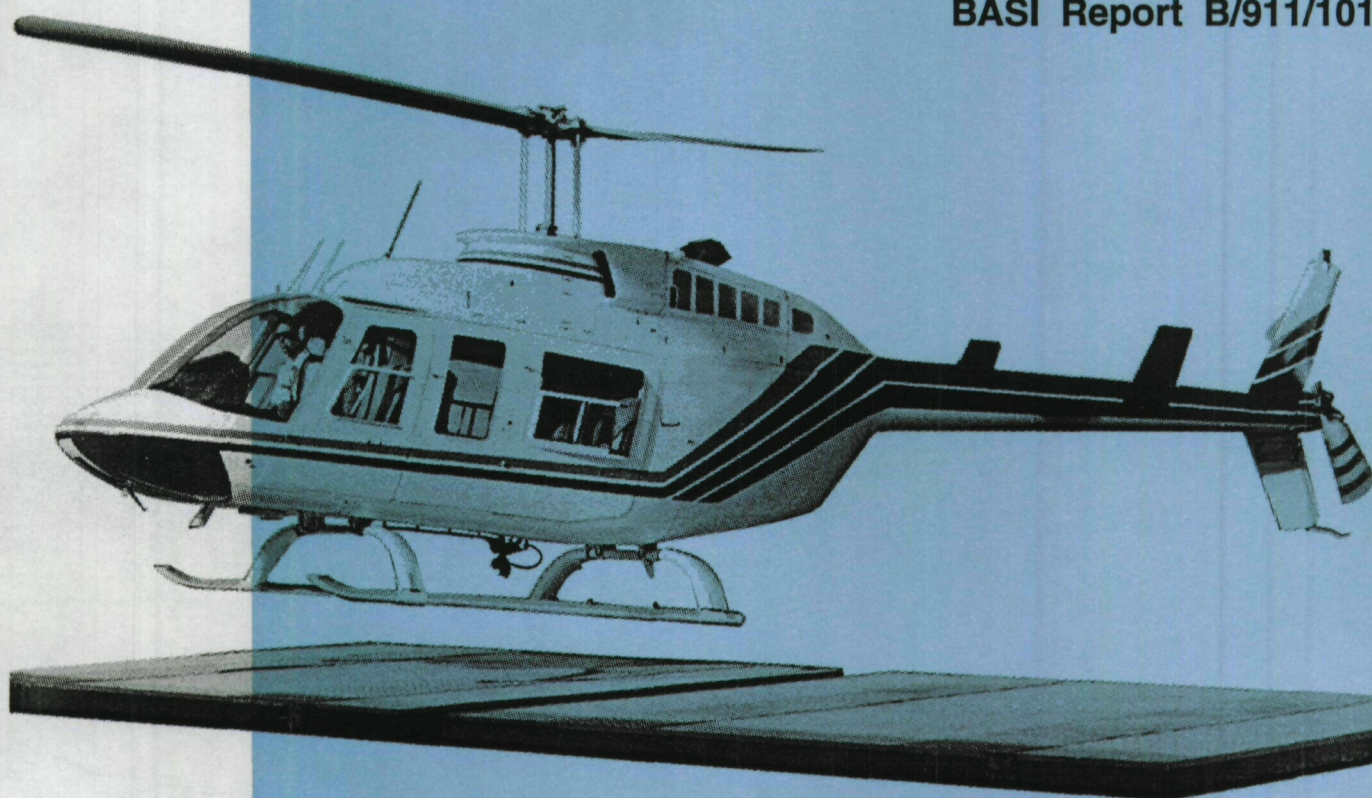


**BUREAU OF AIR SAFETY INVESTIGATION
REPORT**

BASI Report B/911/1019



**Bell 206L-1 Helicopter VH-TCH
South Stradbroke Island Qld
3 March 1991**

BASi
Bureau of Air Safety Investigation



**Transport and
Regional Development**

Department of Transport and Communications

Bureau of Air Safety Investigation

ACCIDENT INVESTIGATION REPORT

B/911/1019

Bell 206L-1 Helicopter VH-TCH
South Stradbroke Island Qld
3 March 1991

July 1992



Released by the Director of the Bureau of Air Safety Investigation
under the provisions of Air Navigation Regulation 283

ISBN 0 642 18242 6

July 1992

This report was produced by the Bureau of Air Safety Investigation (BASI), PO Box 967, Civic Square ACT 2608.

