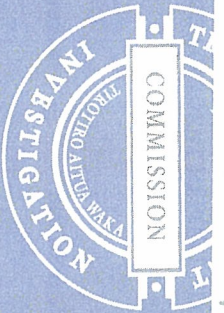


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# AIRGRAFT ACCIDENT REPORT

**No. 90-012T**

**BELL 206B ZK-HZX**

**17 December 1990**

**Transport Accident Investigation Commission  
Wellington - New Zealand**

TRANSPORT ACCIDENT INVESTIGATION COMMISSION  
AIRCRAFT ACCIDENT REPORT NO. 90-012T

Transport Accident Investigation Commission  
Wellington

Chief Commissioner  
Transport Accident Investigation Commission

The attached report summarises the circumstances surrounding the accident involving Bell 206B ZK-HZX on 17 December 1990 and includes suggested findings and recommendations.

This report is submitted pursuant to Section 8(2) of the Transport Accident Investigation Commission Act 1990 for the Commission to review the facts and endorse or amend the findings and recommendations as to the contributing factors and causes of the accident.

9 May 1991  
R CHIPPINDALE  
Acting Chief Executive

APPROVED FOR RELEASE AS A PUBLIC DOCUMENT

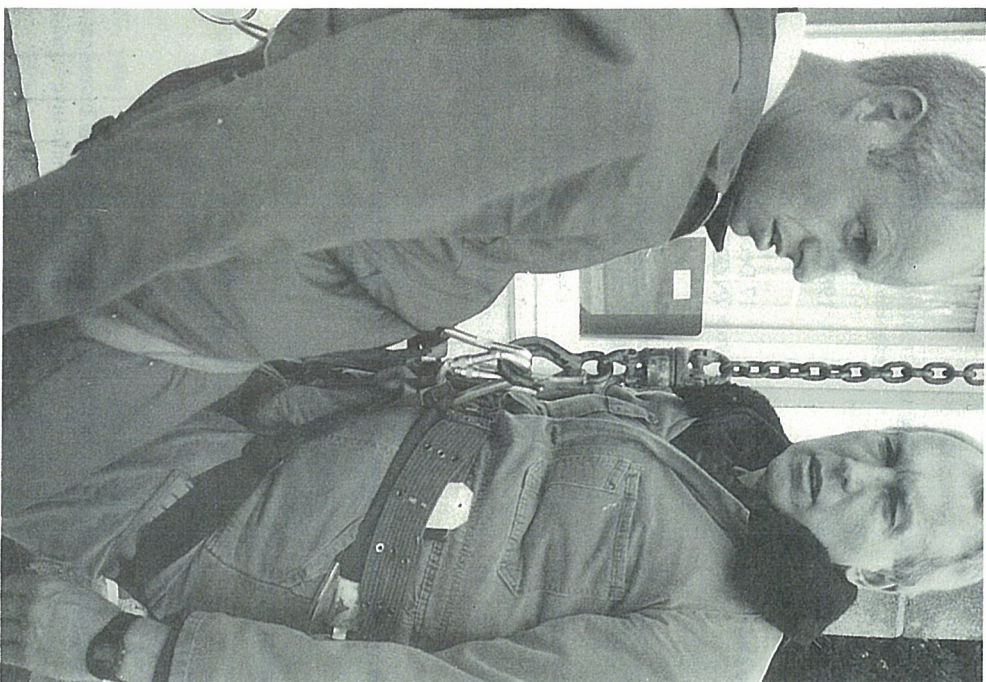
21 May 1991  
M F DUNPHY  
Chief Commissioner

Aircraft Type, Registration and Serial Number	Bell 206B, ZK-HZX, 1851
Number and Type of Engines	1 Allison 250 C20
Year of Manufacture	1987
Date and Time	17 December 1990 1432 hours (NZDT)
Type of Flight	Aerial work
Persons on board	Crew 2 Passengers 2
Injuries	Crew Nil Passengers 1 Fatal 1 Nil
Pilot in Command's Licence	Commercial Pilot Licence (Helicopter)
Pilot in Command's Age	51
Pilot in Command's Total Flying Experience	8875 hours (1052 on type)
Information Sources	Transport Accident Investigation Commission Field Investigation

