



COMMONWEALTH OF AUSTRALIA

ACCIDENT INVESTIGATION REPORT

BELL 204B HELICOPTER VH-UTW AT
BARRACOUTA PLATFORM ON 22nd MARCH 1968

AIR SAFETY INVESTIGATION BRANCH
DEPARTMENT OF CIVIL AVIATION

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF CIVIL AVIATION

ACCIDENT INVESTIGATION REPORT

HELICOPTER UTILITIES PTY. LTD. BELL 204B HELICOPTER VH-UTW
ON BARRACOUTA PLATFORM, BASS STRAIT, ON 22 MARCH 1968

The investigation of this aircraft accident was authorised
by the Minister for Civil Aviation pursuant to the powers
conferred by Air Navigation Regulation 285(2).

August 1968

Prepared by:

Air Safety Investigation Branch

Melbourne

ACCIDENT TO BELL 204B HELICOPTER VH-UTW

AT BARRACOUTA PLATFORM

22 MARCH 1968

CONTENTS

Section 1	INVESTIGATION	Page
	1.1 History of the Flight	1
	1.2 Injuries to Persons	1
	1.3 Damage to Aircraft	2
	1.4 Other Damage	2
	1.5 Crew Information	2
	1.6 Aircraft Information	2
	1.7 Meteorological Information	3
	1.8 Aids to Navigation	3
	1.9 Communications	3
	1.10 Aerodrome and Ground Facilities	3
	1.11 Flight Recorders	3
	1.12 Wreckage	4
	1.13 Fire	5
	1.14 Survival Aspects	5
	1.15 Tests and Research	5
Section 2	ANALYSIS	
	2.1 Tail Fin Failure	6
	2.2 Tail Rotor Unbalance	7
	2.3 Persons on the Helipad	9
Section 3	CONCLUSIONS	11

BELL 204B HELICOPTER VH-UTW
BARRACOUTA PLATFORM, 22 MARCH 1968

1 - INVESTIGATION

1.1 History of the Flight

1.1.1 At approximately 0800 hours Eastern Standard Time on the morning of 22 March 1968 the Bell 204B helicopter, VH-UTW, owned and operated by Helicopter Utilities Pty. Ltd., commenced transporting a party of twenty-six journalists, photographers and public relations personnel from West Sale Aerodrome in Victoria to Barracouta Platform. Three separate flights were required to transport the party which had assembled principally from Sydney, Melbourne and the Gippsland area of Victoria and was visiting the platform for inspection and photographic purposes. The last group arrived at the platform shortly after midday.

1.1.2 Barracouta Platform stands in approximately 150 feet of water and is positioned over a natural gas recovery drilling point at latitude 38 degrees 18 minutes south, longitude 147 degrees 11 minutes east. The platform is 36 miles east south-east of the West Sale Aerodrome and 13 miles off-shore. Barracouta Platform is jointly owned and controlled by Esso Exploration and Production Australia Inc., and Haematite Petroleum Pty. Ltd.

1.1.3 At approximately 1215 hours VH-UTW took off with a party of television cameramen aboard for a short local flight around the platform for photographic purposes. Approximately five minutes later an approach from the east to the Barracouta helipad was made for the purpose of landing. The helicopter made a normal approach which terminated in the hover position with the heels of the undercarriage pontoons approximately four feet above the helipad surface. From this position directional control was lost and, after making contact with the helipad on the pontoons, it slewed through an arc of approximately 160 degrees in a clockwise direction as viewed from above. The helicopter came to rest on the helipad with its tail fin slightly over-hanging the western edge of the pad (Refer to Appendix A). The undercarriage had distorted in such a way as to allow the main rotor blades to make contact with the helipad surface during the rundown period and this induced a fragmentation of the extremities of these blades. During the period between the initial loss of directional control and the final stopping of the main rotor blades, serious injuries were caused to seven of the eleven members of the press party who were observing the landing of the helicopter from positions on the helipad and on its access stairway. In respect of three persons the injuries proved to be fatal but none of the six occupants of the helicopter was injured.

1.2 Injuries to Persons

INJURIES	CREW	PASSENGERS	OTHERS
Fatal	0	0	3
Non-fatal	0	0	4
None	1	5	

1.3 Damage to Aircraft

The aircraft was substantially damaged.

1.4 Other Damage

Some minor damage occurred to the helipad surface.

1.5 Crew Information

Pilot-in-command of the helicopter was Mr. Wallace Bolton RIVERS, 43 years of age, who held Commercial Helicopter Pilot's Licence No. 34 which was valid at the time of the accident. His total flying experience was approximately 7,900 hours of which 3,200 hours had been gained in rotary wing aircraft including 140 hours on Bell 204B aircraft.

1.6 Aircraft Information

1.6.1 Bell 204B helicopter Serial No. 205D was constructed in the U.S.A. by the Bell Helicopter Company in 1966 and was purchased as a new aircraft by Helicopter Utilities Pty. Ltd., of Mascot, New South Wales. The aircraft was entered in the Australian register on 9 March 1967 and was allotted the letters VH-UTW. The certificate of registration issued at that time was to remain current until 8 March 1976.

1.6.2 VH-UTW is equipped with a single two bladed main rotor and a two bladed tail rotor. It is powered by a Lycoming T5311A turbine engine capable of delivering 1100 shaft horse power. The helicopter was equipped to carry 10 passengers in addition to the pilot and, because substantial over water operations were contemplated, an undercarriage consisting of two multi-cell inflated pontoons was fitted.

1.6.3 A certificate of airworthiness was also issued for this aircraft on 6 March 1967, to remain current until 8 March 1976. At the time of the accident, however, the certificate of airworthiness is deemed to have been suspended by virtue of the provisions of Air Navigation Regulation 34(1)(a). The reasons for this suspension are discussed later in this report.

1.6.4 At the time of the accident VH-UTW had flown a total of 579 hours 56 minutes since new and this included 2 hours 8 minutes flying on the day of the accident. Apart from minor component changes the aircraft weekly servicing logs show no record of any abnormal operation nor of any repairs being carried out to the aircraft since the last 100 hourly inspection on 1 March 1968. Since that date daily inspections had been regularly carried out, the last being on the morning of the accident when the daily inspection was carried out by the pilot who was authorised for the purpose.