The Director of the Bureau authorised the investigation and the publication of this report pursuant to his delegated powers conferred by Air Navigation Regulations 278 and 283 respectively. Readers are advised that the Bureau investigates for the sole purpose of enhancing aviation safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purpose.

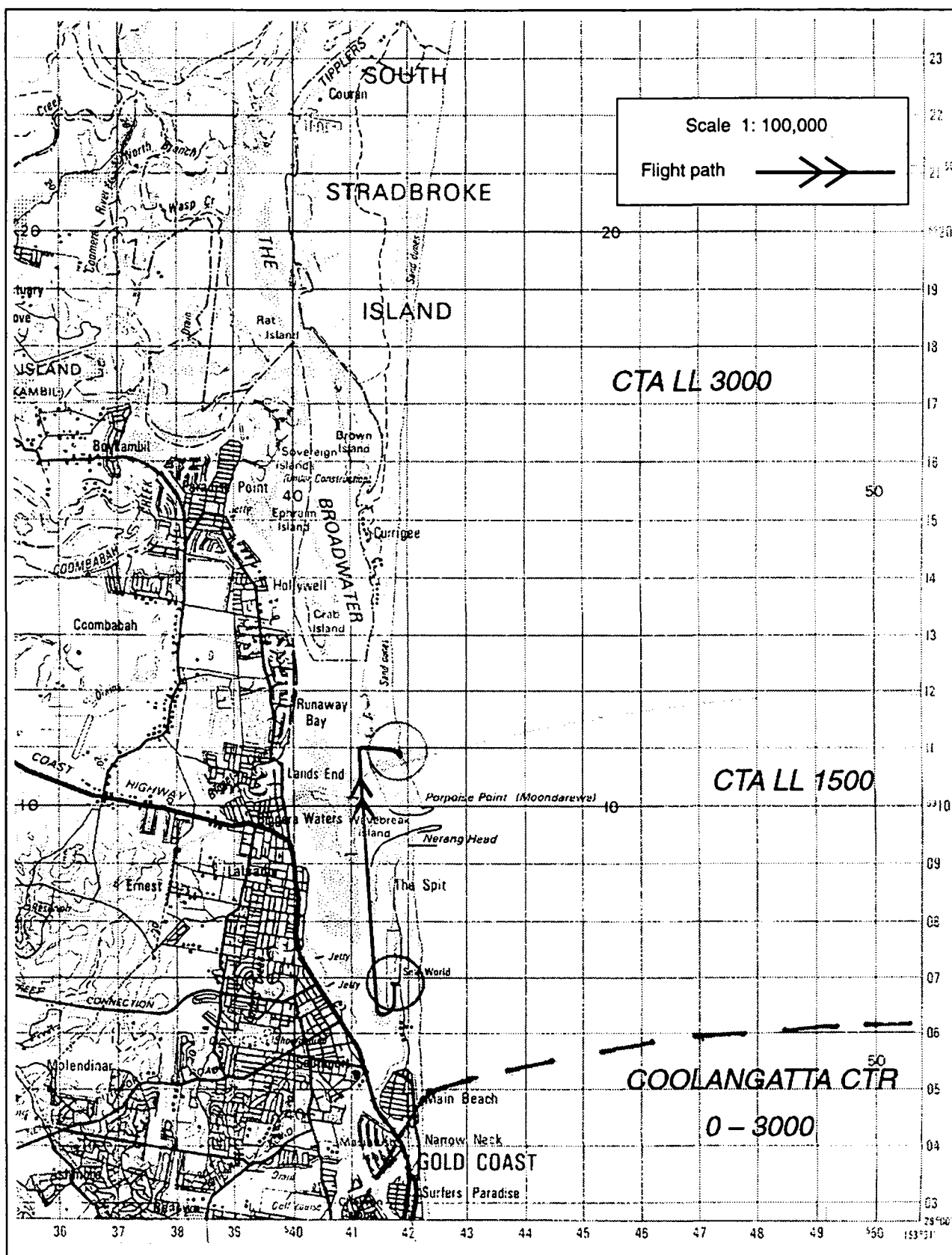
As BASI believes that safety information is of greatest value if it is passed on for the use of others, copyright restrictions do not apply to material printed in this report. Readers are encouraged to copy or reprint for further distribution, but should acknowledge BASI as the source.

