

Uncontrolled Crash into the Ground with Damaged Tail Rotor by Sling Cable during Cargo Transport Flight

Summary: On Monday October 3, 2011, a Eurocopter AS350B3, operated by Company A, took off from the Karasawa temporary helipad in Kiyokawa Village, Aiko-gun, Kanagawa Prefecture to transport cargos and sustained damage to its airframe during flight. The helicopter crashed into the Choja-yashiki Campground.

Two people in total were onboard the helicopter, a pilot and an onboard mechanic. The pilot was killed and the onboard mechanic was seriously injured. The helicopter was destroyed and a fire broke out.

Events leading to the Accident

Around 09:30

The helicopter took off from Karasawa temporary helipad to transport cargos to the location of unloading sites No.1 to No.6.

After flying to and from the sites a number of times, the onboard mechanic observed the sling cable flying in the wind in the direction of the posterior end of the fuselage (around the tail guard) in the rearview mirror and reported the observation to the PIC.

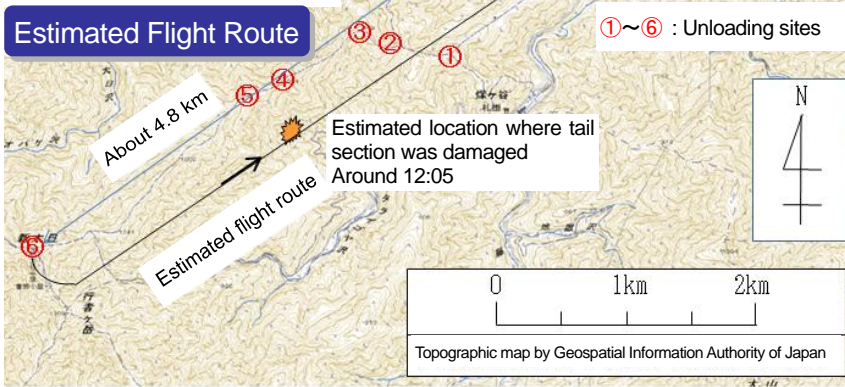
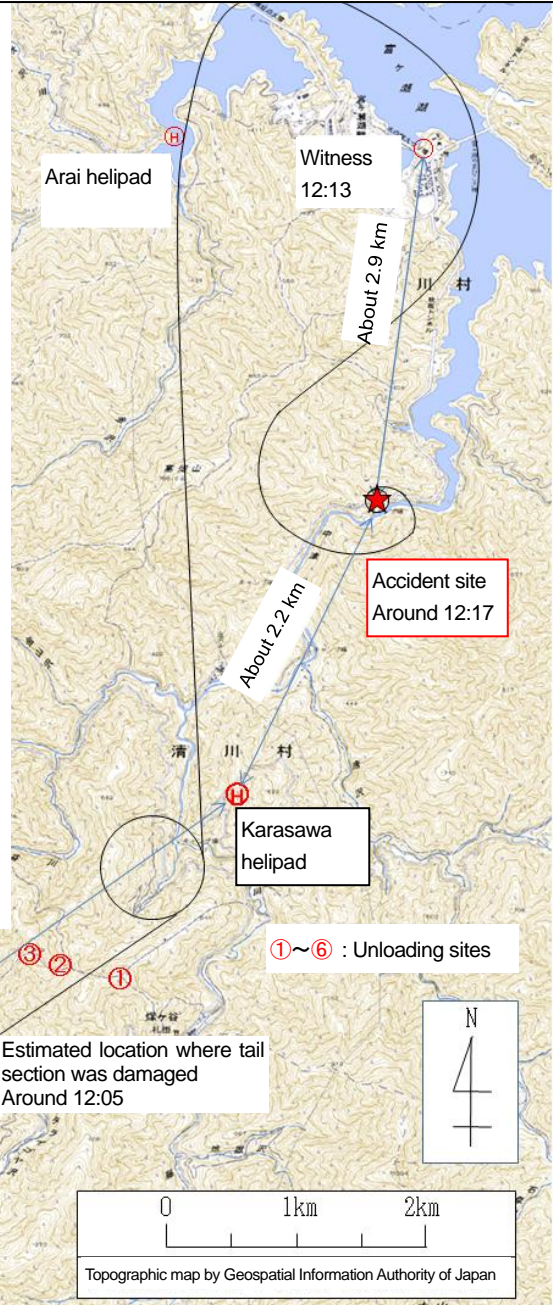
Around 12:05

After unloading the cargos at No.6 site, around midpoint of the return route to the Karasawa helipad, the onboard mechanic heard a loud “Bang” sound. When the onboard mechanic observed behind the helicopter, he found the tail rotor stopped rotating and the blade was broken.