1.6.5 Two days prior to the accident the helicopter was washed and on the day prior to the accident it was polished by the engineer responsible for its maintenance. During the polishing operation he detected a crack in the leading edge

of the starboard elevator, which he repaired, although he did not enter this work in the servicing log at that time. On neither of these occasions, however, did he detect any cracking of the tail fin.

1.6.6 On 27 July 1967 the manufacturers of the helicopter notified the need for a special inspection to detect possible cracking of the tail rotor yoke. The inspection was to be carried out at intervals of not more than 100 hours flying time and the method of inspection involved a dismantling of the tail rotor assembly in a properly equipped workshop. In order to comply with this requirement without undue interruption of the aircraft's operating commitments, Helicopter Utilities Pty. Ltd., purchased an additional tail rotor assembly. The tail rotor assembly installed on VH-UTW at the time of the accident was fitted to the aircraft at the last 100 hourly inspection on 1 March 1968 and the helicopter had completed 41 hours 50 minutes of flight time since that inspection.

1.7 Meteorological Information

At the time of the accident the weather conditions in the vicinity of Barracouta Platform were fine with an air temperature of 72 degrees F, the visibility was unrestricted, there was no low cloud and the wind was from the south-south-west at less than 5 knots. The meteorological conditions prevailing were not a significant factor in this accident.

1.8 Aids to Navigation

Barracouta Platform is not equipped with radio navigation aids and their availability or serviceability was not a factor in this accident.

1.9 Communications

Barracouta Platform and VH-UTW were equipped to communicate with each other but these communications are not normally recorded. There is no reason to believe that there were any communications significant to this accident.

1.10 Aerodrome and Ground Facilities

Barracouta Platform is equipped with a steel helipad 60 feet square, outside of which a wire mesh safety net extends for a further 4 feet horizontally around the perimeter of the helipad. It is located 87 feet above mean sea level and access to it is available via a stairway and a flush opening 11 feet long by 3½ feet wide set in the south west corner of the helipad (Refer to Appendices A and B). The helipad is painted yellow and it is equipped with flush lighting for low visibility operations but there are no other surface markings.

1.11 Flight Recorders

VH-UTW was not equipped with either a cockpit voice recorder or a flight data recorder and there is no requirement for Australian registered aircraft of this category to be so equipped.

1.12 Wreckage

1.12.1 The principal wreckage of VH-UTW remained on the helipad and was found close to the western edge facing in an east north-easterly direction. It is apparent from the evidence of eye-witnesses and the score marks on the helipad surface, that the landing approach was made towards the west and, when directional control was lost, the helicopter rotated about a vertical axis through some 160 degrees in a clockwise direction as viewed from above. The two main rotor blades were foreshortened by 2 feet and 5 feet respectively as a result of contact with the helipad deck. The rear-most portion of the tail rotor drive shaft escaped from its installed position and a small section of it, including the lower splined coupling, was found on the helipad surface. It had been severed from the remainder of the shaft, which was not recovered, by a blow probably occasioned by the tail rotor. The one tail rotor blade which was still attached to the tail rotor assembly showed evidence of a blow, on the leading edge, against an object of similar diameter to the tail rotor drive shaft. This blow caused the retaining socket or grip of the other tail rotor blade to split under inertia loads allowing the blade to separate from the assembly. It was recovered from the water immediately adjacent to the platform.

1.12.2 The heavy vertical and twisting forces applied to the undercarriage attachments caused them to fail and two of the port pontoon cells were ruptured. This permitted the fuselage to move from its normal upright position and allowed the main rotor blades to come into contact with the helipad deck. During the helicopter's turning motion in contact with the helipad, damage was also caused to the port elevator and to the tail skid.

1.12.3 It was found that there had been a complete separation of the upper forward portion of the tail fin to which was still attached the tail rotor gearbox and the tail rotor assembly, minus the single tail rotor blade which was recovered from the water. Although this section of the tail fin had separated completely in a structural sense, it was still connected to the helicopter by the pitch change cables which remained intact, holding the separated components immediately adjacent to the remainder of the tail fin. The tail rotor assembly, including the tail rotor gearbox and the tail fin, were removed from the aircraft for further detailed examination.

1.12.4 There was no evidence that any part of the helicopter came into contact with the helipad prior to the loss of directional control and this is confirmed by the weight of eye-witness and photographic evidence available. The evidence also indicates that the helicopter commenced to roll as it descended onto the helipad from a height of approximately 4 feet. There is some conflict, however, in the witness evidence as to the direction of this rolling motion with the greater strength of evidence favouring the proposition that initially the helicopter rolled to starboard. On the other hand, the damage occasioned to the undercarriage and adjacent parts indicates clearly that the heaviest loads were taken on or towards the port side and, certainly, when the helicopter came to rest, the undercarriage had collapsed in this direction. It is probable that the helicopter did initially roll to starboard and first contacted the helipad deck on the starboard pontoon, but without any gross vertical loading. A much heavier

contact on the port pontoon then occurred at the same time as the helicopter was slewing across the helipad. By the time it had rotated through 90 degrees the roll to port was so pronounced that the port elevator tip was in contact with the helipad deck and by the time the fuselage had come to rest the main rotor was striking the deck on the port side of the aircraft. This pattern of movement by the helicopter is completely consistent with a sudden loss of tail rotor thrust or anti-torque control when it was in the hover position immediately above the intended landing point.

1.12.5 An abnormal freedom of movement was found between the yoke and the trunnion in the tail rotor hub assembly and this was measured to be .065 inches. Since a condition of this sort could be a very potent source of damage in the tail rotor area, a careful dismantling of the tail rotor hub was carried out. This revealed that the freedom of movement arose principally from the absence from the assembly of a nylon thrust washer which, in its normal installed position, would have taken up almost the whole of this movement (Refer to item 5 in Appendix E). A search was then made of the area in which the tail rotor hub had been assembled three weeks prior to the accident, and the missing thrust washer was recovered from a recess beneath a bench on the floor of the workshop in this area.