CONTENTS

Location map	vi
SYNOPSIS	1
1. FACTUAL INFORMATION	1
1.1 History of the flight	1
1.2 Injuries to persons	2
1.3 Damage to aircraft	2
1.4 Other damage	2
1.5 Personnel information	2
1.6 Aircraft information	2
1.7 Meteorological information	3
1.8 Aids to navigation	3
1.9 Communication equipment	3
1.10 Helicopter landing site information	3
1.11 Flight recorder	3
1.12 Wreckage and impact information	3
1.13 Medical and pathological information	4
1.14 Fire	4
1.15 Survival aspects	5
1.16 Tests and research	5
1.17 Additional information	5
1.17.1 Information from witnesses	5
1.17.2 Evidence from check-and-training instructor	6
1.17.3 Torque turn	6
1.17.4 Human factors	7
2. ANALYSIS	7
2.1 Airworthiness of the aircraft	7
2.2 Pre-impact manoeuvres	7
2.3 Medical aspects	7
3. CONCLUSIONS	8
3.1 Findings	8
4. FACTORS	8

ABBREVIATIONS

AVR	automatic voice recording
E	east
ft	foot
g	gravity
h	hour
HLS	helicopter landing site
hPa	hectopascal
kg	kilogram
km	kilometre
kt(s)	knot(s)
MHz	megahertz
min	minute
RPM	revolutions per minute
S	south
s	second
TTIS	total time in service
VMC	visual meteorological conditions
°	degree (geom.)
°C	degree Celsius
'	minute (geom.)
"	second (geom.)



Map showing take-off point and accident location (both circled).

SYNOPSIS

The pilot was conducting a short joy-flight with six passengers from the Sea World complex. About 4 km north of the complex, the helicopter was seen to climb steeply in a near-vertical nose-high attitude. As the helicopter fell backwards from the nose-high attitude, the tail boom was severed by the main rotor blades. The cabin and the separated tail boom fell to ground on the ocean beach of South Stradbroke Island. The main body of the helicopter exploded and caught fire, scattering debris over a wide area. All seven occupants received fatal injuries.

1. FACTUAL INFORMATION

1.1 History of the flight

The helicopter was being operated by a subsidiary company of the Sea World theme park for joy-flights in the local area. The park is located 24 km north-north-west of Coolangatta Airport. The pilot had submitted flight plan details by radio to the Brisbane Flight Service Unit, nominating a SARTIME at the completion of an unspecified number of joy-flights.

The pilot had an arrangement with some friends of his wife to take them on a joy-flight if there was a lack of demand for flights by the public. One commercial joy-flight had been undertaken immediately before the fatal flight.

When the six passengers boarded the helicopter at the joy-flight helipad, the pilot was at the controls with the helicopter operating at ground-idle RPM. It departed the complex at approximately 1358 hours Eastern Standard Time for a standard 5-min flight over South Stradbroke Island.

The helicopter was seen flying at about 500 ft AMSL north over the Broadwater, west of the island. It then completed a steep turn through 90°, and within a short space of time the nose of the helicopter rose to a vertical attitude and the aircraft gained about 200 ft in altitude. As the helicopter started to fall, the main rotor severed the tail boom. The body of the helicopter adopted a nose-down attitude and spiralled down with the engine operating, impacting the ocean beach at the line of an incoming tide. The helicopter exploded in a fireball at impact, throwing debris over a considerable area. The body of the helicopter came to rest upside down in the sand. People were at the site within minutes but could not get close to the cabin because of the intense fire.

A short time later, police moved the helicopter debris further up the beach to protect it from the incoming tide.

The helicopter crashed at approximately 1401 hours in Visual Meteorological Conditions (VMC), at 27°56'S 153°25'E.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	6	—
Serious	—	—	—
Minor	—	—	—
Total	1	6	—

1.3 Damage to aircraft

The helicopter was destroyed by impact forces and the subsequent fire.

1.4 Other damage

No other damage was reported.

1.5 Personnel information

The pilot in command was 27 years of age. He held a current Commercial Pilot Licence (Helicopters) and a Private Pilot Licence (Fixed Wing Aircraft). His licence was appropriately endorsed for Bell 206L-1 helicopters.

