sufficiently towards both the bolt and nut, nor was it tightly secured to either of them. Furthermore, it was not coated with an anticorrosive substance. (see Figure 7, lower left).

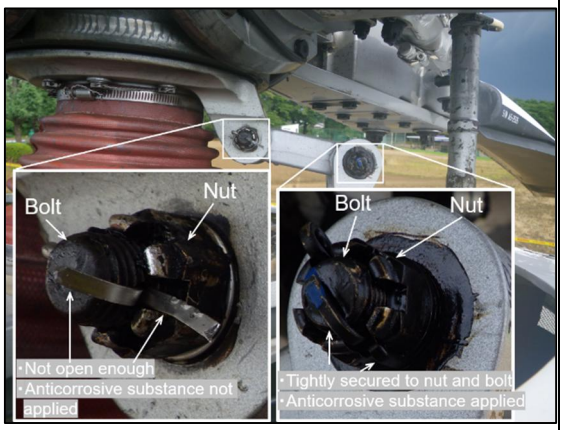

Figure 7: Cotter pin of the scissors of the helicopter

(4) Information on the Installation and Maintenance of the Scissors

According to A109E-MM (Maintenance Manual for A109E helicopter model Second Issue: May 15, 2011, Revision: No. 18 - September 8, 2023, in effect at the time of maintenance activities), the scissors installation process is outlined as follows: (Excerpt from 109E-MM SECTION 62-31 ROTATING CONTROLS)

*a. Position the upper link (44) of the rotating scissors assembly between the clevis of the flange bracket (12,* Figure 8*); align holes and install the sleeve (27) matching the flat side of its flange with the shoulder of the flange bracket (12). Apply to the unthreaded shank of bolt (29,* Figure 8*), a thin layer of corrosion inhibiting compound (D) (C505) or (C587), then install it with washer (28) and with its head in contact with the flange of the sleeve; install washer (26) and nut (25).*

*Torque nut to 8 - 10,2 Nm and fit cotter pin.*

*b. Apply to the unthreaded shank of the lower link mounting bolt, located on the swashplate outer ring, a thin layer of corrosion inhibiting compound (D) (C505) or (C587), then install on it the washer (53) P/N AN960C616L or NAS 1149C0632R.*

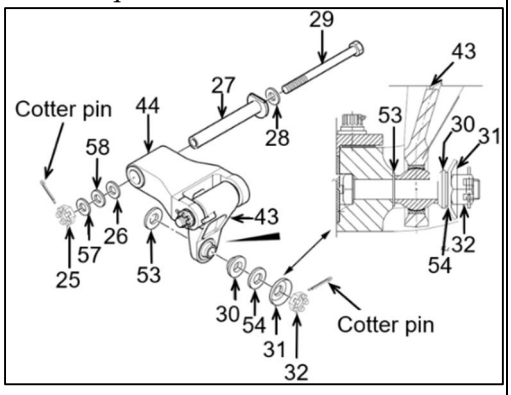


Figure 8: Components around the Scissors

*c. Connect lower link (43) to the mounting bolt and install bevel washer (30) with its bevel side leaning against the lever (43), if necessary, for correct installation of cotter pin, shim with washer (54) NAS1149C0632R to obtain the required thickness, cup washer (31) with its cup outward and nut (32) (see detail in* Figure 8*). Torque nut 8 - 10,2 Nm and fit cotter pin.*

*d. Apply the corrosion preventive compound (C509) to these parts:*

*— the head of the bolt (29), the cotter pin and the nut (25)*

*— the cotter pin and nut (32), the cup washer (31)*

(5) Information on Cotter Pin

Regarding the installation procedure of cotter pins, "Koukuuki-no-kihongijutsu (Aircraft Basic Engineering)" (9th edition, 1st printing, published by the Japan Aeronautical Engineers' Association, pp. 369–374) states the following: (Excerpt):

*2) Installation Procedure of Cotter Pin*

*a. Place the cotter pin so that its long side is facing upwards then push it in as deeply as possible by hand.*

*b. Usually, tap the head of the cotter pin lightly with a plastic hammer until its head is flush with the nut wall, taking care not to deform the pin's head. If the head would be deformed, it is not necessary to make it flush with the nut wall.*

*c. Firmly grasp the upper tip of the cotter pin with pliers, bend it towards the bolt axis while pulling it backwards, and cut it within a range not exceeding the bolt diameter (Figure 14-48).*

*d. Tap the severed pin tip lightly with a plastic hammer and firmly push it to the bolt end.*

*e. Firmly grasp the remaining pin tip with pliers, bend it slightly downwards while pulling it backwards, and cut it to that extent that it does not touch the washer.*

*f. Tap the pin tip lightly with a plastic hammer and firmly push it to the nut wall.*

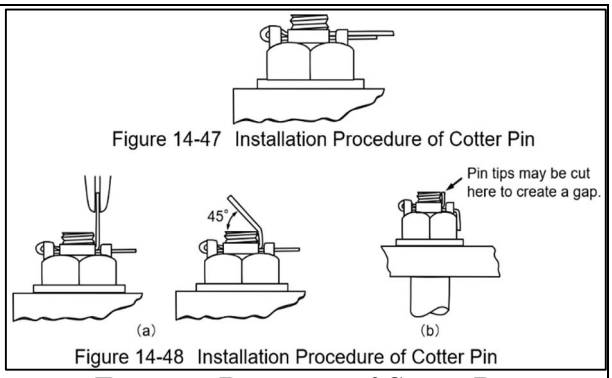


Figure 9: Diagrams of Cotter Pin Installation Procedure

*g. Check whether there is any play in the installed cotter pin.*

(6) Information on Self-locking Nut

The nut (32) in Figure 8 is a self-locking nut that incorporates a non-metallic (nylon) insert that deforms along the threads when the nut is tightened, preventing loosening. The nut (32), together with the cotter pin, acts to prevent the scissors from falling off.

