Australian Government
Australian Transport Safety Bureau

External sling loading accident involving Bell 205, VH-HUE

39 km south-east of Talbingo, NSW, on 10 January 2019

ATSB Transport Safety Report
Aviation Occurrence Investigation
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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 2463 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Email: atsbinfo@atsb.gov.au
Website: www.atsb.gov.au

Addendum

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Safety summary

What happened

On the 10 January 2019, a Bell Helicopter 205A-1, registered VH-HUE (HUE), was being used for external sling loading operations near Talbingo, New South Wales with the pilot as the sole occupant. As the helicopter approached the drop-off site, the load unexpectedly disconnected from the remote cargo hook. One of two ground personnel was struck and seriously injured by the falling load.

What the ATSB found

Despite examination of the involved components, the reason why the load disconnected unexpectedly from the remote cargo hook could not be determined. However, the ATSB found that the loadmasters were not maintaining a safe distance from the load. Their positioning, in combination with the significant movement of the load as it contacted the ground, resulted in one of them being struck and seriously injured.

What's been done as a result

As a result of this accident, all contractors involved reviewed the procedures being used for helicopter lifting operations during this project. They have reviewed the risk controls for receipt and positioning of loads, based on the positioning precision required.

The operator who supplied the loadmasters has reviewed and updated their procedures. They have identified a 'dynamic exclusion zone' as a position above a person's head height that is in the pathway of a potential uncontrolled load that may drop and impact onto a person. In recognition that the zone may vary due to a number of variables, specific guidance will be provided as part of pre-activity briefings.

The lead contractor is overseeing a range of initiatives, including a behavioural safety review of the project with the intention to implement an appropriately designed program to positively influence behaviours across their projects.

Safety message

This incident highlights the dangers associated with external sling load operations. Unexpected events can occur and ground personnel should ensure they maintain their separation from external slung loads that are above head height. Each sling load operation can be unique, with different locations, load shape and environmental conditions creating different safety considerations. As a consequence, clear written procedures and detailed discussions prior to commencement of each operation are essential to ensure all participants are aware of the unique dangers of the operation.

Transport Canada commissioned a video titled 'Keep your eyes on the hook', which shows some of the dangers for ground crew when working around helicopters and longline loads.

The occurrence

What happened

On the 10 January 2019, a Bell Helicopter 205A-1, registered VH-HUE (HUE), was being used for external sling loading operations near Talbingo, New South Wales with the pilot as the sole occupant. As the helicopter approached the receiving site, the load unexpectedly disconnected from the remote cargo hook. One of two loadmasters assisting on the ground, was struck and seriously injured by the falling load.

Preparation for the operation

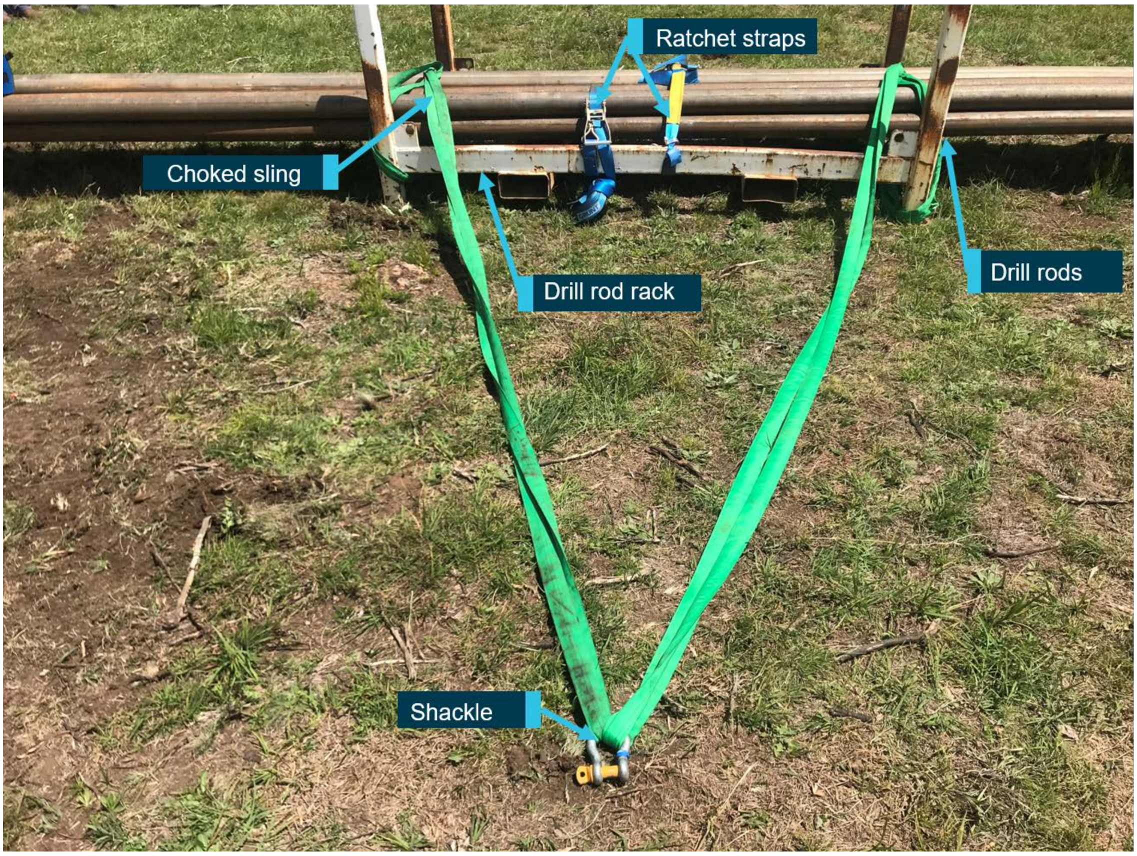
There were a number of different organisations involved in lifting operations on the day. The lead contractor had sub-contracted two helicopter operators to move the equipment from a staging area near Tantangara Dam to a drilling site about 3 km away. The three organisations had conducted this type of work together a number of times. One helicopter operator (operator A) supplied an AS350B3 helicopter, long line, remote cargo hook, lifting equipment and three experienced loadmasters. The second operator (operator B) supplied HUE, a long line and remote cargo hook.