1.12.6 The dismantling of the tail rotor hub also revealed that the two trunnion shim packs (Item 7 in Appendix E) were .027 inches and .049 inches thick respectively and this suggested that, quite apart from any omission of the thrust washer, the trunnion would not have been centrally located in the tail rotor yoke.

1.12.7 No evidence was found of any other defect or malfunctioning in the helicopter which might have contributed to this accident.

1.13 Fire

There is no evidence of in-flight or post-impact fire in this accident.

1.14 Survival Aspects

At the time of the accident all the occupants of the helicopter were secured by seat belts or harnesses which remained intact as did the seat and belt anchorages. The deceleration forces in the impact were not severe and none of the occupants was injured.

1.15 Tests and Research

1.15.1 The tail fin fracture faces were examined by the Aeronautical Research Laboratories with a view to establishing the nature and origin of the structural failure, the extent of the pre-impact failure and the time taken for the crack to propagate. This examination confirmed the view formed earlier that the failure was the result of abnormally high stresses inducing a fatigue propagated crack. It also established a probability that the cracks originated at a Dzus fastener cut-out in the port side cap of the fin main spar. Striation counts carried out at six locations in the fracture faces suggest that the total countable

number was between two hundred thousand and four hundred thousand. If each striation represents one load cycle and each revolution of the out-of-balance tail rotor generates a load cycle, the propagation time of a fracture exhibiting 300,000 striations would have been of the order of three hours flight time assuming an average tail rotor speed of 1600 r.p.m. This estimate contains no allowance for any major arrests in the propagation pattern and it assumes that there was only one point of origin. The significant feature of this conclusion, however, is that the total crack propagation time was of a relatively short duration and this evidence is quite compatible with the pilot's statement that, when he carried out a daily inspection of the aircraft on the morning of the accident, the crack was not visible in the external surfaces of the tail fin.

1.15.2 A puzzling feature of this accident is that the pilot, who had flown this aircraft for approximately 140 hours, received no warning of the impending structural failure during the period immediately prior to the accident when the severe out-of-balance forces in the tail rotor were causing the tail fin structure to crack at a rapid rate. Since this was the only aircraft of its type in Australia there was no possibility of conducting flight tests in the investigation period and the Manufacturer was unable to provide any useful advice as to the vibratory mode likely to be generated or the effect it might have, through the flight control system or through the frame of the helicopter, on the physical senses of the pilot. It is possible that the vibratory mode established was concealed from the pilot by the hydraulic power cylinder installed in the control lines between the cockpit and the rear of the aircraft and by the damping effect of the honeycomb material contained in the tail boom structure.

2 - ANALYSIS

2.1 Tail Fin Failure

2.1.1 It is apparent that the investigation has established the events which took place at Barracouta Platform beyond all reasonable doubt. Apart from the wealth of circumstantial evidence the photographs at Appendices C and D show clearly that there was a structural failure of the tail fin when the aircraft was in the hover position above the helipad, and that this failure progressed from a crack to complete separation of the upper forward portion of the tail fin in a very short space of time. It is equally obvious that such a failure would lead to an immediate loss of drive to the tail rotor thus depriving the pilot of directional control over the helicopter and that this would permit the fuselage to spin under the influence of the torque reaction from the main rotor.

2.1.2 The evidence of the pilot as well as that of the passengers and bystanders indicates that there was virtually no warning of the accident. The pilot, who has considerable experience in rotary wing aircraft, detected no unusual performance quality or vibration prior to the point at which he was deprived of directional control. To the passengers and bystanders the approach of the helicopter to the helipad appeared normal in every respect. There is no evidence that the failure was induced or accelerated by any inadvertent or premature contact of any part of the helicopter with the helipad or any other

external object. The reported and deduced behaviour of the helicopter immediately following failure of the tail fin is completely consistent with the behaviour to be expected in such an event. The action taken by the pilot to immediately reduce power, take necessary fire precautions and supervise the safe evacuation of his passengers was proper and was all he could do in the circumstances.

2.1.3 The metallurgical examination carried out by the Aeronautical Research Laboratories has shown that the ultimate structural failure of the tail fin occurred only after there had been substantial fatigue cracking of both the tail fin spar and the port side skin. It is also apparent that the cracking arose from the application of cyclic loads considerably in excess of those which the tail fin structure was designed to withstand and in excess of those experienced during normal operations in a serviceable aircraft. The metallurgical examination also suggests that the propagation rate of the fatigue crack outside the initiation area was quite high and most of the cracking could well have been contained within the period of flying conducted on the day of the accident. This view is consistent with the evidence of the engineer who inspected the aircraft on the previous day and with the evidence of the pilot who carried out a daily inspection of the aircraft on the morning of the accident.

2.1.4 Inquiries made to the Manufacturer, to the Bureau of Aviation Safety in the United States of America and to military forces operating the same or similar equipment, including the R. A. A. F., and the R. A. N., suggest that this is the first recorded case of an ultimate structural failure of the tail fin in this type of helicopter arising from the propagation of fatigue cracks. There have been several recorded instances of tail fin cracking usually associated with some out-of-balance condition of the tail rotor but, in these instances, the cracking has been detected before a catastrophic structural failure has occurred. Presumably, this has been possible because the out-of-balance condition in these cases has not been severe enough to induce a high rate of crack propagation. Without doubt, however, the most potent source of excessive loads in the tail fin area is an out-of-balance condition in the tail rotor.

2.2 Tail Rotor Unbalance

2.2.1 Earlier in this report, the findings of the tail rotor assembly strip examination have been described including the existence of an uneven distribution of trunnion shims, as well as .065 inches trunnion end float arising from omission of one nylon thrust washer. In combination, these two errors would have permitted the centre of the tail rotor yoke to be displaced from the trunnion centre or drive shaft axis by up to .011 inches in one direction, along the axis of the trunnion, or up to .054 inches in the opposite direction. In addition, since the tail rotor was balanced on a special tool which permitted the yoke centre to be displaced from the balancing axis by up to .004 inches, the centre of gravity of this tail rotor assembly, when installed on the aircraft, could have been displaced from the drive shaft axis by up to .058 inches in one direction or up to .015 inches in the opposite direction. Since the Manufacturer's Maintenance and Overhaul Instructions require the assembly of the tail rotor to be carried out so that the trunnion end float does not exceed .004 inches and the object of the balancing procedure is to ensure that the centre of gravity of the

tail rotor coincides with the drive shaft axis, it is apparent that this assembly fell far short of the Manufacturer's requirements. The shortcomings of the assembly were of a nature likely to produce severe out-of-balance forces whenever the tail rotor was operated.