## 1. FACTUAL INFORMATION

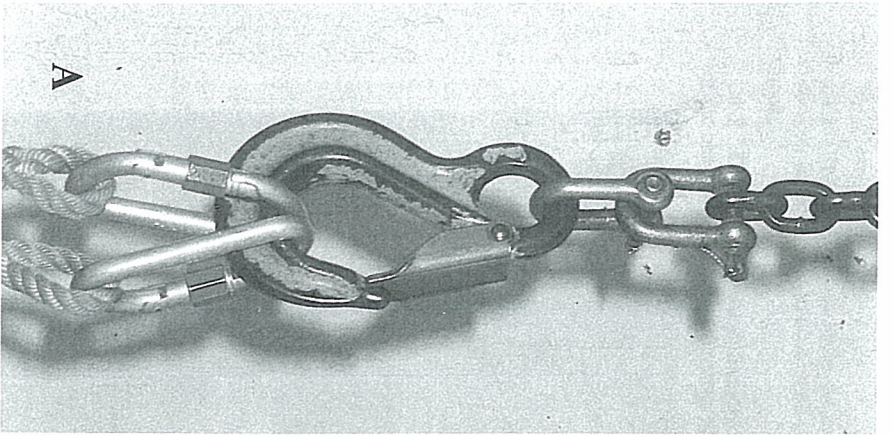
1.1 The aircraft was involved in an aerial work operation during which two men were suspended on a chain which was attached to the aircraft's cargo hook.

1.2 Each man wore a sit harness which was attached to a hook on the end of the chain with a mountaineering, screw-lock, karabiner (See Fig. 1).

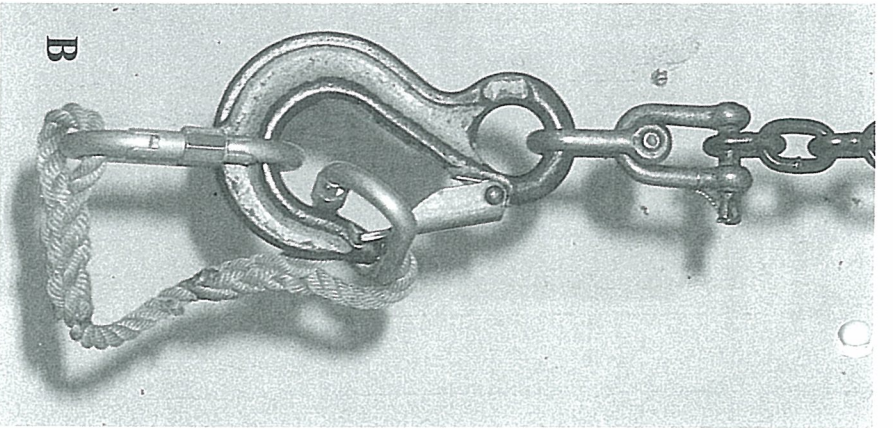


*FIGURE 1*

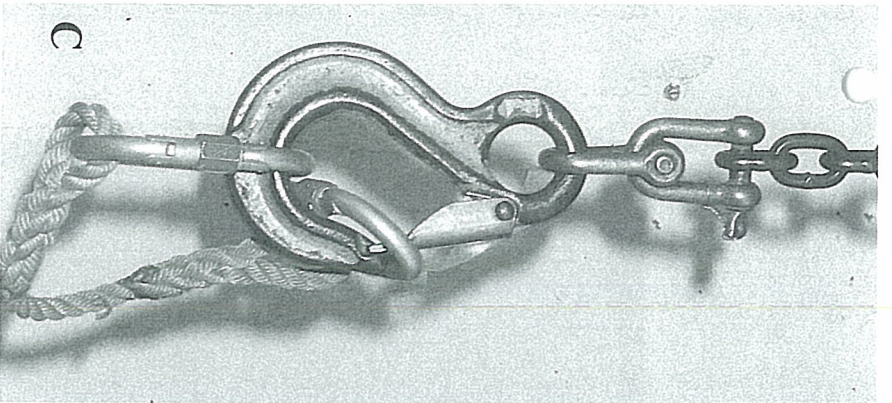
1.3 There were two chains attached end to end beneath the aircraft's cargo hook. The upper chain had a welded steel ring at its upper end and a hook at the lower end. The longer and lower chain had a similar ring at its upper end but the hook on its lower end was attached to the chain by a swivel.