At around 0800 Eastern Daylight Time,[1] two of the loadmasters arrived at the staging site to begin preparations for the day. Both helicopters and the third loadmaster were delayed due to fog. The loadmasters checked all the lifting equipment, including the slings and shackles, for integrity and ensured they had been checked during the last routine equipment inspection. They then began working with the drilling crew to organise, weigh and rig the loads to be moved by the helicopters. The third loadmaster arrived after the fog had lifted, and they all worked together to finish rigging the loads.

Among the loads were three lots of drill rods on drill racks (Figure 1). The loadmasters decided not to use the lift points on the drill racks, as the lift points were not rated or stamped. Working together, the loadmasters ensured the weight of the loads were equal, secured the drill rods to the rack and rigged the slings, so the loads would be balanced during flight. To do this, they used two 6 m round slings, rated to carry 2,000 kg, choked at either end of the rod rack. The slings were then attached to a shackle, which connected directly to the remote cargo hook. A 5.6 m tag line was attached to the load, to assist with manoeuvring the load into the required position at the receiving site. The loadmasters rigged the loads a number of times before they were happy with the rigging.

[1] Eastern Daylight Time (EDT): Coordinated Universal Time (UTC) + 11 hours.

Figure 1: Drill rods ratcheted to the rack and slings attached.



The figure shows the drill rods ratcheted to the drill rod rack and the slings which are choked at the ends of the drill rack.
Source: NSW police, annotated by ATSB

After all the loads were rigged to their satisfaction, the pilots and loadmasters then held an aviation briefing where they discussed a helicopter lift plan. One of the loadmasters then led a *toolbox talk*, with all people involved in the day's operations. They discussed every item on their company's safe work method statement, which included known hazards. It was reported that the discussion clearly identified:

- safe sites for people not involved in the helicopter lifting operations
- the routes the helicopters would be taking
- being mindful of avoiding the 'crush zone'.

Inside the 'crush zone' there was an injury risk from contact with the external loads. There was no definition for the extent of the crush zone.