At the time of the accident, the pilot had a total flying experience of 364 h of which 218 were in helicopters. He had flown 146 h in Bell 206L-1 helicopters, including 135 h as pilot in command. He had flown 47 h on the type within the last 30-day period and about 45 min on the day of the accident. His most recent proficiency check was on 25 January 1991 when he completed a periodic, company initiated, check-and-training flight in a Bell 206-B helicopter.

It was the second consecutive day that the pilot had been rostered for flying duties, following two days of rostered time off duty. He commenced duty at 0800 hours on both days. He flew 3.4 h on the day before and only 45 min on the day of the accident.

The pilot passed his last Aviation Medical Examination on 18 May 1990. His licence was not endorsed with any medical restrictions and there was no record in his medical history of any medical problems.

1.6 Aircraft information

The helicopter, registered VH-TCH, Serial Number 45209, was manufactured by the Bell Helicopter Company in the USA in 1979. It was a single main rotor, single turbine engine helicopter with a maximum take-off weight of 1,837 kg. The helicopter had accumulated a total time in service (TTIS) of 5,284.5 h. It was equipped with seven seats including two cockpit seats. The helicopter was not fitted with dual controls for this flight.

The helicopter had a valid Certificate of Airworthiness. The Maintenance Release was valid until 20 February 1992 or until 5,366.4 h TTIS, whichever came first. Inspection of the aircraft records indicated that there were no maintenance defects outstanding.

A loading control system was employed by the company which relied on the use of standard weights for passengers (77 kg per adult person). Lack of detailed information of where each person was seated precluded exact calculations; but using standard weights, the weight and centre of gravity of the helicopter were found to be within specified limits. Approximately 135 kg of Jet A1 fuel was on board at the time of the crash.

1.7 Meteorological information

The general area was under the influence of a moist south-east stream which brought the occasional squall and intermittent rain showers. At the time of the accident, the surface wind was south-south-east at about 12 kts, the visibility was 30 km and the atmospheric pressure was 1,020 hPa. The temperature was 23°C. The cloud cover consisted of scattered cumulus at 2,500 ft and broken stratocumulus at 7,000 ft. It was not raining at the time of the accident. One witness recalled that the helicopter was bathed in sunlight during the manoeuvre. VMC prevailed.

The sun elevation was 52° on a bearing of 297° True.

1.8 Aids to navigation

The immediate area is served by radio navigational aids located at Coolangatta Airport and at Jacobs Well. The flight was conducted under Visual Flight Rules in VMC. The radio navigation aids were not of any significance in this accident.

1.9 Communication equipment

Brisbane Flight Service Unit was operating on its allocated frequency of 119.5 MHz. The automatic voice recording (AVR) tape of communications between Brisbane Flight Service and aircraft in the general area indicates that satisfactory two-way communications existed at the time of the accident.

Examination of the AVR tape revealed that the pilot had submitted a flight plan, by radio, for multiple joy-flights. No transmissions from VH-TCH were monitored by Brisbane Flight Service during the helicopter's last joy-flight.

1.10 Helicopter landing site (HLS) information

The Sea World HLS is situated 27°57'20"S 153°25'45"E, at the western boundary of the Sea World theme park, and 2 km north of Coolangatta Control Zone boundary. It consists of two separate platforms, each about 6 ft above the high-water mark at the edge of the Broadwater. All approaches and departures are over water in an arc from north through west to south. Approaches and departures were into wind and towards the south on the day of the accident.

