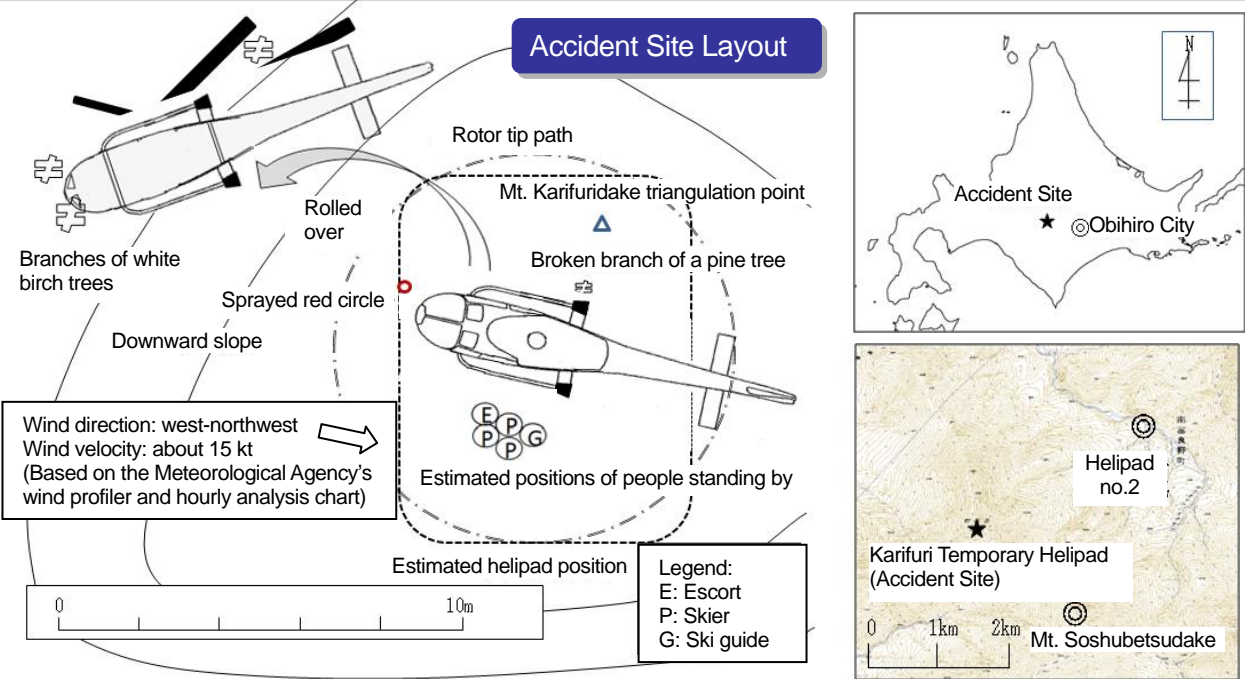


**The continued lift-off sequence while being caught by ground obstacles led to a dynamic roll over**

Summary: On Sunday February 19, 2012, at around 13:25 local time (UTC+9 hours), Eurocopter EC120B, operated by Company A, rolled over during takeoff from Karifuridake temporary helipad in Minami-Furano Town, Sorachi-Gun, Hokkaido, and sustained substantial damage. On board the helicopter was a pilot, but he suffered no injury. The helicopter sustained substantial damage, but there was no outbreak of fire.



Events Leading to the Accident

Around 13:25

As a service to transport skiers to a mountain top (Heli-skiing), the pilot transported skiers and guides to Karifuridake temporary helipad and disembarked them. Then, the helicopter was about to take off to return to the Helipad no.2.

As the pilot felt uneasy that the right skid (a landing gear) seemed to be caught by something, he immediately aborted the lift-off sequence and gave a small forward control input.

As the pilot felt that the restraint was cleared, he resumed the lift-off sequence.

Next moment, the helicopter abruptly **rolled over** to the right.

