AIRCRAFT ACCIDENT INVESTIGATION REPORT

SERIOUS INJURY TO A GROUND OPERATOR DURING CARGO SLING WORK,

SHIKOKU AIR SERVICE CO., LTD.

Bell 412EP (Rotorcraft), JA6977

DAISEN TOWN, SAIHAKU DISTRICT, TOTTORI PREFECTURE, JAPAN

AT ABOUT 10:25 JST, SEP 29, 2023

JULY 5, 2024
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member SHIMAMURA Atsushi
Member MARUI Yuichi
Member SODA Hisako
Member NAKANISHI Miwa
Member TSUDA Hiroka

Company	SHIKOKU AIR SERVICE CO., LTD.
Type, Registration Mark	Bell 412EP (Rotorcraft), JA6977
Accident Class	Injury to a ground operator during cargo sling work
Date and Time of the Occurrence	At about 10:25 Japan Standard Time (JST: UTC+9 hours), Sep 29, 2023
Site of the Accident	Daisen Town, Saihaku District, Tottori Prefecture (35° 22' 15"N, 133° 32' 18"E)

1. PROCESS AND PROGRESS OF THE ACCIDENT INVESTIGATION

Summary of the Accident	On Friday, September 29, 2023, when the helicopter unloaded the Cargo

	covered by a cargo net[*1] (hereinafter referred to as "Cargo net") at the top of Mt. Daisen in Daisen Town, Saihaku District, Tottori Prefecture, it came into contact with a ground operator and the ground operator was seriously injured.
Outline of the Accident Investigation	On September 29, 2023, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this accident. Comments on the draft Final Report were invited from the parties relevant to the cause of the accident. Comments on the draft Final Report were invited from the Relevant State.

2. FACTUAL INFORMATION

Aircraft Information

Aircraft type: Bell 412EP

Serial number: 36586 Date of manufacture: November 30, 2011

Airworthiness certificate: No. DAI-2023-073 Validity: May 1, 2024

Personnel Information

Captain: Age 60

Commercial pilot certificate (Rotorcraft) January 18,1990

Expiration date of piloting capable period January 20,2025

Type rating for Bell212 July 21, 2006

Class 1 aviation medical certificate Validity: July 29,2024

Onboard mechanic: Age 27

In-house cargo transport experience (after obtaining in-house qualifications): 2 months

Ground operator (signal person): Age 55

In-house cargo transport experience (after obtaining in-house qualifications): 2 years 2 months

Ground operator (assistant): Age 47

Helicopter cargo transport experience: 1 years 6 months

Meteorological Information

According to the statements of the captain and the ground operators, visibility was 20 to 30 km at the unloading site at the mountaintop, and clouds occasionally drifted over near the mountaintop, but there was no wind that would shake the Cargo net.

Event Occurred and Relevant Information

(1) History of the Flight

The company was contracted to transport materials by helicopter from the contractor who was renovating the wooden path on the Daisen Tozan Trail. The helicopter took off from an operation site in Daisen Town, Saihaku District, Tottori Prefecture in order to conduct the transportation with underslung external cargo for the renovation work, and the helicopter was scheduled to sling up Cargo net from a loading site adjacent to the operation site in the town and unload it at the top of Mt. Daisen about 15 times.

With the captain seated in the right pilot's seat and the onboard mechanic in charge of the helicopter guidance seated in the guide seat on the left side of the cabin, the helicopter started the

∗1 "Cargo net" refers to a tool used to wrap and suspend loads by attaching suspension straps to the four corners of the rope woven nets.

transport from about 09:20, equipped with the sling rope approximately 8 m in length and hooks.

At about 10:20, the helicopter lifted a Cargo net from the loading site and headed to the top of Mt. Daisen for its 6th transport. (See Figure 1)

While watching the clouds flowing near the mountaintop, the captain confirmed the unloading site located between the other luggage and the wooden path indicated by the signal person who was waiting at the mountaintop and had the helicopter approach from the southwest side of the unloading site. After that, the onboard mechanic provided guidance to the captain according to the signal person's signals, and the captain had the helicopter descend to ground the Cargo net.