1.11 Flight recorder

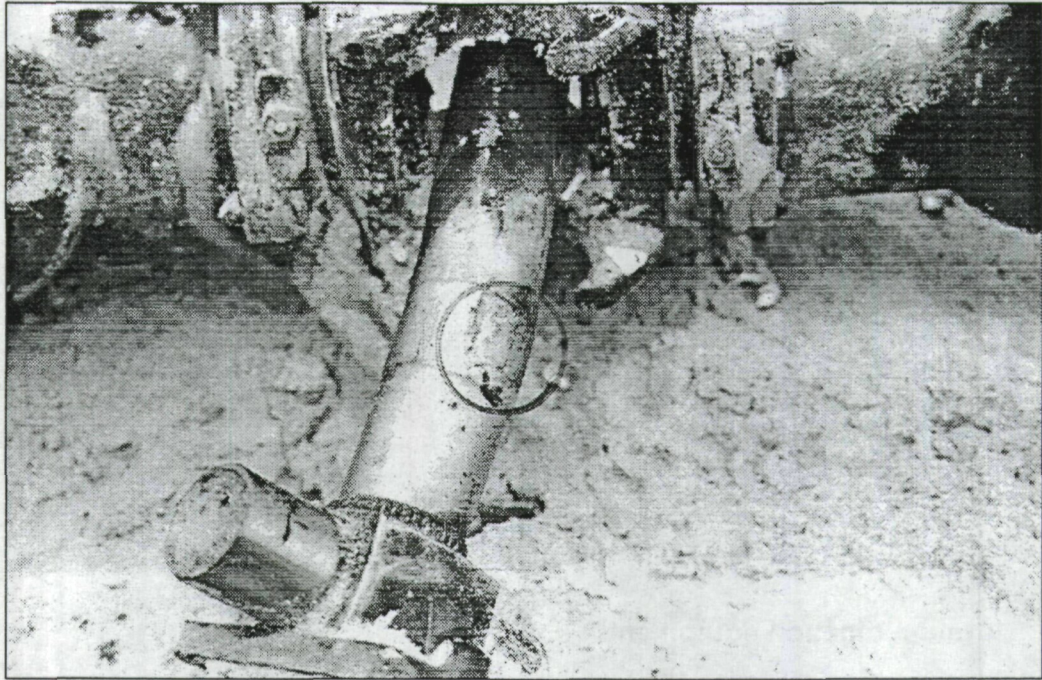
The helicopter was not equipped with a flight data recorder or a cockpit voice recorder, nor was either required by regulation.

1.12 Wreckage and impact information

The helicopter struck the sand of a wide section of ocean beach about 4 km north of the Sea World complex. The beach at that point is gently sloping. Witness information indicated that the final flight path was vertical with the body of the helicopter nose-down and rolling about its longitudinal axis. The helicopter exploded almost immediately following impact and came to rest upside down, burning fiercely.

Debris was spread over several hundred metres. The heavier pieces were close to the main wreckage but the lighter material was blown north along the beach by the prevailing wind. The end of the tail boom with an undamaged tail rotor fell clear of the main wreckage, landing in the surf.

Damage to the main structure was severe. The landing gear skids had separated and broken at



Main rotor head separated from mast. Marks (circled) indicate severe mast bumping.

first impact. The rotor mast was bent in two places due to ground impact and imprints of the blade stops on the mast indicated that severe mast bumping had occurred in flight. Damage to the main rotor blades was extreme, evidence that both blades struck the sand before the cabin impacted. Any remaining integrity of the structure was destroyed by the explosion and subsequent fire.

