



**Report 96-204**

**Mackcraft Jet Boat**

**Kawarau River, Queenstown**

**4 May 1996**

### **Abstract**

On Saturday, 4 May 1996, at approximately 1530 hours, the driver of a passenger jet boat, whilst attempting a high-speed close encounter with a rock face at Highcliffs on the Kawarau River, glanced the boat off a rock outcrop and the boat collided, head on, with the cliff face. The driver and four passengers received minor to serious injuries in the collision. Causal factors included an error of judgement by the jet boat driver. The driver's last-minute attempt to abort the manoeuvre was a contributing factor to the collision. Safety issues discussed relate to improved protection for passengers.

# Transport Accident Investigation Commission

## Marine Accident Report 96-204

### Boat particulars

Type:	Jet boat
Class:	Passenger (under six metres)
Limits:	Lake Wakatipu and Kawarau River
Allowable passengers:	11 (plus driver)
Length:	5.8 m
Construction:	Aluminium mono-hull
Power plant:	One 350 cubic inch (5735 cc), 244 kW, Chevrolet petrol engine driving a single-stage Hamilton water-jet unit
Normal operating speed:	55 km/h
Owner/operator:	Alpine Jet Ltd
Location:	Highcliffs, Kawarau River, Queenstown
Date and time:	4 May 1996 at 1530 hours <sup>1</sup>
Persons on board:	Crew: 1 Passengers: 4 (one non-fare-paying)
Injuries:	Crew: 1 (serious) Passengers: 4 (3 serious, 1 minor)
Nature of damage:	Substantial to bow plating and main frame
Inspector in charge:	T M Burfoot

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<sup>1</sup> All times in this report are NZST (UTC + 12 hours)