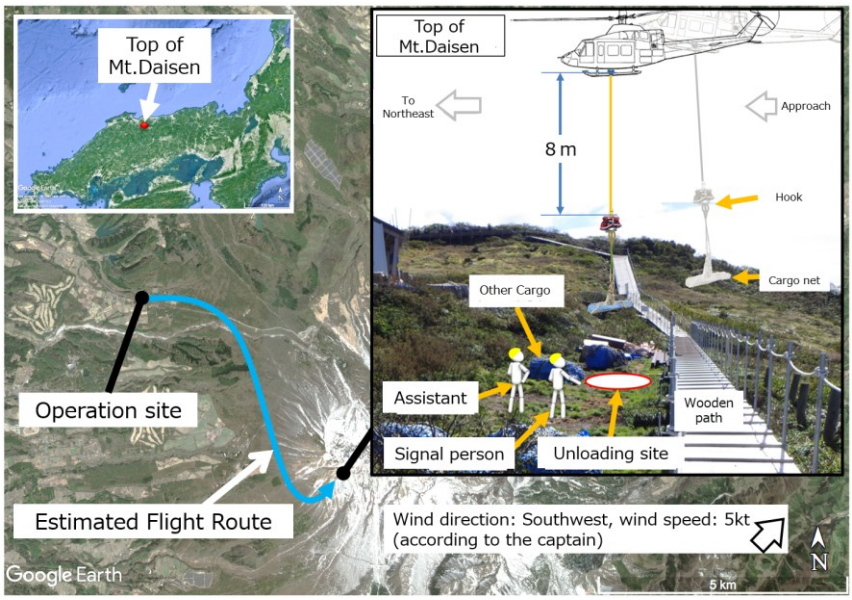

Figure 1: Outline of the Helicopter Flight

The Cargo net swung counterclockwise due to the wind blown down by the helicopter main rotor and landed on top of other cargo placed on the northeast side of the unloading site. Therefore, signal person thought that the Cargo net would need to be repositioned and sent a "Lift up" signal to the onboard mechanic.

The onboard mechanic provided guidance to the captain, who had the helicopter climb about 1 meter and then retreat approximately 1 meter toward the wooden path to adjust the landing position of the Cargo net.

At the time the Cargo net moved to the appropriate position, although the Cargo net did not sway and was stable, since the Cargo net was close to the renovated wooden path, the signal person thought that some assistance might be required to prevent contacting the Cargo net with the wooden path. Thus, the signal person moved toward the wooden path while sending a "Lower down" signal to the onboard mechanic. (Figure 2①)

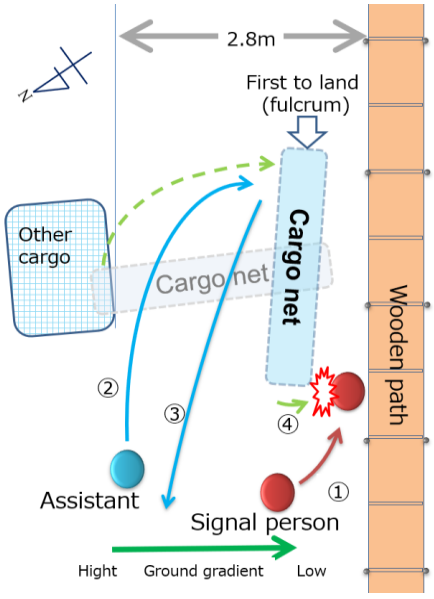

Figure 2: Image of unloading site

The assistant pushed clockwise the end of the Cargo net that was overlapping the other cargo when the Cargo net was lifted due to the climb of the helicopter, and adjusted the direction of the Cargo net so that the direction of the long side of the Cargo net could be parallel with the wooden path. (Figure 2②)

The signal person confirmed the Cargo net that had gradually descended and the situation of assistant's assist work. When the end of the cargo net on the assistant's side touched the ground first, the signal person assumed that the cargo net would not swing and instructed the assistant to move for the next work area. Receiving the instruction, the assistant moved for the next work

area site on the west side of the unloading site. (Figure 2③)

Distracted by the assistant moving between the Cargo net and other cargo, the signal person took the eyes off from the Cargo net when the end of the Cargo net hit the signal person's left foot. (Figure 2④)

At this time, the onboard mechanic temporarily took the eyes off from monitoring the ground work due to keep the eyes on the clouds careful near the mountaintop. When the onboard mechanic resumed monitoring the ground work and found the signal person between the Cargo net and the wooden path. Thinking that the signal person might be going to be sandwiched between the Cargo net and the wooden path, the onboard mechanic provided guidance for the captain to have the helicopter move forward about 50 cm and then descend, allowing the Cargo net to touch the ground.

The signal person evacuated from between the Cargo net and the wooden path and checked the condition of the Cargo net, and found the Cargo net completely grounded, thus, the signal person sent a signal to the onboard mechanic to remove the Cargo net from the hook.

After receiving the signal, the onboard mechanic removed the cargo net from the hook and saw that the signal person appeared to tumble on one knee, therefore, the onboard mechanic reported what the onboard mechanic saw to the captain.

Upon receiving the report from the onboard mechanic, the captain steered the helicopter to the west, when the captain received a company radio message about the work suspension from the signal person, thus stopped the work and headed off to the operation site, and landed the helicopter at 10:29. With difficulty walking on the signal person's own feet, the signal person went down the mountain by rescue helicopter and was taken by ambulance to the hospital where the signal person was diagnosed with left fibula fracture and others.

(2) Unloading Site and Cargo Net

The unloading site was an area approximately 2.8 m wide between the other cargo and the wooden path, and the ground was not flat with a slight downward slope from the other cargo side to the wooden path. (See Figure 2)

The cargo involved in this accident was the one with materials wrapped in a blue sheet and covered entirely with cargo net, and was approximately 2.6m long, 0.4 m wide, 0.2 m high, and the weight was approximately 832 kg. (See Figure 3) Besides, no rope for assistance work was attached to the Cargo net.