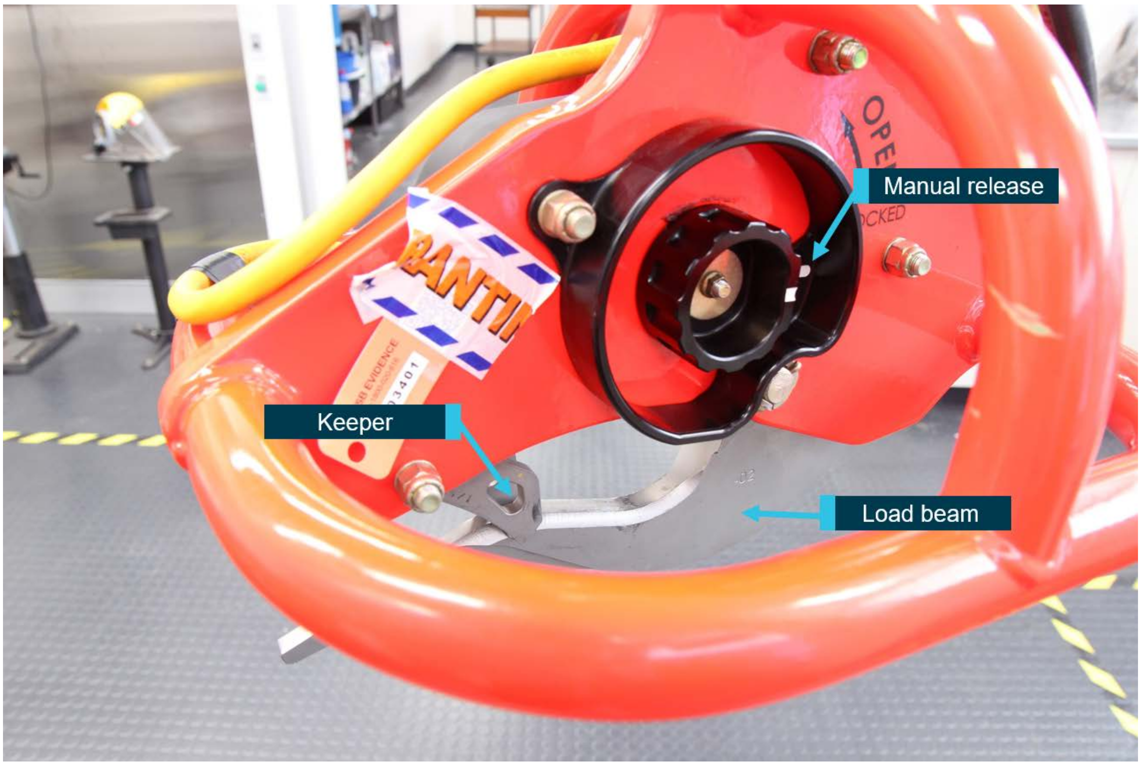
The loadmaster also highlighted that:

- as taglines were being used, people should not become fixated on getting hold of them
- ground personnel should not put themselves in a dangerous position and were to remain within the view of the pilot at all times.

The lead contractor then conducted a third briefing, which discussed their company's expectations including radio communications, transfer of crew between the loading and receiving zone, staff resourcing of both the loading and receiving areas, and emergency procedures. It was reported that all three briefings were done methodically, with clear instructions and time for all involved to ask questions and understand their role.

The people who were being flown to the drill site were then given a helicopter induction. While this was occurring, inspections of the helicopter's cargo hook on the underside of the helicopter, long lines and remote cargo hook connections were conducted. This involved a number of release and reattachments of the long line to the cargo hook on the underside of the helicopter and a number of pilot-operated releases and manual releases by the loadmasters of the remote cargo hook. After the loadmasters had checked the shackles to ensure they fitted in the cargo hook throat (Figure 2), the group split up and went to their designated areas. One loadmaster went to the loading site and two went to the drill site, which was receiving the equipment. At the drill site, the supervisor identified the designated safe zone ensuring all personnel not involved in the lifting operations were within this zone, and placed the emergency equipment to ensure easy access if required.

Figure 2: Cargo hook



Source: ATSB

Lifting operations

Operations commenced after lunch with a check of the radios. The loadmasters had VHF radios in their helmets, which they used to communicate with each other at the drill site and with the helicopter pilots. The pilot of HUE conducted the first lift and, having requested to start with a light load, moved an 800 kg load to the drill site with no issues. Loadmaster 1 conducted all radio communications with the pilot at the drill site. He reported that when the helicopter was clear of all obstacles along the approach path, he advised the pilot and then gave directions to position the load where it was required, with clear advice of the height of the load above the ground.

It was reported that one load carried by the AS350B3 was spinning on arrival at the drill site. In response, the pilot touched the load to the ground away from the loadmasters to stop the spin. The helicopter then lifted the load off the ground to about knee height and the loadmasters manoeuvred the load to its position on the site while directing the pilot.

Accident load

After moving two lighter loads, the pilot of HUE requested a heavier load be connected. The loadmaster selected one of the drill rod racks, weighing about 1,200 kg, and connected the shackle to the hook. As the load lifted, it was slightly uneven and the loadmaster instructed the pilot to return the load to the ground, so he could re-adjust the slings. The pilot lowered the load and placed the hook on the load. After adjustment to the sling, the load lifted evenly and was flown to the drill site (Figure 3).