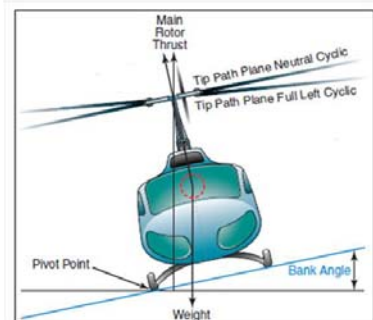
Causal Factors of the Accident

It is highly probable that obstacles, possibly branches of creeping pines (\*1) covered with snow, restrained the right and left skids, and it continued the lift-off sequence with the right skid sill restrained. As a result, abrupt right roll started and the roll angle exceeded the critical roll-over angle. The aircraft rolled over to the right in a state of dynamic roll-over, and sustained damaged.

\*1: A prostrate evergreen coniferous shrub which grows on high mountains in north-central Honshu and in Hokkaido.

Description of Dynamic-Rollover in "ROTORCRAFT FLYING HANDBOOK" compiled by the Flight Standard Service, Federal Aviation Administration (FAA)

- ◇ A helicopter is susceptible to a lateral rolling tendency, called dynamic rollover, when lifting off the surface.
- ◇ For dynamic rollover to occur, some factor has to first cause the helicopter to roll or pivot around a skid, or landing gear wheel, until its critical rollover angle is reached.
- ◇ If the critical rollover angle is exceeded, the helicopter rolls on its side regardless of the cyclic corrections made (\*2) as main rotor thrust beyond this point continues, the roll and recovery is impossible.



From FAA "ROTORCRAFT FLYING HANDBOOK"

\*2 : A maneuver to move an aircraft either forward, backward or sideways

The fact that Karifuridake Temporary Helipad being established on the pressed snow with creeping pines underneath has the potential of degrading the helipad requirements in case of protruding tree branches for possible left roll-over pivoting over the left skid where the skiers remained.

## Takeoff/Landing Assisted by Escort

The escort was probably performing the safety check against obstacles before takeoff as stipulated by Company A. However, it is highly probable that the escort was unaware of the degraded helipad surface with the obstacles: possible pine branches protruded from beneath the surface.

Some facts that there were no possible obstacles when the escort checked the helipad during landing before the occurrence of the accident, and he was occupied to pay attention to disembarked skiers who were staying near the helicopter, are considered possible contributing factors to the escort's **lack of attention to the ground obstacles**.

Regulations on Heli-skiing procedure "Work Standard" defined by Company A. (excerpt)

### 4-6-1 Engine Start

(4) When a skid is frozen to the ground, a dynamic rollover may develop into a serious accident. In case of frozen skid, remove ice completely with a shovel and/or de-icing chemicals.

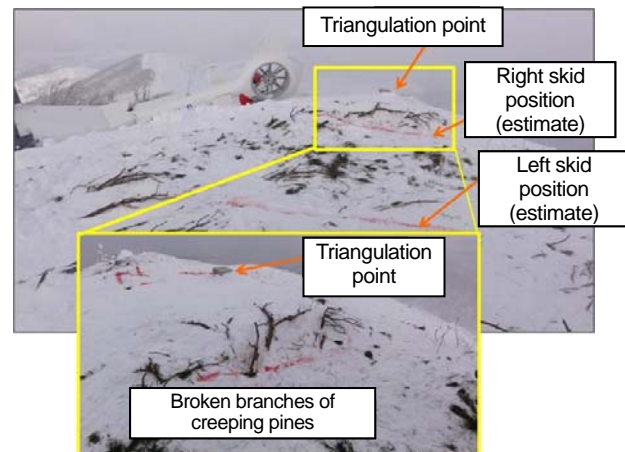
### 4-6-2 Takeoff

(2) When an assistant is on board, he/she should make sure before takeoff that skid skis or snowshoes (\*3) are clear of obstacles (such as railroad ties) and check the condition of a ski rack.

\*3: A helicopter version of snowshoe attached under the rear part of a skid to prevent the skid from sinking into the snow.