(7) Information on the Similar Event in the Past

On July 26, 1999, an Agusta A-109-E helicopter, registration EC-GQX, which is the same model of the helicopter, was flying over in the suburbs of Madrid, Spain, and, according to the related CIAIAC Final Report, the most probable cause was that it crashed as the scissors become detached during the flight due to the fracture on the stud bolt caused by the incorrect installation of scissors (in the inverted position). The helicopter was destroyed, and one pilot on board suffered a fatal injury.

## 3. ANALYSIS

(1) Situation at the Time of Forced Landing

The JTSB concludes that it is most likely that the linear, narrow trench extending in about 180° direction at the forced landing site was caused by the helicopter's tail skid, and that the helicopter had approached and made a forced landing in about 180° direction. The scratch marks on the outer panel of the right side of the aft fuselage, which extended in a straight line about 10° downward towards the forward, were most likely caused by the outer fence of the Sports Park. Therefore, it is probable that the helicopter came into a contact with the outer fence with its nose up at an angle of about 10° while its tail skid was touching the ground. The several consecutive impact marks on the upper part of the outer fence were highly probable caused by the rotating TRBs. The TRDS was probably broken due to the significant load applied when the TRBs hit the outer fence.

(2) The Status of a Failure Occurred during the Flight

The JTSB concludes that the sudden banging sound during the flight most likely occurred when the scissors lower link of the scissors detached from the upper swashplate stud bolt, causing the nuts and other components to hit and penetrate the MRB Red. Based on the fracture of the MRB Red, it is most likely that the nut penetrated it from the top to the bottom.

When the scissors detach from the upper swashplate, the upper swashplate would rotate via

the pitch change links, since the pitch change links connected to each MRB are also connected to the upper swash plate. However, it is most likely that the relative position between the pitch change link and the upper swash plate is irregularly out of the correct position, resulting in the MRB pitch angle being close to the minimum. It is highly probable, therefore, that the vertical and angular movement of the upper swashplate does not transmit to the MRB, resulting in a reduction in torque. The significant drop in the helicopter's controllability was due to the separation of the scissors, which meant that rotation was transmitted only through the upper and lower connections of the pitch change link. Although the torque barely followed the movement of the CPL, it is most likely that the CYS was still able to control the helicopter's attitude, as evidenced by the nose-up movements during turns and touchdown. However, it is possible that, in the situation where the scissors detached from the upper swashplate, the helicopter's attitude control was unable to respond perfectly to the CYS movement.

(3) Flight Status after Failure Occurrence

The JTSB concludes as follows:

Despite descending having an extremely serious flight control failure following the failure, the helicopter made a distress call and a forced landing in the unused playground, having avoided high-voltage power lines. The scissors linkage detached from the upper swashplate is considered a catastrophic failure. And this situation was most likely an extremely dangerous situation in which the helicopter could crash, resulting in fatalities among those on board, as occurred in the similar event. It is highly probable that there were no injuries to persons on board and that the helicopter sustained minimal damage because the captain made the right decisions regarding the forced landing site, route, and flight control in response to the situation. In addition, it was a calm response for the captain to make a distress call despite being unable to control the helicopter.

(4) Scissors Installation Procedure

The JTSB concludes that the scissors lower link most likely became detached from the upper swashplate stud bolt, together with the nut and washers, because the self-locking nut and the cotter pin had eventually lost their function. The following are possible reasons why the self-locking nut and the cotter pin lost their function.

a. The tightening torque of the self-locking nut was insufficient.

b. Just as with the upper scissors' cotter pin, the lower scissors' cotter pin was not installed correctly, with insufficient bending and no anticorrosive substance applied. This caused the scissors lower link to detach or break during the five-hour flight.

c. The cotter pin was not installed.

However, the self-locking nut and the cotter pin were not found, and there was insufficient information regarding their installation status. Therefore, it could not be determined. In any case, it is likely that the self-locking nut and the cotter pin lost its function because the scissors were not installed correctly.

Besides, the periodic checks prior to airworthiness inspections, including the scissors installation procedure, were conducted by Mechanic B only. It is possible that the confirmation following the scissors installation was inadequate.

## 4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this serious incident was that it is most likely that while the helicopter was flying, the self-locking nut and the cotter pin used to lock the scissors lower link and the upper swashplate had eventually lost their function, which resulted in the lower

link of the scissors, together with the nut and washers, becoming detached from the upper swashplate, causing a failure in the helicopter operation.

It is possible that the self-locking nut and the cotter pin lost their function because the scissors were not installed correctly and the confirmation following the scissors installation was insufficient.

## 5. SAFETY ACTIONS

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| **5.1 Safety Actions Required** | Including the scissors' cotter pin installation, which was described in "3 ANALYSIS", it is important that maintenance staff shall conduct the aircraft maintenance procedure appropriately and confirm this upon completion. |