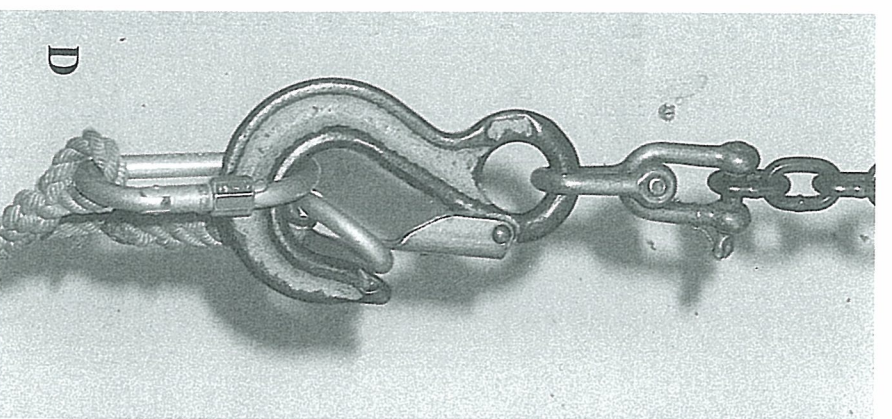
a. Two karabiners securely in hook.



b. Karabiner mispositioned across jaw of hook.



c. Load on karabiner applied between keep and lip of hook.



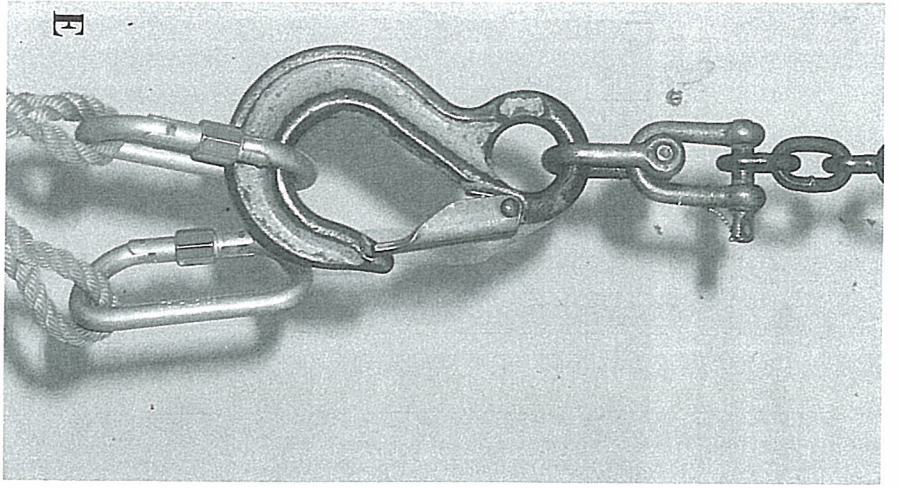
d. Keeper pushed back by karabiner.

A simulation of the sequence of events which has resulted in a karabiner separating from a hook provided with a keeper.

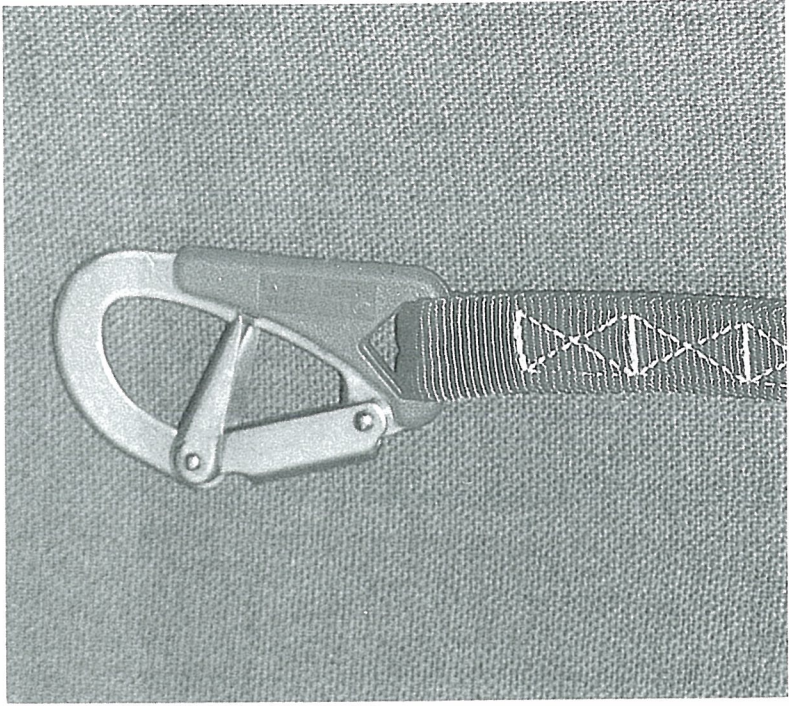
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e. Karabiner falls free.



