Aviation Safety Investigation Report 199702470

Bell Helicopter Co 47G-3B-1 Soloy

01 August 1997

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Occurrence Number:	199702470		Occurrence	e Type: Accid	lent	
Location:	Comboyne					
State:	NSW		Inv Catego	ry: 4		
Date:	Friday 01 August	t 1997				
Time:	1310 hours		Time Zone	EST		
Highest Injury Level:	Minor					
Injuries:						
		Fatal	Serious	Minor	None	Total
	Crew	0	0	1	0	1
	Ground	0	0	0	0	0
	Passenger	0	0	1	0	1
	Total	0	0	2	0	2
Aircraft Manufacture	r: Bell Helicopter	r Co				
Aircraft Model:	47G-3B1					
Aircraft Registration:	VH-CSW			Serial Numb	er: 6765	
Type of Operation:	Miscellaneous	Expe	rimentation			
Damage to Aircraft:	Destroyed					
Departure Point:	Comboyne, NS	SW				
Departure Time:	1310 EST					
Destination:	Comboyne, NS	SW				

Crew Details:

	Hours on				
Role	Class of Licence	Туре Нои	rs Total		
Pilot-In-Command	Commercial	500.0	6850		

Approved for Release: Monday, August 10, 1998

FACTUAL INFORMATION

Background

The pilot/owner of VH-CSW had been approached some time before the accident with a request to allow passengers to abseil from his helicopter while it was in a hover. The pilot approached a Civil Aviation Safety Authority (CASA) representative who advised the pilot that he would need to submit a proposed amendment to the company's Operations Manual detailing how such flights would be conducted. The representative also advised that any proposed amendment would have to be approved by CASA before any such flights could be conducted and that the representative had already approached a CASA helicopter specialist to discuss safety aspects of the proposed flights.

Because of the CASA requirement for a detailed proposal for conduct of the proposed flights, the pilot decided to conduct some controllability tests prior to submitting his proposed Operations Manual amendment. Because the pilot declined to be interviewed or to supply the investigation with a statement, it is not known whether he conducted any calculations into the lateral centre of gravity (cg) implications of the proposed flights.

The pilot positioned the helicopter to a helipad near the accident site on the morning of the accident and carried out some local flights prior to the accident flight. Another helicopter pilot, who had flown for the company on a casual basis in the past, drove to the area with addition fuel for the day's planned flights.

A briefing was conducted by the pilot to explain how he proposed to conduct the experimental flight. Present at that briefing were the passenger, who had accompanied the pilot to the site in the helicopter that morning and who had an interest in the proposed abseiling flights, the casual helicopter pilot and another local person. A fourth person was also present at the scene but did not attend the briefing.

The proposed flight discussed at this briefing required that an abseiling rope be attached to the outside of the front cross-tube of the skid assembly of the helicopter and that one passenger be seated in the right seat of the helicopter. The rope would be attached in such a manner that it hung over the outside edge of the right skid tube. The pilot then intended to lift the helicopter to a hover about 10 m above the helipad and the casual pilot was briefed to walk under the hovering helicopter and to gradually apply his weight onto the abseiling rope. One of the persons briefed earlier had radio communication with the pilot through a hand-held radio transceiver.

History of the flight

The flight proceeded as planned initially and the pilot was able to remain in control of the helicopter with one person, the other pilot, who weighed about 70 kg, suspended by the abseiling rope. The person at the helipad stated that the pilot then contacted him by radio and asked that the other person standing there (who had not attended the briefing) also put his weight on the rope.

That spectator quickly moved under the helicopter and applied his weight, reportedly about 80 kg, onto the rope. The helicopter rolled rapidly to the right and began to go out of control. When it became evident to the persons on the rope that the pilot could not control the helicopter with both their weights applied, they both quickly let go and attempted to move away from under the helicopter. Although the casual pilot managed to get clear, the other person's ankle became entangled in the rope and he was lifted by the helicopter as it banked steeply right, (now out of control), and it proceeded to pivot 180 degrees to the right and move across the road towards a small service station, dragging the person below it by the leg.

One of the helicopter's main rotor blades struck the steel upright of a large illuminated sign; the helicopter then descended and struck the rear of a vehicle parked in front of the service station. The helicopter landed heavily beside this vehicle with its tailboom broken off but with its engine still running and main rotor still turning, causing major damage to the vehicle and multiple blade strikes to the building.