2.2.2 The evidence of the engineers and pilot who inspected the aircraft indicate that there was no visible cracking on the morning of 22 March and the results of the metallurgical examination tend to confirm this evidence. In view of the fact that the fin failed only 2 hours 8 minutes of flight time later it is apparent that the crack propagation rate was quite high in the final stages before ultimate failure. Having regard to the degree of unbalance existing in this tail rotor and the fact that the load being applied to the tail fin was dynamic in nature the occurrence of a high propagation rate is not a surprising result in a fabricated component of this type. It is somewhat remarkable, however, that such a severe out-of-balance condition was not capable of producing a vibration detectable by the pilot, but this may be characteristic of the particular helicopter type since the tail rotor and elevator control systems contain hydraulic power cylinders and the tail boom contains a substantial section of honeycomb material which would probably have a damping effect.

2.2.3 The maintenance staff who serviced the aircraft on the day of the accident had no previous experience with this helicopter and so they were unable to make any useful assessment of tail boom vibration during ground running. On the morning of the day prior to the accident, however, an engineer who was more familiar with the aircraft, discovered a crack in the starboard elevator which had apparently developed during a 50 minute flight on the previous day. The crack was repaired at that time but, in retrospect, it may have been an indication that a severe vibratory mode had already begun to manifest itself in the tail fin area.

2.2.4 Although the engineering personnel responsible for the assembly of the tail rotor on 28 February 1968 in the Helicopter Utilities Pty. Ltd., workshops at Mascot, had previously dismantled and assembled tail rotors for this type of aircraft, this was the first occasion on which they had to do more than re-assemble the components of the previous assembly. Because a difficulty was experienced in balancing the tail rotor after the first assembly, it was decided to replace the tail rotor yoke with a new one drawn from store and, because of dimensional differences, this involves a re-assessment and adjustment to achieve the required fits and tolerances. Although the engineer supervising the assembly referred to the Manufacturer's assembly instructions, it is apparent that the trunnion bearing shims were adjusted in an attempt to achieve the proper blade grip spacing instead of the blade grip bearing shims (Item 13 in Appendix E) as the instructions require.

2.2.5 The point in the assembly process at which the nylon thrust washer escaped from the tail rotor hub cannot be determined since the engineers involved, understandably, were unable to recall the precise detail of procedures followed in this particular assembly process. The thrust washer was recovered, however, from the workshop area where the assembly took place and there is no doubt that it escaped during this process without being noticed by

any of the engineers involved. It is probable that the .065 inches of play in the tail rotor hub assembly was not detected by the engineer responsible for the installation of the tail rotor on VH-UTW on 1 March or by the persons carrying out the daily inspections and regular servicing of the helicopter because the greasing of the trunnion bearings created an hydraulic lock preventing axial movement of the trunnion under normal check loads.

2.2.6 Paragraph 4.2 of Air Navigation Order 100.4 states that "Overhaul of aircraft components shall be performed in accordance with procedures approved for the purpose by the Director-General" and Note 1 to this paragraph recognises manufacturers' current maintenance and overhaul manuals as being approved documents for this purpose. Since the assembly of this tail rotor did not comply with the Manufacturer's instructions it is apparent that, prior to the accident, VH-UTW had ceased to conform with requirements made under the Air Navigation Regulations in respect of maintenance and inspection and in the terms of Air Navigation Regulation 34(1)(a) it's certificate of airworthiness must be deemed to have been suspended.

2.3 Persons on the Helipad

2.3.1 There is clear photographic evidence that, at the time of the attempted landing which culminated in this accident, there were at least seven persons standing on the helipad deck and at least a further three persons standing on the access stairway with parts of their bodies projecting above the level of the deck. All of these persons could be seen by the pilot during the landing approach.

2.3.2 The press visit to Barracouta Platform was under the control of public relations officers employed by Esso Standard Oil (Australia) Ltd., and Haematite Petroleum Pty. Ltd. It is understood that persons normally employed on the platform are instructed that they must not be on the helipad whilst helicopters are taking off or landing but the evidence shows that no briefing was given to members of the press party in relation to their presence or otherwise on the helipad during landing and take-off operations. Having regard to the nature and purpose of the press visit to Barracouta Platform and the difficulties of accommodating a party as large as this in such a small area, it is not surprising that some of the party were concerned to observe or photograph the helicopter operation onto or off the helipad at close range. It is also apparent that, during earlier landing and take-off operations on the day of this accident some persons were present on the helipad.

2.3.3 Since the helipad on Barracouta Platform is neither a Government nor a licensed aerodrome, nor was it specifically approved by the Director-General, the authority of Helicopter Utilities Pty. Ltd. to use it for landing or take-off operations must stem from general authorisations made by or approved by the Director-General. With one possible exception, the dimensions of the helipad and the circumstances of the landing on Barracouta Platform satisfied the minimum requirements of the Director-General and of Helicopter Utilities Pty. Ltd. The possible exception stems from the fact that there were persons standing on the helipad at the time of this landing.

2.3.4 Over the period 21 to 29 February 1968 an instruction issued by the Director-General under the title of "Authorised Helipads" and referred to as AIP/AGA-5, was posted to some 4,000 addressees including the Operations Manager of Helicopter Utilities Pty. Ltd. and Mr. W.B. Rivers, the pilot of VH-UTW. This instruction described the minimum physical requirements for helipads and the circumstances in which they must be used in order to become helipads authorised under the general description provisions of Air Navigation Regulation 85. Paragraph 1.1(d) of AIP/AGA-5 says, inter alia, "Adequate precautions shall be taken by the pilot to ensure that persons, objects and animals are clear of helipads during landing and take-off operations". In another part of this instruction, the minimum permissible dimensions of a helipad are described but it is the intention of the instruction that, regardless of dimensions, no person should be on any area designated as or intended for use as a helipad whilst a helicopter is landing or taking off.