[FIGURE 31]

1.4 Each of the hooks had a guard, or keeper, across the open section of the hook.

1.5 The ring on the upper end of the upper chain was also attached to the aircraft by a nylon strop with a hook on each end which in turn was attached by separate "U" bolt shackles to the ring on the upper end of the upper chain.

1.6 The nylon strop passed across the aircraft's rear floor area and through the aircraft's rear door openings in order to hold the chain secure should the aircraft's cargo hook be operated inadvertently.

1.7 As an additional safeguard the circuit breaker for the release system for the cargo hook was de-activated prior to the flight.

1.8 Two knives were located in the rear cockpit, on the back of the aircraft's front seats, so that the strop could be cut in an emergency and the hook released by the pilot operating the manual release or re-energising and operating the electric release system.

1.9 A crewman was carried to advise the pilot of the activities of the men on the hook and to cut the strop should an emergency arise.

1.10 On this flight the crewman was seated in the front left seat and the aircraft was operated with all four of its doors removed.

1.11 The two men on the ground hooked their karabiners onto the hook on the lower length of chain before the aircraft was lifted off to raise the two chains to their full extent. Each of the men checked that their karabiners were correctly locked and sitting in the hook with the keeper across the jaw of the hook and clear of obstructions, they then gave the "thumbs up", which the crewman reported to the pilot, before the pilot raised the collective, to lift them off the ground, and started to move the aircraft ahead.

1.12 After the men on the hook had given the "thumbs up" and their weight was taken by their harnesses the second man to hook on inquired if the other was comfortable. He obtained that assurance then reached up and grasped the chain to ease the weight on his harness to settle into it more comfortably. When he released the chain he fell free from the hook.

1.13 When the men on the hook were about 50 feet agl the pilot felt the aircraft lurch. As the movement felt unusual to the pilot he looked down and saw one of the men free falling to the ground.

1.14 The fall to the ground was unsurvivable.

1.15 The pilot landed the other man on the hook near the victim immediately but the victim was beyond assistance.

1.16 An inspection of the aircraft's cargo hook, the restraining nylon strop, the two chains and associated hook and rings plus the single swivel established that each of these items was intact and showed no signs of unusual loading.

1.17 The victim's personal harness and its associated karabiner were also intact and the karabiner was locked.

1.18 Such a situation had occurred previously during helicopter rescues, mountaineering and yachting.

1.19 In such a situation a karabiner could separate from the hook by twisting in such a way that the portion of the karabiner outside the hook bore down on the keeper and allowed the inner portion to fall free (See Fig. 2). With two persons on the hook the second person to hook on was at greater risk because his was the karabiner closer to the "keeper" over the gap in the hook and the other man's weight kept the hook under load and relatively stationary.