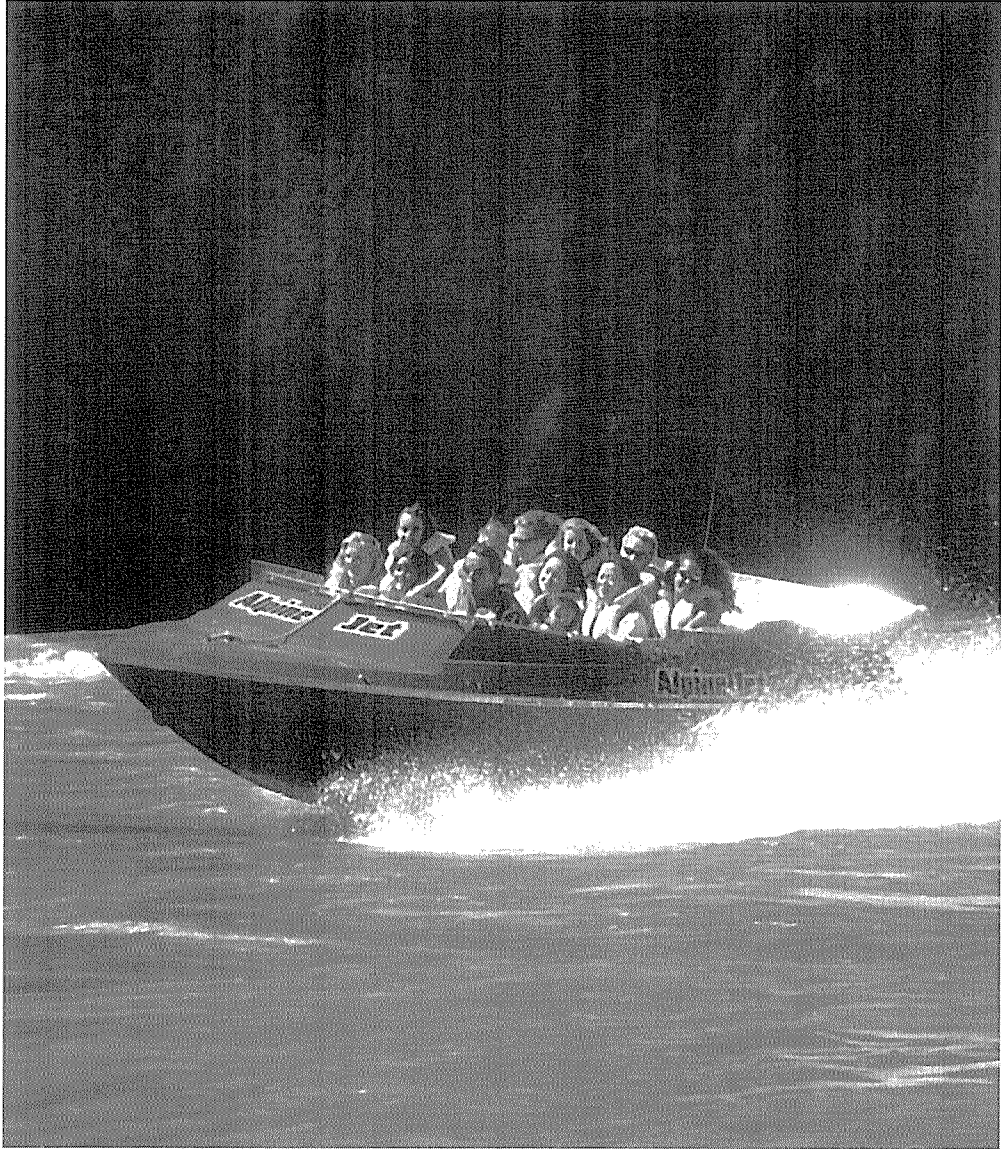
# **1. Factual information**

## **1.1 History of the voyage**

- 1.1.1 At approximately 1505 hours on Saturday, 4 May 1996, the jet boat (see Figure 1) departed from a jetty on the Frankton Arm of Lake Wakatipu, Queenstown. On board were the driver and four passengers. The passengers were all friends.
- 1.1.2 Prior to departing, the five occupants donned their lifejackets and the driver warmed the engine through. The passengers embarked and were given a safety briefing by the driver including the following points:
- Remain seated while in the boat.
  - Keep your arms inside the boat.
  - On hearing and/or seeing the pre-arranged signal from the driver, hold on.
- 1.1.3 The weather was fine with clear skies. The river level was average and steady over the four hour period prior to the accident.
- 1.1.4 The boat crossed the Frankton Arm of Lake Wakatipu, passed over a small drop under the Kawarau Bridge and entered the head waters of the Kawarau River. For the ensuing 17 km down river the driver manoeuvred the boat at high speed close to various trees and shingle banks to add a degree of excitement for the passengers. The driver executed several flick turns<sup>2</sup> along the route near features of interest. After each turn he gave a brief talk about the history of each feature. He also used these opportunities to assess the passengers' reaction to the manoeuvres he had performed with the boat. To him, none of the passengers showed any signs of apprehension.
- 1.1.5 The turn-around point for the trip was at a feature called Highcliffs. At this point the river was divided by a shingle bank, the main flow running along a cliff face which had several outcrops jutting into the river. The driver stopped the boat adjacent to the cliffs and gave the passengers a brief historical account of the area as the boat drifted down with the current. As was the custom for the return trip the driver intended to make a high speed pass close to the cliff face, turning towards the rock outcrops and using the boat's side-slip (drift) in the turn to create an illusion that the boat was going to collide with the terrain.
- 1.1.6 At approximately 1530 hours the driver applied full power and lined the boat up for the manoeuvre. As the boat was approaching the first rock outcrop on the plane, at approximately 40 km/h, the driver realised that he was off his intended approach line. He decided to abort the manoeuvre, and instead of turning into the outcrop, as would normally be done, he turned away. This action resulted in the boat's stern swinging toward the cliff face and its starboard rear corner striking the rock outcrop (see Figure 2). When he felt the stern of the boat glance off the rocks the driver throttled off instinctively.