Figure 3: Images showing the occurrence load during departure from loading site.

The image on the left shows that on departure the load was slightly uneven, the image on the right shows the load after loadmaster had adjusted the slings.
Source: Helicopter Operator A, annotated by the ATSB

As the helicopter approached the drill site, the pilot contacted the loadmasters and advised them that he was carrying the drill rods. Loadmaster 1 told him that the load was to go to a different area of the site and advised that the wind had dropped to around 3–5 km/h (0.5–1.5 kt). Loadmaster 1 subsequently told the pilot that they could see the helicopter and gave him advice on directions and distance to run to the drill site. He then advised the pilot he could descend, calling out the load's height above the ground. The loadmasters began to approach the load when it was at about 7 m above the ground. Loadmaster 1 later advised that the plan was to lower the load to touch the ground and then raise it to knee level before moving it to its final resting position. Both loadmasters were reportedly careful to maintain clearance with the area under the load and stood at 45° to the load. They were both on the same side of the load. It was reported that the load was steady as it was flown in to the drill site.

The load was moved very slowly down to an area having an estimated 10˚ slope, with loadmaster 1 being downhill of loadmaster 2. Loadmaster 1 observed loadmaster 2 step toward the load, reach up, take hold of the tagline and immediately step back out to regain their 45˚ spacing. Loadmaster 1 reported that the load was about 5 m above the ground at this stage and the pilot reported that the end of tagline appeared to be near the ground.

Loadmaster 1 reported that as loadmaster 2 returned to their position, the slight forward motion of the load stopped and the load moved back slightly towards the rising ground. As the load moved back, the load detached unexpectedly from the hook.

It was reported that as the load fell, it seemed like one end of the load fell faster than the other and after it struck the ground, the load either bounced or pivoted around. Both loadmasters had to scramble backwards away from the load but the movement resulted in loadmaster 2 being struck by the drill rods and knocked to the ground under the load.

The pilot reported that he felt the helicopter 'pop up a bit' and thought that a sling had snapped as he had not released the load. Loadmaster 1 advised that he did not hear the 'clack' sound associated with the solenoid release of the hook (see the section titled *Remote Cargo hook*). He advised that the sound of the solenoid activation was audible over the helicopter noise and while wearing a helmet.

Loadmaster 1 spoke to the helicopter pilot on the radio and advised him that the sling had not separated, the hook was useable and to bring the helicopter back to lift the load. The pilot re-positioned the helicopter and loadmaster 1 re-connected the load, which was then lifted off the seriously injured loadmaster.

Remote cargo hook

The remote cargo hook used by the operator of HUE was a TALON 6K half-cage cargo hook (Figure 2). This was the first operational use of this hook following a recent overhaul and was also the first time the helicopter (HUE) was used with this long line and remote hook combination.

The load beam on the remote cargo hook can be made to release by two methods:

- a pilot-activated switch on the cyclic, which activated a solenoid in the hook to release the load beam
- a manual release on the hook itself.

The hook and long line inspections conducted prior to the flight, included a number of activations of both of these release systems.

The pilot advised that, due to a previous injury to his hand, he had to deliberately move his hand to the top of the cyclic and move the switch sideways to activate the hook. As such, unintended load release by that mechanism was considered very unlikely. The ATSB viewed video footage of the helicopter pilot operating the switch at the top of the cyclic, which supported that conclusion.

The keeper was designed to allow items to enter the hook throat but not return. It opened toward the inside of the load beam and had a spring-loaded automatic return to the closed position.

Loading equipment examination

The slings, shackle and hook were examined by the ATSB. The inspection of the slings determined they were intact. To check that the load had not released through dynamic rollout,[2] the ATSB ensured that the hook and shackle combination did not allow the shackle to pass the end of the load beam. The cargo hook owner's manual specified that the shackle used with this hook should have an inside diameter less than 11.4 cm. The internal diameter of the shackle used was 5.5 cm. A physical examination of the hook was conducted and it was determined that the manual release and the keeper worked as expected. The ATSB did not dismantle the hook or connect the hook to an electrical supply.

The ATSB examined video footage of the helicopter lifting the load from the loading site. It showed that the 'D' shackle was behind the keeper (Figure 4) when the helicopter departed and that the load was evenly balanced as the helicopter flew towards the drill site (Figure 3).