1.13 Medical and pathological information

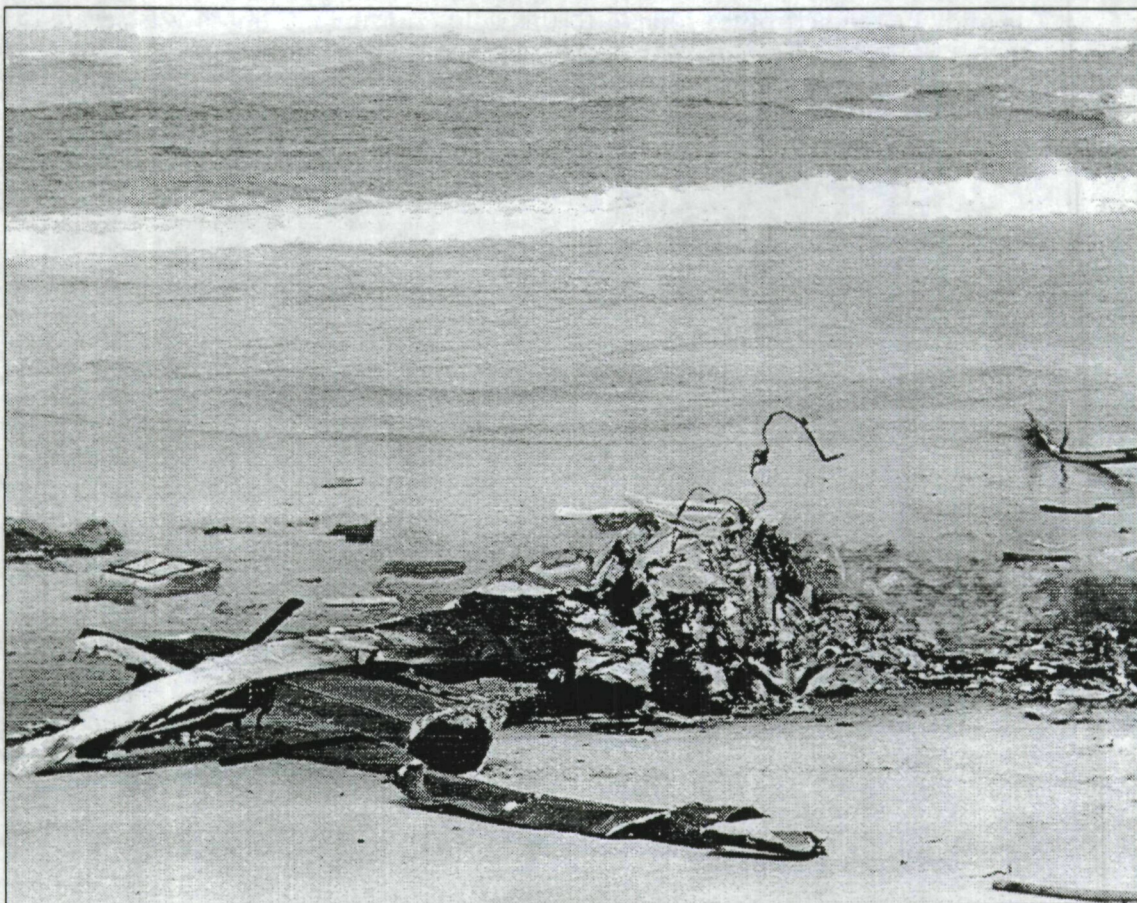
The pilot was suffering from a temporary, undiagnosed heart condition known as myocarditis. The post-mortem examination disclosed an acute condition. Specialist medical advice indicated that the pilot may have experienced serious disturbances of the cardiac rhythm which had the potential to cause loss of consciousness or sudden death.

Myocarditis is quite frequently a secondary trauma associated with a large number of common viral and bacterial diseases. The person involved often does not realise that he/she has this temporary dysfunction. The symptoms of myocarditis may not be obvious, but can include a shortness of breath and severe influenza-type symptoms. The pilot apparently showed no obvious symptoms and did not visit a medical practitioner in the weeks before the accident. However, he did have an uncharacteristic need for additional sleep in the last three weeks of his life. Fatigue is a symptom of myocarditis.

The post-mortem examination did not reveal the presence of any drugs or alcohol. An insignificant level of carbon monoxide was present.

1.14 Fire

An explosion at first impact was followed by a fierce fuel-fed fire. The intensity of the blaze indicated that a significant quantity of fuel was carried in the helicopter's fuel tank. There were no fire-fighting facilities at the site and the remnants of the cabin were destroyed by the fire.



Remnants of burnt out helicopter.

1.15 Survival aspects

It was not possible to calculate the impact forces. However, the extent of structural disintegration at impact with the ground and the subsequent explosion indicated that the accident was not survivable.

1.16 Tests and research

The instruments and annunciator panel of the helicopter were examined in a laboratory. No significant findings were made. A detailed examination of the mechanical components of the helicopter found no indications of pre-impact failures.