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<sup>2</sup> A spectacular manoeuvre, unique to jet boats, where the boat is turned at relatively high speed, almost within its own length. The manoeuvre is normally used when a rapid stop, or change in direction is required in narrow sections of the river. It is sometimes referred to as a Hamilton Turn and is often performed by drivers to enhance the degree of excitement for the passengers.

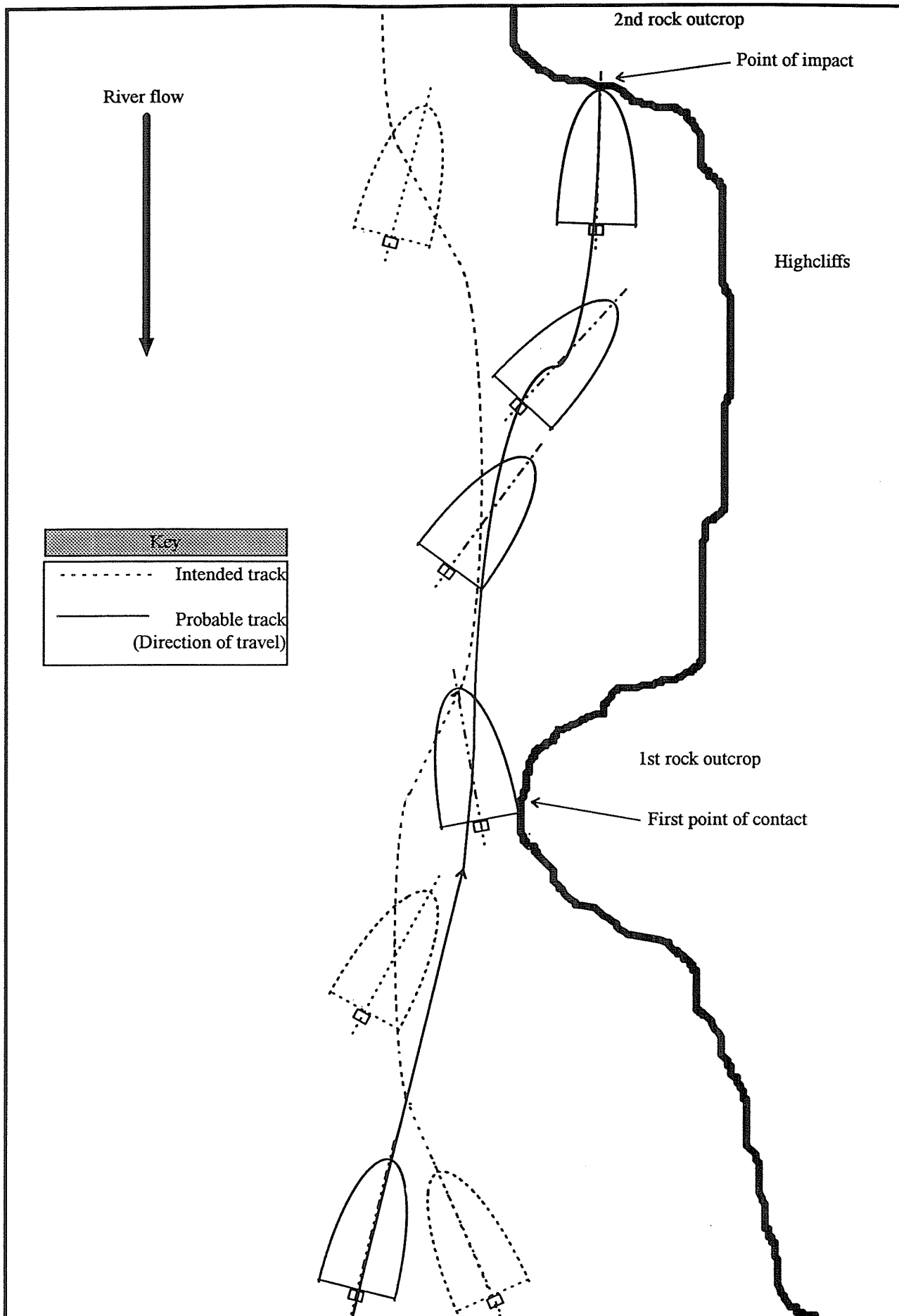


**Figure 1**  
**Typical Alpine Jet boat (Mackcraft)**

- 1.1.7 The glancing blow deflected the stern causing the boat to veer towards the cliff face. The driver attempted to recover the situation by opening the throttle fully and applying maximum port helm. The boat recovered from the deflection, but too late to prevent it colliding with the second rock outcrop, head on. The distance between the rock outcrops was approximately 30 metres.
- 1.1.8 The boat climbed approximately three metres up the near vertical rock face before sliding back into the water. As a result of the impact, the driver suffered facial injuries and a dislocated shoulder, and the passengers suffered injuries which included broken limbs, concussion, cuts and bruises. The motor cut out in the collision but the driver, despite his injuries, was able to stabilise the boat in the river and use a portable radio to send a Mayday call. Another jet boat responded to the Mayday and was on the scene within 10 minutes of the accident. Subsequently the five injured occupants were airlifted to hospital by helicopter.
- 1.1.9 The boat suffered structural damage to the plating and main frame in the bow. A dent and scrape was evident on the starboard rear corner which was consistent with the glancing blow against the first rock outcrop. The steering wheel was broken and the middle seat's aluminium