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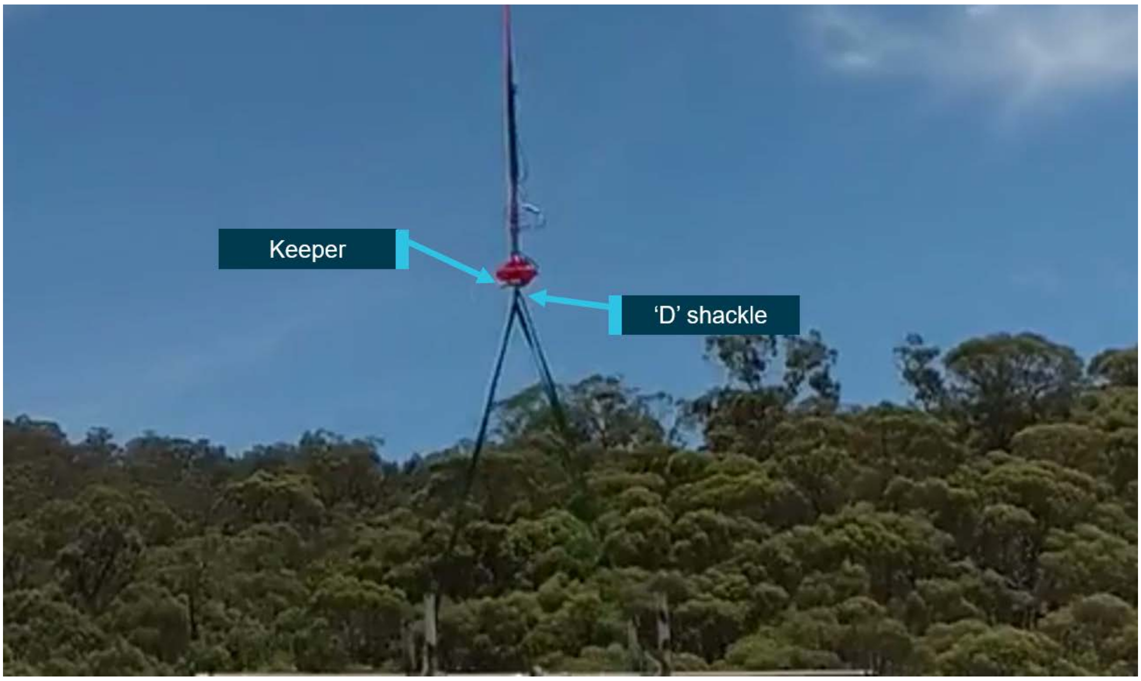
[2] Dynamic rollout: An uncommanded release of the load can occur when the internal diameter of the shackle is big enough to pass over the tip of load beam, opening the keeper and releasing the shackle.

Figure 4: Image shows that the 'D' shackle was behind the keeper.



The image shows that on departure after the load had been adjusted, the 'D' shackle was behind the keeper.
Source: Helicopter operator A, annotated by the ATSB

Electromagnetic interference

The ATSB also considered whether electromagnetic interference (EMI) could have resulted in the inadvertent release of the load. While this accident occurred in an area which has high voltage power lines from the Tumut 3 power station, the aircraft was about 35 km from the power station and 10 km from the closest high voltage power lines. Research suggests that magnetic radiation returns to normal levels at about 150 m from power lines.

A licenced aircraft maintenance engineer inspected the electrical system used on the helicopter to control the hook release mechanism and they reported that the system was working as expected. It was reported that there were no exposed wires within the system that could have resulted in a short circuit if exposed to electromagnetic interference from equipment in the aircraft. The helicopter operator also reported that the system has not had any issues with the hook release system since the accident.

Procedures used for this operation

The ATSB reviewed the procedures used by the different operators involved on the project on the day. The lead contractor had conducted a risk assessment of the overall project, which involved all of the contractors involved.

Operator A had completed a helicopter lift plan for the day and a safe work method statement that identified hazards and the mitigations for lifting operations. There were a number of areas in the procedures indicating that no one should be located below the suspended load. The procedures also specified that people should not be within the 'crush zone' but did not identify where the crush zone was. The operator advised that the crush zone was dependent on a number of job-specific variables, including the load shape and size, and the length of sling required. While there was no specific section in the safe work method statement to prompt this discussion, the loadmasters worked together to rig the loads, adding tag lines where required, and so were aware of the individual load's size, shape and aerodynamic stability.