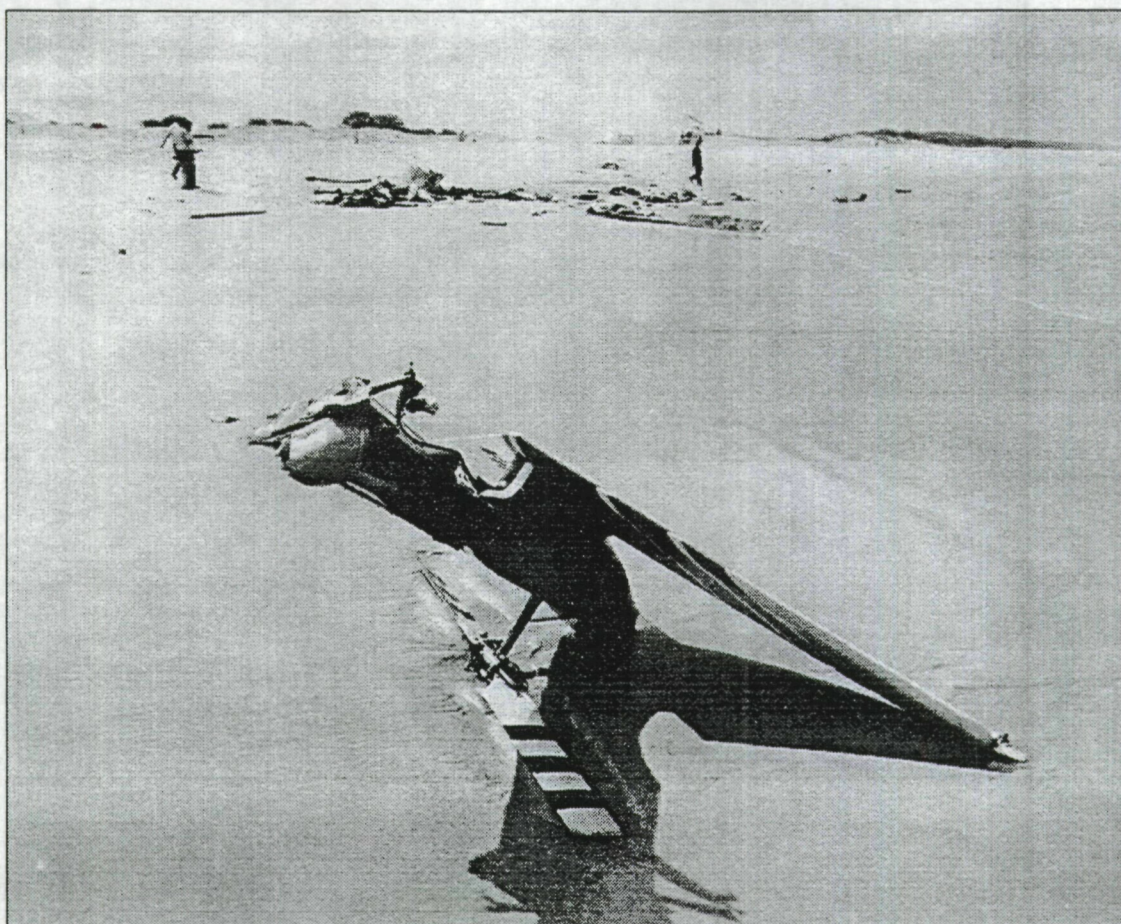
1.17 Additional information

1.17.1 Information from witnesses

A number of witnesses saw the whole of the last 30 s of flight; others saw only the fall to the beach. Some of the witnesses were experienced in helicopter operations, either as pilot or regular passenger. Their observation points varied from the ocean beach of South Stradbroke Island to the Broadwater between the island and the mainland. Their recollections were reasonably consistent. The comment which was prevalent was that the pilot appeared to be performing aerobatics or a stunt. One witness thought that the pilot may have attempted a manoeuvre known as a torque turn.

The helicopter adopted a nose-high attitude which continued past the vertical at its apogee.

The body of the helicopter rotated to the right, and the tail boom was severed before it adopted a nose-down attitude. It then spiralled to the ground, rotating about its longitudinal axis.



Rear section of tail boom complete with rotor. Remainder of wreckage is in the background.

1.17.2 Evidence from check-and-training instructor

The company organised for all its pilots some check-and-training flying with a Grade 1 helicopter instructor. During the first session in January 1991, the pilot's flying ability was below an acceptable standard.

As a result of this poor performance he was taken off the flying roster and scheduled for another check a week later. During this session his flying ability came up to an acceptable standard and he was released for simple operations involving joy-flights. The pilot was scheduled for a follow-up performance check a week after the accident.

The instructor had not shown the pilot any torque turns or wing-over manoeuvres because he considered the pilot was insufficiently skilled.

1.17.3 Torque turn

A torque turn involves the helicopter adopting a significant nose-high attitude and as the airspeed decreases, the anti-torque control is reduced. This has the effect of rotating the body of the helicopter to the right around its mast until the pilot reapplies the anti-torque control. If the manoeuvre is judged correctly, the helicopter is then in a nose-down attitude, accelerating under the influence of gravity. If the manoeuvre is misjudged and the helicopter experiences negative gravity, severe mast bump can occur.