back support and hand rail was separated from its mounting and bent by the impact of the two passengers in the rear seat when they were thrown forward. The vessel remained watertight. The engine was restarted successfully by rescuers after the accident. Although the wheel was broken the steering system was still functional.

## **1.2 Crew information**

- 1.2.1 The driver had been involved with small boats for approximately 10 years. He had owned his own jet boat for approximately one year in 1994/95 during which time he commenced training on the Kawarau River to obtain his Commercial Jet Boat Licence with the Queenstown Lakes District Council (QLDC). Obtaining a QLDC Commercial Jet Boat Licence involved:
- 25 hours training in the area under the supervision of a qualified driver.
  - A practical and theory test to the QLDC Harbourmaster's satisfaction.
  - A further 25 probationary hours of passenger operations.
  - A current first aid certificate.
- 1.2.2 In September 1995 the driver passed his theory and practical test, bought the existing jet boat company and continued operating in its designated area, employing up to six full-time drivers to operate three boats in the peak season. By January 1996 he had accumulated the required 25 probationary hours and became a fully licensed jet boat driver.
- 1.2.3 The driver had completed numerous return trips to Highcliffs during his training and over the first summer of operation. On most of those trips he had performed the close pass manoeuvre which he was attempting when the accident occurred.
- 1.2.4 The trip on which the accident occurred was the driver's first for the day, the rest of the day having been spent on boat maintenance. His previous night's sleep was "good" and there was no evidence to suggest that his judgement was impaired by medical unfitness, fatigue or other factors.