Safety analysis

The ATSB considered a number of inadvertent load release mechanisms, including:

- the pilot release system
- dynamic rollout
- failure of the manual load release
- electromagnetic radiation
- failure of the hook mechanism.

A previous injury meant that accidental release by the pilot was unlikely and the loadmaster did not hear the audible 'clack' of the solenoid, associated with operation of the pilot-activated release.

The shackle was the appropriate size, to ensure a dynamic rollout would not occur. The video footage shows that the 'D' shackle was securely behind the keeper as the helicopter departed from the loading area.

While flying in an area of electricity production, the helicopter was 35 km from the closest power station and around 10 km from the closest power lines. The wiring was also checked and there were no bare or loose wires in the system. If the load had released through EMF activation of the release system, the loadmasters would have heard the 'clack' of the solenoid releasing.

There were no indications that the remote hook release mechanism was faulty after the previous overhaul and the pilot and loadmasters conducted an operational check of the mechanism before operations began on the day. It also successfully lifted the two previous loads and lifted the load off the loadmaster after the incident. In addition, the manual release mechanism operated correctly at the ATSB facility and an examination of the hook release electrical system in the helicopter did not reveal any faults. Despite this, a transient hook fault that resulted in an inadvertent release of the load could not be ruled out.

In summary, based on the available evidence, the mechanism that led to the release of the load could not be determined.

Immediately prior to the accident, the load was being positioned without needing to be adjusted. The plan was that it would touch the ground and then be lifted to knee height before being moved to its final position. Therefore, being in the vicinity of the load when it was above head height was an unnecessary risk.

When the load released, one end fell first and there was likely a movement back toward the rising ground. The loadmasters were reportedly standing to the side and at 45˚ angles from the load, but they were still close enough for one of them to be struck when the load pivoted.

The procedures and briefings for the operation contained several references for individuals not to place themselves in a dangerous position with respect to the load. While the extent of the crush zone was not defined in general, there were a number of variables unique to each job that made this difficult. The opportunity to discuss these aspects was during the briefing, although there was no discussion on the specific loads in this instance. Despite this, the loadmasters did discuss and adjust the different loads, adding tag lines where required. This would imply they were aware of the load size, weights and aerodynamics of specific loads for this job.

ATSB comment

In response to a previous accident, CASA released Airworthiness Bulletin, AWB 25-006 Issue 2, which provided advice to operators involved in sling load operations. While not directly relevant to this occurrence, it details important information relating to external sling load operations. This included information related to the inadvertent release of the load through the use of the incorrect shackle size and electromagnetic radiation (EMI).

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The load released from the hook unexpectedly for reasons that were not determined.
- The loadmasters were not maintaining a safe distance from the load. Their positioning, in combination with the significant movement of the load as it contacted the ground, resulted in the loadmaster being struck and seriously injured.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

As a result of this accident, all the contractors jointly reviewed the processes used on this project. They determined that the existing documentation contained sufficient warning for personnel to not enter the ‘crush zone’ or ‘work under loads’, but also identified enhancements to the existing processes. This included a control that removed all people (including loadmasters) from the receiving area where there was no requirement for precision in the placing of the load and increased controls where a precision placement of the load was required.

Helicopter operator who supplied the loadmasters

Operator A advised the ATSB that they have reviewed their own safe work method statement and made changes including identifying a ‘dynamic exclusion zone’[3] under the moving helicopter. Recognising that the zone may vary due to a number of variables, the intention is that specific guidance will be provided as part of pre-activity briefings.

Lead contractor

The lead contractor is overseeing a range of initiatives, including a behavioural safety review of the project with the intention to implement an appropriately designed program to positively influence behaviours across their projects.

[3] Dynamic exclusion zone: A dynamic exclusion zone is a position above a person’s head height that is in the pathway of a potential uncontrolled load that may drop and impact onto a person.

General details

Occurrence details

Date and time:	10 January 2019 – 1205 EDT	
Occurrence category:	Accident	
Primary occurrence type:	Loading related	
Location:	39 km south-east of Talbingo, NSW	
	Latitude: S 35° 50.17'	Longitude: E 148° 34.97'

Aircraft details

Manufacturer and model:	Bell Helicopter Textron 205A-1	
Registration:	VH-HUE	
Serial number:	30290	
Type of operation:	Aerial work	
Departure:	Near Tantangara Dam, NSW	
Destination:	Near Tantangara Dam, NSW	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 0	Person on ground – 1 (serious)
Aircraft damage:	None	

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within ATSB's jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.