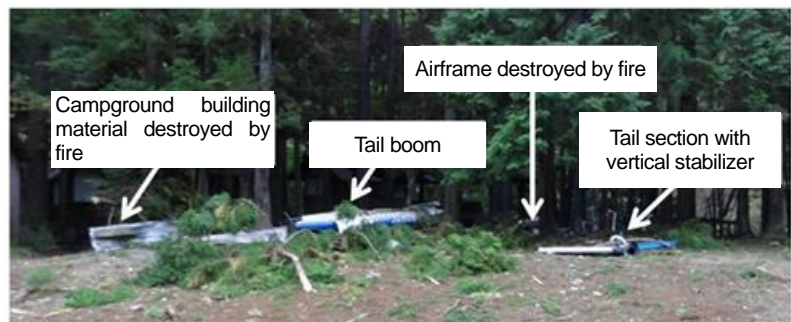
The pilot continued the flight to search for the landing site while contacting with the onboard mechanic and a ground operator.

After initial yawing, the helicopter gradually lowered its nose.

Around 12:17 The helicopter crashed into Choja-yashiki Campground



Accident Helicopter



Accident Site

Damage to the Tail Rotor

The sling cable was not stable

Information on sling work was provided by the helicopter's design and manufacturing company in its Service Letter, but was not shared with the Flight Operation Department of Company A.

At the time of the accident, a sling cable of 7 m long was attached with no load.

It is highly probable that the sling cable was not stable due to insufficient ballast (*1) weight and it is probable that the sling cable was prone to cause the upward movement.

*1: Weight for adjusting the center of gravity

Service Letter from Helicopter's Design and Manufacturing Company (excerpt)

- ◇ Unloaded sling cables, especially short sling cable (5 to 10 m), should be ballasted with at least 15 kg at cargo hook.
- ◇ With unloaded sling cable, avoid descending at airspeed above V_y (*2), and avoid load factors (*3) less than 0.5 G.

(Omitted)

*2: V_y is the best rate of climb speed and is used to attain the maximum height in a short period of time.

*3: Value of load acting on aircraft during flight (forces acting on aircraft such as air force, inertia force) divided by aircraft gross mass.

Recognition of cargo sling condition

During the flight before accident, the onboard mechanic observed the sling cable coming close to the tail of the fuselage and reported the observation to the pilot.

It is probable that the PIC did not recognize the situation until the warning was given by the onboard mechanic and therefore had not appropriately monitored the sling cable with the mirror.

Increased airspeed

Fog occasionally flowed into No.6 unloading site, causing occasional brief difficulties in unloading cargo.

It is possible that the PIC increased the airspeed to accelerate the pace of work considering the remaining work to be done when returning from No.6.

Upward movement of sling cable

When the pilot adjusted the flight route downward, the helicopter entered into the downward accelerated flight.

The distance between the end of the sling cable and the tail section decreased, because the sling cable moved relatively upward due to the effect of inertia and aerodynamic force.

It is probable that the sling cable contacted the tail rotor, damaging with and damaged the tail rotor and resulting in a loss of the tail rotor thrust.

Decision on an Emergency Landing

- ◇ According to the Company A's Manual, pilots are required to select emergency landing sites prior to starting the work of cargo transport, and it is probable the PIC was not prepared for such an occurrence and was not well-prepared so as to be able to decide where to make an emergency landing.
- ◇ It is probable that the pilot continued flying the helicopter, without anticipating the possibility that the damage to the helicopter could worsen and make the helicopter uncontrollable.

Training of the Pilot

Training for Preparation for Tail Rotor Failure

- Training for this preparation was provided two times at 4 years and 9 months or more ago before this accident, but they were based on the assumption of the tail rotor control failure in the different type of helicopter to approach and land on a runway.

Training for Autorotation (*4)

- Training for autorotation based on the assumption of an engine failure was provided.