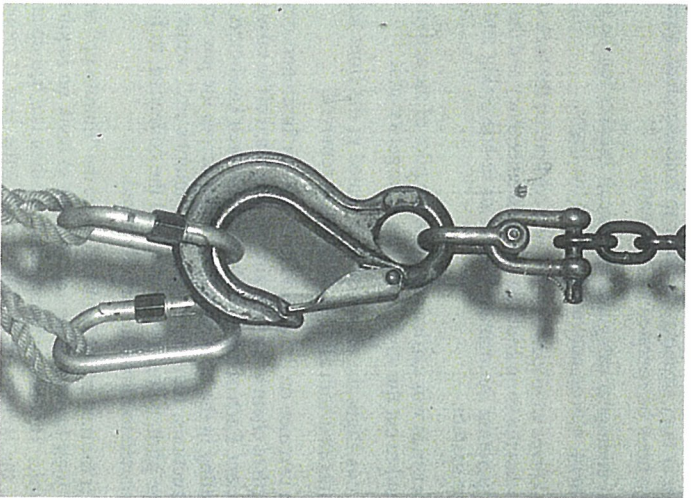


FIGURE 21

1.20 The approval used for this operation was subject to the conditions published in Civil Aviation Safety Order (CASO) number 20.

1.21 Part 10 of this Order dated 11 September 1989 covered the requirements for "Winching, Rapelling and Human Sling Loads".

1.22 Paragraph 10.2.1 sub paragraph (d) required that:  
"All components of the equipment used shall be of approved types and any additional limitations associated with the approvals shall be complied with."

"approved" in terms of the Civil Aviation Regulations meant "Approved by the Director (of Aviation Safety) in writing."

1.23 Paragraph 10.2.1 sub paragraph (f) required that:

"The rope or cable on which the person is suspended shall be capable of release from the helicopter by the crew, but the system

shall be so arranged that two separate actions must be taken to effect release."

The singular, "person" indicated that the carrying of two men on the hook was not envisaged by the author of the order.

1.24 Although there was no easy access from the front left seat of the Bell 206 to the rear passenger area, the crewman was able to execute the separate action of cutting the nylon strop necessary to release the chain from which the men were suspended.

1.25 An attempt to replicate the conditions which lead to the accident was not conclusive but each item of the equipment was intact and the process by which karabiners have been released from hooks with similar keepers was well known in several fields which used such equipment. As a result hooks have been designed with additional safeguards which prevent the keeper from moving under the influence of the karabiner once it is in place (See Fig. 3). As the man had checked the karabiner was in place on the hook prior to lift off it could not have come off by whatever means had a lockable keeper been available and used correctly.

1.26 While the equipment used for attaching the men to the aircraft's hook had not been approved by the Ministry of Transport as required by CASO 20 it was apparent that such approval would have been granted for the equipment used without the requirement for any modification to the hook.

1.27 The operation had been approved in 1988 without any requirement for the role equipment to be approved but with a requirement that the harness used meet New Zealand Standard, NZS 5811:1981. This approval which was for "persons" to be suspended under the helicopter also required that a crewman be carried in the rear cabin who was "able to release" the rope on the aircraft's cargo hook.

1.28 The Civil Aviation Officer who viewed the role equipment referred to both a rope and a chain as suspension "links" and noted that the hook on the end of the chain was swivel mounted.

1.29 In 1989 the operation was approved subject to the role equipment being approved. As the operation had been approved in writing in 1988 using the same equipment the operator understood the equipment itself had the necessary approval.

1.30 The airworthiness officers had no specifications or design standards for such role equipment and when the first request for approval was received they issued an approval after ensuring each component was strong enough for the static loads to which it would be subject.

1.31 The performance under dynamic loads was not explored in relation to the behaviour of the human sling load in the air. The need for a swivel was not recognised in the approval which was issued after the accident and the approving officer was not aware of the need for a lockable "keeper" on a hook.

1.32 The probable cause of this accident was the carriage of two men on a single hook, the lack of a keeper which was proof against a known hazard, the last man on the hook inadvertently applying a twist to his karabiner which secured his webbing harness as he placed the karabiner on the hook and the



omission of the officer who approved the operation in 1988 to seek advice from persons in other spheres of activity who used similar equipment.

## 2. RECOMMENDATIONS

2.1 As a result of the investigation of this accident it was recommended to the General Manager of the Air Transport Division of the Ministry of Transport that with immediate effect he:

Cancel any approvals for human sling loads which were issued prior to the promulgation of CASO 20,

Ensure that operators were reminded of the requirement to have the equipment used approved by the Ministry of Transport,

Institute a schedule of routine inspections for the equipment once it has been approved, and

Review the procedures in use for releasing the chain from the aircraft if it should become snagged.

21 May 1991

M F DUNPHY  
Chief Commissioner