1.17.4 Human factors

An assessment of the pilot determined that he was an industrious and self-motivated individual. He was a long-time employee of the theme park and had impressed people with his willingness and diligence. Following a period of employment in the helicopter hangar, he obtained a company scholarship to train for a commercial helicopter licence. He was well liked by his colleagues and noted as being sensible and mature, if not a little introverted.

There was nothing to suggest that the pilot was under any undue pressure or stress, or that his activities had changed dramatically in the three days prior to the accident. The only uncharacteristic behaviour noted was his failure to get permission from company management to take acquaintances on a free flight.

2. ANALYSIS

2.1 Airworthiness of the aircraft

Examination of the helicopter wreckage and maintenance documentation failed to reveal any abnormalities which could lead to a loss of control.

2.2 Pre-impact manoeuvres

Witnesses observed two manoeuvres immediately before the crash. The helicopter was flown through a right turn which was tight enough to cause distinctive blade slap. Then several seconds of level flight preceded a nose-high climb which continued past the vertical. Once the tail boom had been severed under zero or negative g conditions, the helicopter was probably not controllable, as the main rotor RPM had likely deteriorated below an operational minimum because of the g conditions and the tail boom strike. The witnesses did not observe any change in nose attitude during the helicopter's final plunge.

The vertical manoeuvre had certain hallmarks of an attempt at a torque turn, a manoeuvre the pilot was not sufficiently skilled to perform. The investigation found no evidence of the pilot having attempted such a manoeuvre previously and considering his rather conservative character, it is considered unlikely that he would have attempted a torque turn with a fully loaded helicopter. It is also considered unlikely that he was 'showing off' for his passengers.

2.3 Medical aspects

The pilot was suffering from an undiagnosed, temporary heart dysfunction known as myocarditis, which can lead to loss of consciousness or sudden death. He showed no symptoms other than uncharacteristic fatigue in the weeks prior to his death. The post-mortem examination did not establish whether the pilot suffered an incapacitating event during the accident sequence.

It is possible that the vertical manoeuvre was initiated by the pilot losing control due to an incapacitating event. The lack of change in the helicopter's attitude during its final moments is also consistent with pilot incapacity.

3. CONCLUSIONS

3.1 Findings

1. The pilot was correctly licensed and qualified to undertake the flight.
2. The pilot was suffering from a temporary heart dysfunction which may have caused loss of consciousness or sudden death.
3. This condition was undiagnosed and the pilot may not have been aware of any dysfunction.
4. The helicopter was airworthy and correctly loaded.
5. There was no evidence that the pilot attempted a deliberate manoeuvre.
6. There was no evidence of control interference.
7. The pilot lost control of the helicopter.

4. FACTORS

The reason for the loss of control could not be established.

BASI CONTACTS:

Adelaide

PO Box 20
Rundle Mall SA 5000
Telephone: (008) 011 034
Facsimile: (08) 237 7791
12th Floor
Capita Building
10-20 Pultney Street
Adelaide SA

Brisbane

PO Box 10024
Brisbane Adelaide St
QLD 4000
Telephone: (008)011 034
Facsimile: (07)832 1386
Australia House
12th Floor
363 Adelaide Street
Brisbane Qld

Canberra (Central Office)

PO Box 967
Civic Square ACT 2608
Telephone: (008) 020 616
Facsimile: (06) 247 3117
24 Mort Street
Braddon ACT

Melbourne

Telephone: (008) 011 034
Facsimile: (03) 685 3611
2nd Floor Building 3
6 Riverside Quay
South Melbourne Vic. 3205

Perth

PO Box 327
Belmont WA 6104
Telephone: (008) 011 034
Facsimile:(09) 479 1550
Pastoral House
277-279 Great Eastern H'way
Belmont WA

Sydney

PO Box Q78
Queen Victoria Bldg NSW 2000
Telephone: (008) 011 034
Facsimile: (02) 283 1679
7th Floor
1 Market Street
Sydney NSW

CAIR

Reply Paid 22
The Manager
CAIR
PO Box 600
Civic Square ACT 2608
Telephone: (008) 020 505
24 Mort Street
Braddon ACT