2.3.5 Since this accident occurred probably within two weeks of receipt by Helicopter Utilities Pty. Ltd., of the AIP/AGA-5 specification of the Director-General's requirements for authorised helipads and, since receipt of these requirements generate a need for the preparation, printing and distribution of carefully worded instructions relating to all of the various helicopter types in use by the Company, it is considered that this accident occurred before the requirements of AIP/AGA-5 could reasonably have been communicated to the pilot by amendment of the relevant Operations Manual.

2.3.6 A copy of AIP/AGA-5 was also posted direct to the pilot, Mr. W.B. Rivers, at the address which he had notified to the Department for this purpose which was c/o Helicopter Utilities Pty. Ltd., P.O. Box 173 Mascot, New South Wales. Although the precise date on which the instruction was received at this address is not known and the situation is compounded by the possible existence of some delays in the delivery of mail at the relevant time, it is clear that Mr. Rivers, whilst acting in pursuit of his employment, would not have been at or near this address at any relevant time between the arrival of the instruction and the accident. It is also apparent that neither he nor his employers had any reliable arrangement to ensure that mail of this type was immediately forwarded to his actual place of employment and, as a result, he obtained his first knowledge of the requirements of AIP/AGA-5 when he returned to Sydney after the accident. Having regard to the uncertainty as to the delivery date of this instruction in Sydney and the further delays implied in any reasonable arrangement to re-address mail of this type to Apollo Bay or West Sale in Victoria, it is not completely clear that this instruction could have come to Mr. Rivers' attention prior to the accident on 22 March. In view of the evidence that Mr. Rivers had not seen AIP/AGA-5 prior to the accident, the doubt that it could reasonably have come to his notice prior to the accident and the fact that Helicopter Utilities Pty. Ltd. did not have a reasonable time to prepare Operations Manual amendments prior to the accident, it cannot be concluded, beyond all reasonable doubt, that this instruction should have been complied with at the time of the accident.

2.3.7 Prior to the implementation of AIP/AGA-5 the authority of Helicopter Utilities Pty. Ltd. to use the Barracouta helipad was derived from the company

Operations Manual and the effective instructions relating to the presence of persons on the helipad were those contained in this manual at Part 2, Section 1, Paragraph 1-16. The first sub-paragraph (b) of this section states that "there shall be an obstruction-free area centred around the touchdown area giving sufficient space for the helicopter to safely manoeuvre. (Obstruction-free means that there shall be no obstructions projecting above the level of the touchdown area)". At a later point in this same paragraph, it says that the pilot-in-command is responsible to ensure that "Adequate precautions are taken to keep all persons clear of helicopter rotors particularly the tail rotor". Since the instructions are not couched in quantitative terms and since the precautions taken by the pilot on this occasion to keep all persons clear of the rotors would have been adequate in the situation of a normal landing it is considered that the pilot's actions in this case were not in obvious disregard of these instructions.

2.3.8 Although the action of the pilot in attempting to land whilst these persons were on the helipad was not patently in contravention of any instruction which had come to his notice, it is considered that the landing should not have been attempted in the circumstances that existed. The party on the helipad was a relatively large one and the individuals in it were not familiar with the needs or dangers of helicopter operations. Standing on the brink of an 87 foot drop into the sea they also had no practical avenue of escape in the event of a hazardous situation arising. Arrangements could have been made for their removal by using the available radio communication channel to the platform and such a request would have met with little opposition since only casual photographs were being taken from the helipad and then only by two or three persons. It is considered that, if the pilot had exercised proper prudence in the interests of safety, he would not have attempted to carry out this landing on Barracouta Platform whilst members of the press party were on the helipad.

3 - CONCLUSIONS

3.1 At approximately 1220 hours E.S.T. on 22 March 1968 a Bell 204B helicopter, registered VH-UTW, crashed onto the helipad serving Barracouta Platform in Bass Strait.

3.2 The aircraft was owned and operated by Helicopter Utilities Pty. Ltd., and, at the time of the accident, was engaged on a charter flight transporting movie cameramen for photographic purposes around the platform.