**Figure 2**  
**Diagram showing probable tracks and approximate heading of the jet boat**  
**(Not to scale)**

### **1.3 Vessel information**

- 1.3.1 The aluminium jet boat was a 5.8 m Mackcraft powered by a 350 cubic inch Chevrolet petrol engine driving a single-stage Hamilton water-jet unit, which gave a normal, full load, operating speed of approximately 55 km/h.
- 1.3.2 The boat was inspected and licensed by the QLDC to carry up to 11 passengers plus the driver.
- 1.3.3 Steering was achieved by a cable-operated deflector plate in the jet-stream which deflected the efflux to the left or right in accordance with the direction in which the steering wheel was turned.
- 1.3.4 Speed and reverse thrust were achieved by the combination of throttle setting and a cable driven reverse duct<sup>3</sup>. When the reverse duct was fully open the jet-stream was rearwards, thrusting the vessel forward. As the reverse duct was closed an increasing amount of the jet-stream was deflected forward, progressively changing the resultant thrust from forward to reverse. When the reverse thrust equalled the forward thrust the unit was at “zero speed” (neutral). The engine throttle could be adjusted independently of the duct setting. At full reverse thrust, with the throttle fully open, the braking effect on the boat was similar to that obtained with the wheel braking of a car.
- 1.3.5 Typically river jet boats have a shallow vee (foot) forward transforming to a relatively flat bottom near the stern. The resultant shallow draft allows them to operate in extreme shallows, making them ideal for operating in the river environment. This feature makes them prone to excessive drift in a planing turn and can lead to a spin-out at high speed if the turn is not controlled carefully.
- 1.3.6 The drift in a planing turn can be controlled by adjusting the throttle and/or the tightness of the turn. Spinning out in a planing turn can be prevented by turning slightly into the drift. To “throttle off” halfway through a tight, planing turn will usually induce a spin.
- 1.3.7 The Mackcraft has a 12 - 14° vee forward and “planing strakes” on the bottom of the hull to reduce the drift and make it more responsive in a turn. Throttling off in a turn usually results in the boat continuing in the approximate direction in which it was travelling at the time of throttling off.

## **2. Analysis**

- 2.1 There was nothing unusual about the trip on the day of the accident. The weather was suitable and the river level was within normal operating limits. The boat was carrying less than half its permitted load, but this would not have altered its handling characteristics significantly.
- 2.2 The engine was running normally producing sufficient power to complete the manoeuvre being attempted at the time of the accident. The driver did not notice any defect with the steering before the accident.
- 2.3 The driver had completed the manoeuvre successfully on numerous occasions in the past; however, on this occasion he approached the rock outcrops from further out in the river. Realising he was off his desired line, the driver tried to abort the manoeuvre and turn away from the cliff face in a planing turn to port. Had he delayed his turn by a few seconds, the stern of the boat would have swung into the bay between the two rock outcrops, avoiding the first contact.

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<sup>3</sup> A scoop which is closed into the jet-stream to deflect some or all of the water forward.

- 2.4 The stern struck the rock causing the stern to spin out to port throwing the boat into a starboard planing turn, heading toward the rock face. The driver's instinctive reaction to throttle off would have resulted in the boat maintaining its direction of travel towards the cliff face. The driver's application of full throttle and hard port wheel prevented the boat from striking the cliff face, but was too late for him to avoid the second rock outcrop.
- 2.5 A better option would have been for the driver to apply full reverse thrust to reduce the force of, if not avoid, the collision.
- 2.6 A number of the passengers' injuries were sustained because they were unrestrained in their seats. While restraints may have reduced the type of injuries sustained in this case, they would have the potential to cause some occupants to drown under different circumstances should the boat over-turn.
- 2.7 The manner of the middle seat back's failure probably reduced the severity of upper body injuries sustained by the two rear seat passengers; however, its design afforded little protection against cuts and bruising.

### **3. Findings**

- 3.1 The jet boat met the requirements of the QLDC.
- 3.2 The driver was appropriately licensed to operate the boat.
- 3.3 Mechanical failure did not contribute to the accident.
- 3.4 The collision was caused by an error in judgement by the driver.
- 3.5 The injuries sustained by the boat's occupants would have been significantly reduced if they had been restrained, however, under different circumstances this would increase the potential for drowning.
- 3.6 The design of the seat backs could be improved to lessen the risk of superficial injuries in similar accidents.

### **4. Safety Action**

- 4.1 The QLDC Harbourmaster withdrew the driver's Commercial Jet Boat Licence pending a further 25 hours driver training under the supervision of a senior qualified driver, followed by a practical boat handling test.

### **5. Safety Recommendation**

- 5.1 It was recommended to the owner of Alpine Jet Ltd that he:

Take steps to improve the passenger protection in each of the jet boats operated by Alpine Jet Ltd. (060/96)

11 December 1996

M F Dunphy  
Chief Commissioner