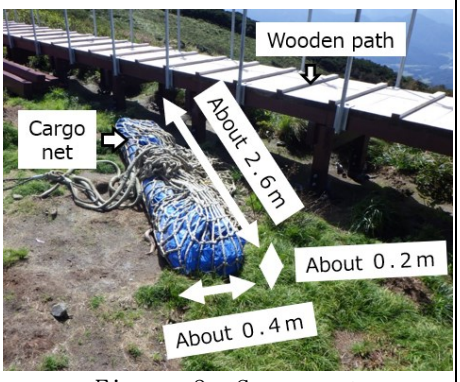

Figure 3: Cargo net

(3) Precautions for Ground Work (Unloading)

Regarding the ground work related to this transport, the signal person, who was an employee of the company, was engaged in the ground work as its supervisor, in addition, there was an employee of other company that had been contracted by the constructor to carry out the related work, was engaged in the work as a ground operator (assistant) after receiving the education and training based on the Operations Procedures for Cargo Transport.

The Procedures stated that during unloading work, the ground operators must closely monitor the movement of the aircraft and the suspended cargo (suspended cargo including Cargo net), and that after instructing the unloading site, they must move away to safe position even if the suspended cargo swings. The Procedures also included precautions such as paying close attention to assistance work and keeping assistance time to a minimum.

Although the company did not have the specific procedures for assistance work, in education and training related to ground work, the company instructed that for long items such as main pillars for steel tower and base rods that cannot be packed in Cargo net, or a cargo that the entire package is not covered with Cargo net, ropes for assistant work should be attached to.

3. ANALYSIS

The JTSB concludes that it is certain that the signal person was injured when the Cargo net swung while the helicopter was unloading it, and the Cargo net hit the left leg of the signal person who had moved to the side of the wooden path thinking that assistance work might be required.

As for the swing of the Cargo net, it is highly probable that although the Cargo net was stable while the helicopter was descending, the end of the Cargo net that touched down first served as a fulcrum, and the end of the cargo net that did not touch the ground swung toward the wooden path. And the wind blowing down by the main rotor more likely affected in addition to the fact that the ground of the unloading site sloped downward toward to the wooden path.

It is highly probable that the Cargo net hit the signal person because during unloading, the signal person was in the range where the Cargo net could swing and reach.

The reason the signal person was in the range where the Cargo net would swing, and reach was certainly because the rope for assistance work was not attached to the Cargo net, and it was necessary for the signal person to touch Cargo net directly.

Distracted by the assistant moving between the Cargo net and other cargo, the signal person took the eyes off from the Cargo net, which also more likely contributed to. It is more likely that the signal person's paying attention to the movements of the assistant was to act as a supervisor, however, it is probable that even if the Cargo net swung, the signal person should have taken actions as a supervisor of the ground work after moving away to safe position.

The company needs to ensure that ground operators are fully aware of the ground work (unloading) precautions such that they must closely monitor the movement of the aircraft and suspended cargo, and that after instructing the unloading site, they must move away to safe position even if the suspended cargo swings. In addition, if assistance work such as adjusting position or direction of suspended cargo is expected, it is required that the work should be done in a way that allows assistance work to be conducted in a safe position even if the suspended cargo swings, for example by attaching a rope for assistance work.

4. PROBABLE CAUSES

The JTSB concludes that in this accident, it is certain that the signal person was injured because while the helicopter was unloading, the Cargo net swung and hit the left leg of the signal person who had moved to the side of the wooden path thinking that assistance work might be required.

It is highly probable that the Cargo net hit the signal person because during unloading, the signal person was in the range where the Cargo net could swing and reach. Distracted by the assistant moving between the Cargo net and other cargo, the signal person took the eyes off from the Cargo net, which also more likely contributed to.

5. SAFETY ACTIONS

(1) Safety Actions Required

The company needs to ensure that ground operators are fully aware of the ground work (unloading) precautions that the company has established. In addition, if assistance work such as adjusting position or direction of suspended cargo is expected, it is required that the work should be done in a way that allows assistance work to be conducted in the safe position even if the suspended cargo swings, for example by attaching a rope for assistance work.

(2) Safety Actions Taken by the Company after the Accident

1. All personnel involved in cargo transport in the company were informed of the outline of this accident and thorough safety confirmation. (November 8, 2023)
2. In the Operations Procedures for Cargo Transport, the company stipulated, as the basic policy for handling suspended cargo, that ground operators should not touch the suspended cargo, and to ensure the safety of ground operators, a distance has been set between the suspended cargo and ground operator. In addition, in case that a suspended cargo has the specified position or direction of unloading, a support rope shall be attached and a distance from the suspended cargo shall be maintained even during assistance work, as well as the specific procedures using a support. (Revised on November 1, 2023)
3. Re-education for ensuring safety was conducted for pilots, onboard mechanics, and ground operators engaged in cargo transportation. (Completed on November 7, 2023) Besides, it has been decided that the ground operators outside of the company shall be assigned to be engaged in the ground work after receiving the education and training based on the revised Procedures.