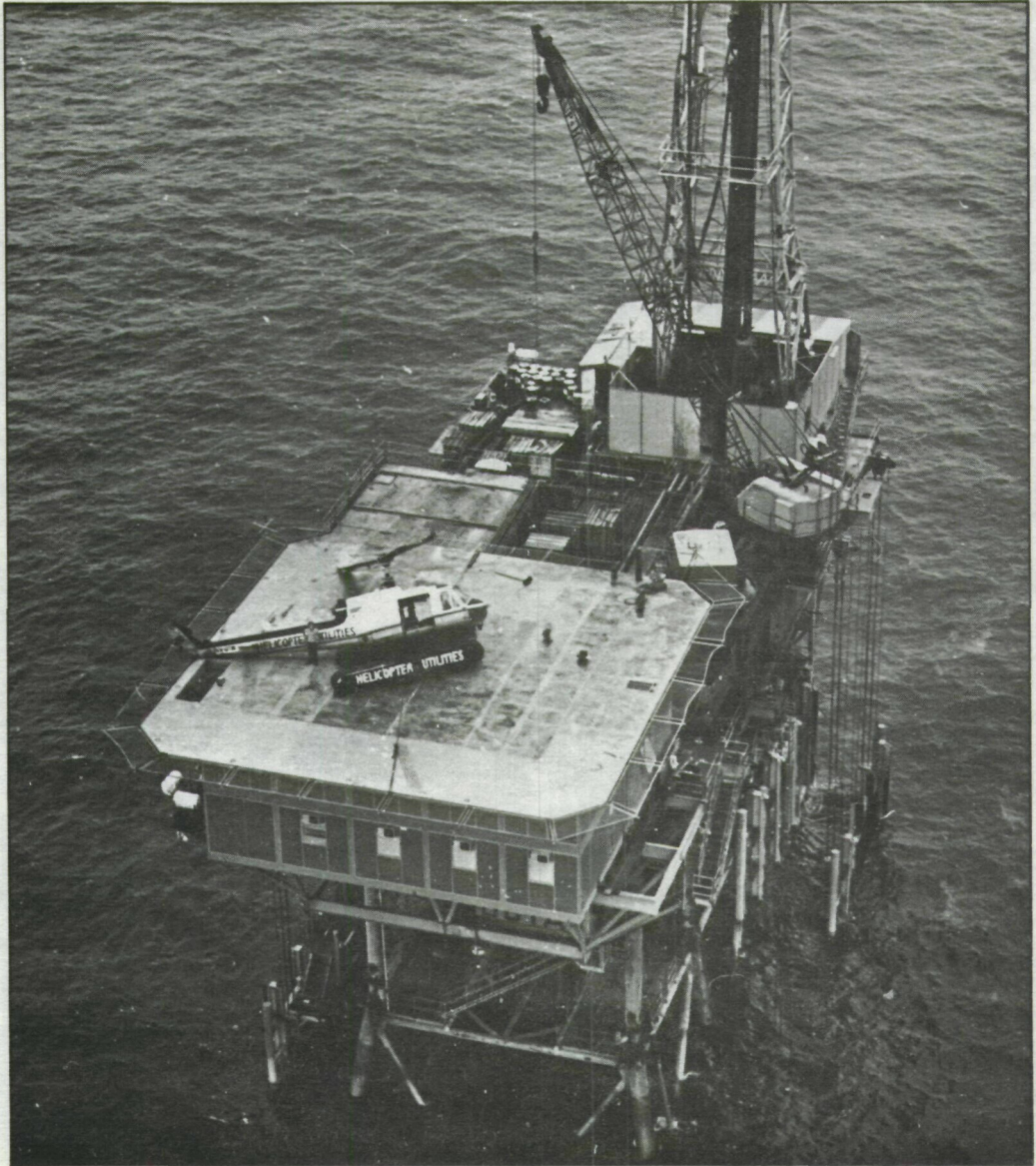
3.3 At the time of the accident the helicopter was being flown by Mr. Wallace Bolton RIVERS and there were five passengers on board. None of the occupants of the helicopter were seriously injured in the accident but seven persons standing on the helipad were seriously injured, three of them fatally, when they were struck by components of the helicopter.

- 3.4 The helicopter was substantially damaged by impact forces and there was minor damage to the helipad.
- 3.5 The pilot, Mr. W.B. Rivers was 43 years of age and holds a commercial helicopter pilot licence. At the time of this accident, his total flying experience was approximately 7,900 hours of which some 3,200 hours had been gained on rotary wing aircraft, including approximately 140 hours on the Bell 204B type.
- 3.6 The helicopter was loaded within safe limits.
- 3.7 Although there was a certificate of airworthiness current in respect of VH-UTW at the time of this accident, in accordance with Air Navigation Regulation 34(1)(a), it is deemed to have been suspended at that time because the aircraft had ceased to conform with requirements made under the Air Navigation Regulations for the maintenance and inspection of component parts.
- 3.8 During the assembly of the tail rotor, which was fitted to the aircraft 41 hours 50 minutes of flight time prior to this accident, a trunnion thrust washer was omitted and, as a result, the trunnion end play was substantially outside the maximum tolerance specified by the Manufacturer.
- 3.9 It is probable that, during the assembly of the tail rotor, an attempt was made to achieve a proper blade grip spacing by transposition of the trunnion shims instead of by the proper method of adjusting the blade grip bearing shims. This procedure would have displaced the trunnion centre from the position of co-incidence with the yoke centre intended by the Manufacturer.
- 3.10 These assembly errors and, in particular, the omission of the thrust washer, led to a gross tail rotor unbalance which induced abnormal loads in the tail fin resulting in substantial cracking of the tail fin structure. In this condition it was unable to withstand the loads imposed when the aircraft came into the hover position for this landing. The tail fin then failed, allowing the rear section of the tail rotor drive shaft to uncouple and thus the pilot was deprived of directional control at a critical stage of the landing.
- 3.11 It is probable that all or most of the crack in the tail fin was induced during the time in which the helicopter was being operated earlier on the day of the accident.
- 3.12 Although the action of the pilot in attempting to land whilst persons were standing on the helipad was not in contravention of any instruction of which, beyond all doubt, he should have been aware, it is considered that his action reflected the acceptance of an unsatisfactory level of safety. Since the presence of these persons on the helipad was not essential to the operation, the landing should not have been attempted in the circumstances that existed.