*4: A flight condition where the main rotor blades are driven by the force of the relative wind passing through the blades while descending, rather than by the engine.

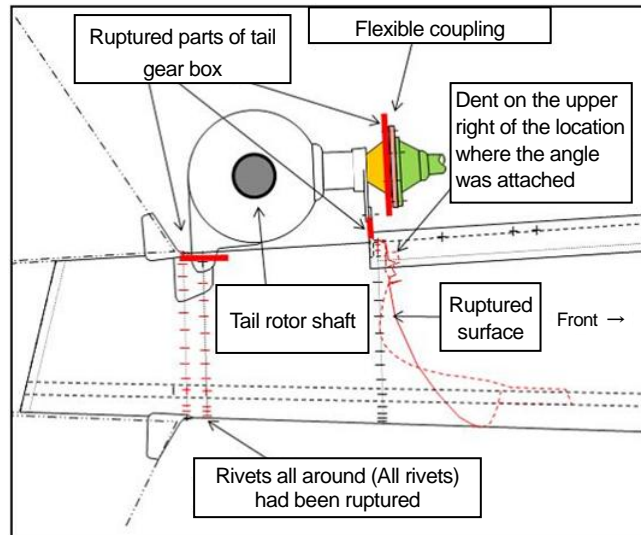
It is possible that the pilot had difficulty deciding on whether to make an emergency landing by autorotation upon loss of tail rotor thrust.

Uncontrollable Helicopter and the Crash

The mount of the tail gear box was broken by the impact of the contact of sling cable with the tail rotor causing the tail rotor shaft to tilt backward.

The flexible coupling with no support swung wildly, with the protruding portion colliding with and damaging the surrounding structure, and the damage to the tail section was exacerbated while searching for an emergency landing site.

It is probable that the helicopter became uncontrollable and crashed as a result of the rupture of the tail section including the vertical stabilizer.



Ruptured Tail Boom

In order to Prevent Recurrence

- (1) The following measures should be taken to prevent the sling cable from contacting the airframe.
 - ▶ If towing a sling cable without any attached load, an appropriate amount of ballast should be attached to the hook to maintain the balance of the sling cable.
 - ▶ During a flight, sudden sharp movements should be avoided, such as a reduction in load factor and sudden lowering of the tail section.
 - ▶ While being towed, the sling cable should be monitored appropriately with a rearview mirror or other device, and an airspeed at which an appropriate distance to the airframe can be ensured should be maintained.
- (2) To be prepared for accident such as in this case where tail rotor lost thrust, it is generally necessary to take the following measures.
 - ▶ Pilots should select appropriate emergency landing sites before flight and should always keep these selected sites in mind and be prepared for an emergency, including expectation which site to choose in different situations.
 - ▶ If damage to the airframe may be anticipated to expand, which can result in increased difficulty in operating the helicopter, pilots should make an emergency landing as soon as possible.
 - ▶ Training on emergency procedures should periodically be provided so that pilots can maintain necessary skills.

○ Safety Actions Taken by Company A

- (1) Amendment to Flight Procedures: Flying with a light-weighted hook alone slung beneath the helicopter is prohibited and the descending airspeed of a helicopter with a sling cable shorter than 10 m must be V_y or lower.
- (2) Special training on emergency procedures for tail rotor failure and procedures for selecting emergency landing site was provided to all pilots. Periodic assessment of the flying skill of pilots engaged in cargo transportation carrying a load slung beneath the helicopter will be made.
- (3) Safety Management Department was established to confirm that no problem related to laws and regulations exist, as well as to confirm safety prior to issuing work instructions.
- (4) The technical information communication system was amended to widely disseminate to all departments involved the technical information from manufacturing companies or other relevant sources.

○ Measures taken by the Design and Manufacturing Company

The design and manufacturing company changed the Caution section of External Load Transport in the Flight Manual attached to the Type Certificate to include the description of "ballast" as follows.

Before change : "Flying with a cable with no load attached or an empty net slung beneath a helicopter is prohibited"

After change : "Flying with an un-ballasted sling or an empty net slung beneath a helicopter is prohibited"

The investigation report of this case is published on the Board's website (issued on April 26, 2013).

http://www.mlit.go.jp/tsb/eng-air_report/JA508A.pdf

(This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.)