The pilot was winded in the accident, partly because the shoulder harness section of his inertia reel seatbelt had failed on impact. He managed, with some difficulty, to activate the emergency fuel cut-off to shut down the engine after unsuccessfully attempting to stop the engine by switching off the magnetos.

Spectators arrived to assist the pilot and passenger from the severely damaged cabin and to extinguish a fuel fire that had started below the ruptured left fuel tank.

The two occupants of the helicopter and the person caught by the leg by the abseiling rope all received minor injuries. The helicopter was destroyed and severe damage was caused to the service station buildings and the vehicle parked in front of the office. Although there were persons in the buildings when the helicopter crashed, none of them were injured.

The aircraft

The helicopter had been manufactured in 1970 and its data plate identified it as a Bell 47G-3B-2. It had been converted some time later to a Bell 47G-2A-1, although registration records show the type as a Bell 47G-3B-1.

Examination of the aircraft at the accident site and a search of maintenance records proved that the aircraft was suitably registered and that the maintenance release was current. No defects that would have affected the flight were apparent. The failed pilot's shoulder harness inertia reel was recovered for failure analysis.

The pilot was suitably licensed and endorsed on the aircraft type.

ANALYSIS

The Flight Manual for the helicopter type did not cover abseiling operations and there was no procedure for the attachment of ropes or lifting devices to the skid tubes in the manner used on the accident flight. There was no centre of gravity (cg) chart provided in the manual for loads attached to the skids. In normal operations, any loads that are to be suspended below the helicopter are attached to the purposely installed cargo hook mounted under the helicopter close to the cg. CSW was fitted with such a device which has both electrical and mechanical methods for instantly releasing the load when required, especially in an emergency.

The forward skid cross tube was about 780 mm forward of the optimal longitudinal centre of gravity and any load applied on a rope attached to it would cause the helicopter to pitch nose-down as well as causing it to roll to the right.

The Flight Manual for the Bell 47G series of helicopter has a section on loading of cargo litters (if installed) which states that the maximum load allowable on a litter is 102 kg. Litters are mounted fore-and-aft on the skid cross-tubes between the cabin side and the outside of the skid. An asymmetric loading chart is provided with the litter kit and is used for calculation of maximum allowable difference between loads on the left and right litters. As an example of the sensitivity of this type of helicopter to asymmetric lateral loads, if there is a passenger of 75 kg in the right seat, it is only possible to carry about 55 kg more on the right litter than on the left to remain inside allowable lateral cg limits. As the outside of the skid tube is several centimetres outboard of the litter centreline, any load applied at the skid tube would have a greater adverse effect on the lateral cg than the same load on a litter.

On the accident flight, the pilot was simulating an asymmetric load of about 150 kg (no load on the left skid tube, two persons hanging from the right skid), attached to the helicopter in such a manner that the lateral cg limits imposed by the manufacturer were exceeded. This lateral cg exceedance combined with a pitch-down of the nose as the load was applied, resulting in a loss of control.

The carriage of a passenger of about 80 kg in the right seat would have resulted in the helicopter being close to a laterally balanced condition before any load was applied to the rope. If it had been decided to conduct a proving flight after calculation of the lateral cg implications, the conditions would have been better simulated with no passengers in the cabin or with one occupying the centre seat. It would be expected that the person from the right seat would have been the one abseiling from the helicopter. A seating configuration which left the right seat empty would have reduced the exceedance of lateral cg experienced on the accident flight.

The two persons applying their weight to the rope attached under the helicopter released their hold when they realised the helicopter was not maintaining a steady hover. As one of the persons stepped backwards, his ankle became entangled in the rope. He was lifted by the helicopter then dragged up a bank onto a road. This dragging load, which could not be released from the aircraft in an emergency, probably prevented the pilot from regaining control before the helicopter struck the sign.

Although abseiling from helicopters is frequently carried out in military operations, the aircraft used are normally larger, cabin-class helicopters and it is possible for persons abseiling from the helicopter to do so from each side simultaneously, thus reducing the risk of an exceedance of lateral cg limits.

Investigation into the failure of the pilot's shoulder harness inertia reel revealed that the unit fitted to the helicopter was not approved for installation in Bell 47G aircraft type.

SIGNIFICANT FACTORS

The pilot was attempting to explore the effect on helicopter control of a lateral load applied to the outside of the right skid tube.

The lateral centre of gravity limitations of the helicopter were exceeded, resulting in loss of control.

The pilot was unable to regain control before impact with a sign when a person became entangled in the rope attached to the helicopter.