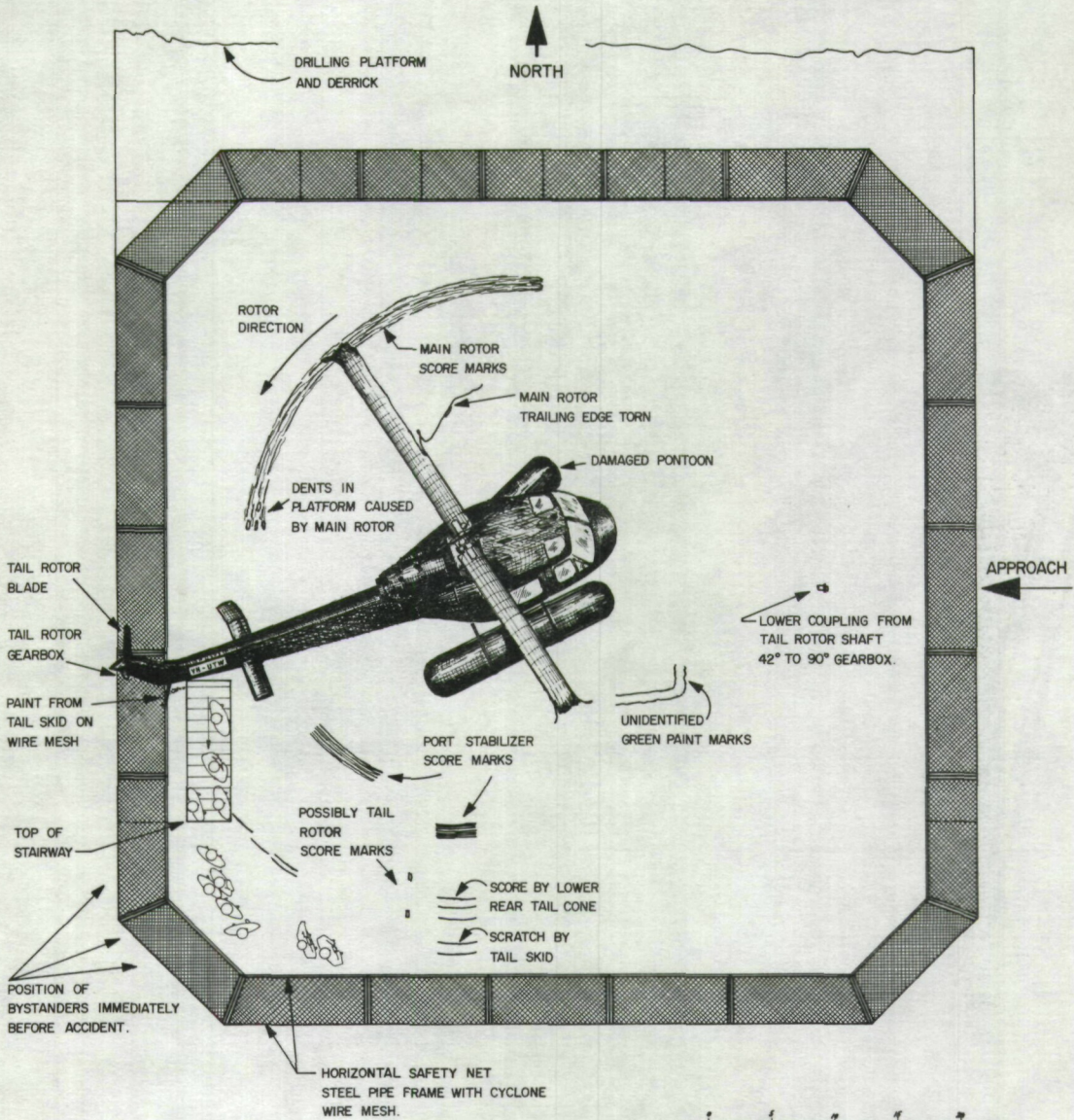
3.13 The pilot made a normal approach for landing and, when the aircraft was hovering with approximately four feet of clearance above the centre of the helipad deck, a catastrophic tail fin structural failure suddenly occurred, and deprived the pilot of directional control. The helicopter descended quickly onto the helipad deck and slewed through approximately 160 degrees about a vertical axis. During and immediately subsequent to this circumstance the principal injuries to bystanders occurred as a result of them coming into contact with the rotors or with pieces separating from the main rotor as it came into contact with the helipad deck.

3.14 The cause of this accident was that, during the assembly of the tail rotor, the inadvertent omission or loss of a trunnion thrust washer was not detected.

APPENDIX A



View of Barracouta Platform showing the position at which
VH-UTW came to rest on the helipad.



NOTE - HELIPAD DIMENSIONS 60' X 60' NOT INCLUDING 4' SAFETY NET.

ACCIDENT TO BELL 204B ON BARRACOUTA RIG

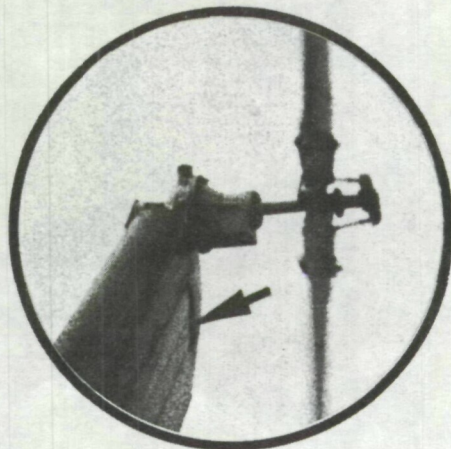
22nd MARCH 1968

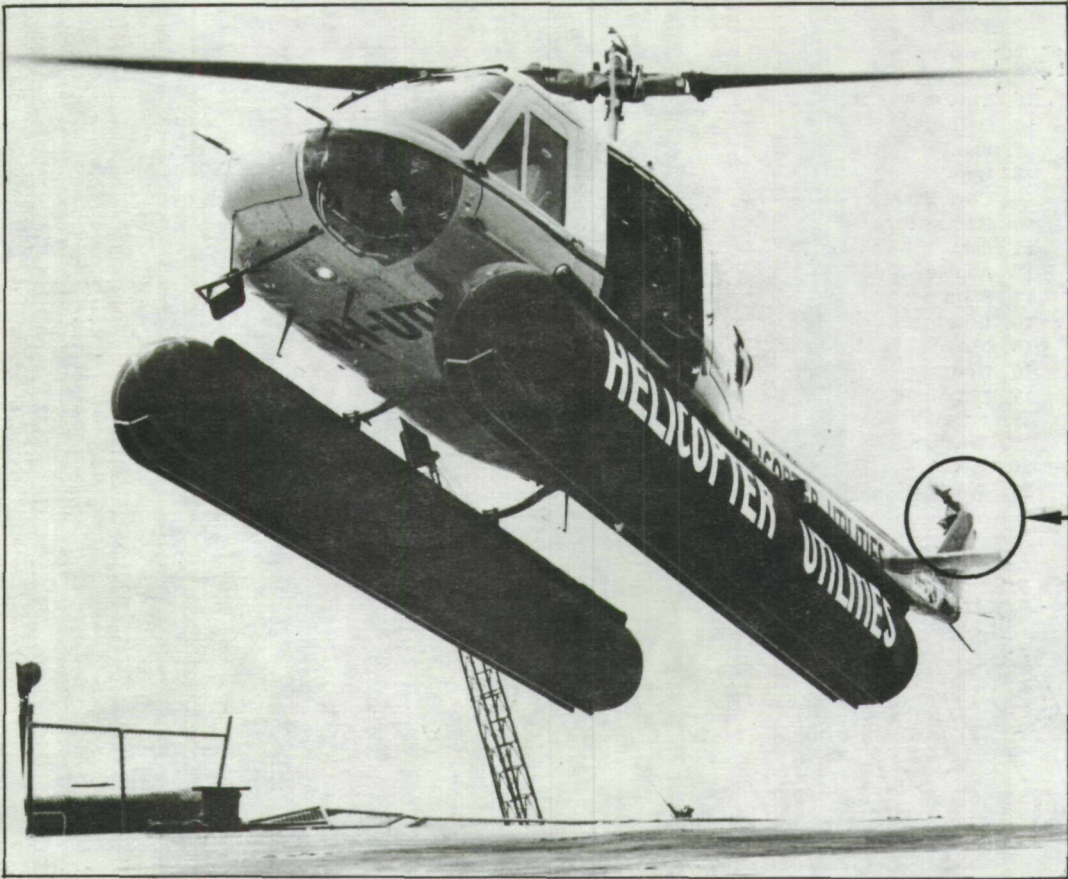
DIAGRAM SHOWING FINAL RESTING POSITION
OF HELICOPTER AND SIGNIFICANT IMPACT MARKS
ON THE HELIPAD