Accident site (on the day of the accident)



Accident site (three days after the accident)

## Involvement of Knowledge and Skills in the Roll-over

When a pilot aborts a lift-off sequence, it is desirable to ask the ground crew to check the skid situation and carefully resume the sequence confirming no indication of roll over. However, the pilot probably did not do so.

### Training Provided by Company A to the Pilot

- ◇ The pilot boarded a Heli-skiing helicopter and observed Heli-skiing once in 2011 as observation. Also, before getting engaged in Heli-skiing in 2012, he received preliminary training for thrice (twice for terrain features familiarization flights) as a PIC.
- ◇ With the absence of the Heli-skiing related contents in Company A's regulations for training and qualification check, the company's instructions did not provide him with classroom lectures or actual flight training using snow-covered mountain tops.

Possible contributing factors for the PIC's **lack of cautiousness against ground objects** are **lack of knowledge and skills** against: mountain top operations under snow covered conditions; and **unexpected situation** where skids are restrained by obstacles protruding from beneath the snow surface.

The following are possible preventive measures against dynamic roll-over during takeoff from a snow covered helipad.

▶ Establish and maintain appropriate helipad

The shape, area and surface conditions of a helipad constantly change depending on the snow conditions. Thus, the close coordination of a pilot and ground crew is indispensable to check the helipad consistency with the requirements of approved temporary helipad. Paying special attention to obstacles and gradient which lead to dynamic roll-over is necessary.

▶ Countermeasures against abnormal helicopter behavior during lift-off

In case of abnormal helicopter behavior such as unexpected skid lift-off, immediately abort the lift-off. Coordination with the ground crew is necessary to make sure the skids are clean and cautiously resume the lift-off sequence.

▶ Takeoff and landing training on snow-covered mountain tops and others

Safe operations to and from snow-covered mountain tops require appropriate grasping of the changing situation of helipads and act accordingly.

The pilot who assumes the duties which include snow-covered mountain top operations must be properly trained and tested for required skills and knowledge. The same is true for the ground crew who support Heli-skiing. They must be trained to be properly fit for the duties thereof.

Following considerations are addressed for skiers' stand-by position during lift-off.

▶ Prohibit the access to the helipad

It is anticipated that skiers will have difficulty in moving away promptly from the helicopter after disembarking on a snow-covered mountain-top helipad.

In a case like this accident where passengers and others remained within the adjacent areas of a helicopter on a helipad, there was a possibility of a helicopter roll-over toward them. It is necessary to prohibit unauthorized access to the helipad and its adjacent area where it hampers the aircraft operation during helicopter lift-off/landing.

Following actions have been taken in response to the accident by Company A and by Civil Aviation Bureau (CAB), Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

○ Safety Actions Taken by Company A

(1) Appropriate Management of Temporary Helipads

The company has established the company rule of "Regulations for the Management of Temporary Helipads" while compiling a checklist for helipad use.

(2) Safety Management of Heli-skiing

The company has revised the "Operations in Snow-Falling Area" of the internal "Work Standard". The changes are as follows.

1. Established detailed procedures for examining changes by snowfall and corresponding restoring actions define to require periodic checks on the approved temporary helipads on mountain tops for changes and necessary restoring actions.
2. Revised to add provisions to clarify the escort's role and coordination with the pilot.

(3) Heli-skiing Training and Qualification Check

1. The company has added training and evaluation procedures for pilots on Heli-skiing as special training in "Training and Qualification Manual".
2. The company has added Heli-skiing training and check procedures on flight managers, mechanics, ground crew and escort in the internal "Work Standard".

○ Safety Actions Taken by Civil Aviation Bureau (CAB), MLIT

Based on the on-site safety audit for the company, CAB has ordered its Regional CABs which have jurisdiction over business license to instruct applicants of temporary helipad for Heli-skiing about the safety measures to be taken to prevent the same failure in line with the safety audit results.

The investigation report of this accident case is published on the Board's website (issued on January 25, 2013).

[http://www.mlit.go.jp/itsb/eng-air\\_report/JA710H.pdf](http://www.mlit.go.jp/itsb/eng-air_report/JA710H.pdf)

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