APPENDIX C

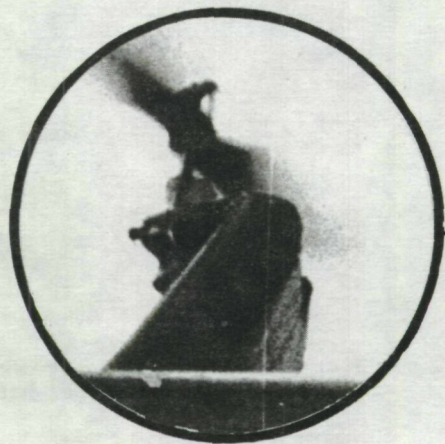


View of VH-UTW some ten feet above the helipad. The arrow points to the fatigue crack in the port side of the tail fin opened under flight loads imposed by rotor thrust.



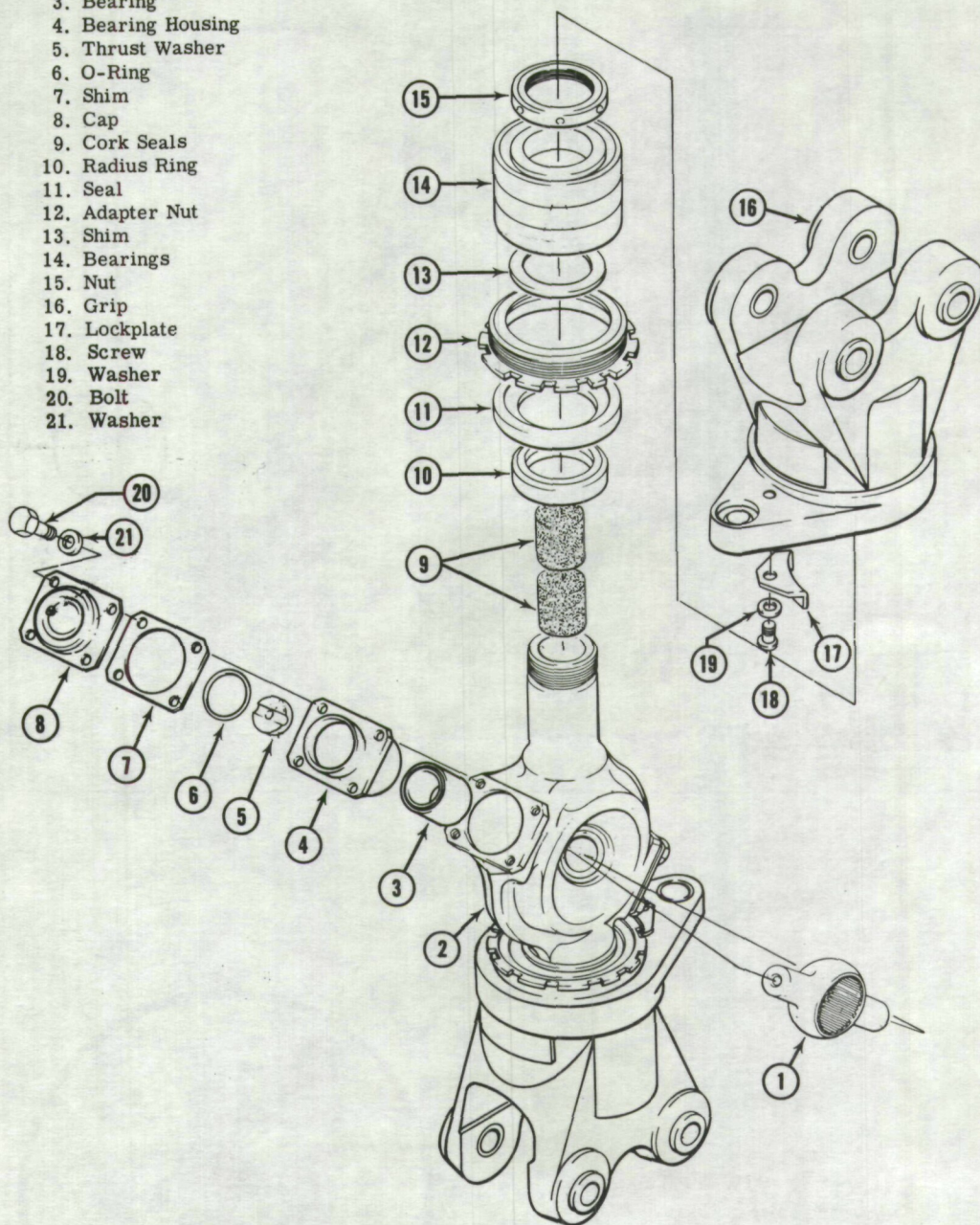


View of VH-UTW some four feet above the helipad. The inset view shows the upper forward portion of the tail fin separating with the tail rotor and tail rotor gear box attached.



APPENDIX E

1. Trunnion
2. Yoke
3. Bearing
4. Bearing Housing
5. Thrust Washer
6. O-Ring
7. Shim
8. Cap
9. Cork Seals
10. Radius Ring
11. Seal
12. Adapter Nut
13. Shim
14. Bearings
15. Nut
16. Grip
17. Lockplate
18. Screw
19. Washer
20. Bolt
21. Washer



Assembly drawing of the tail rotor hub showing the several component parts and their proper positioning relative to each other.

