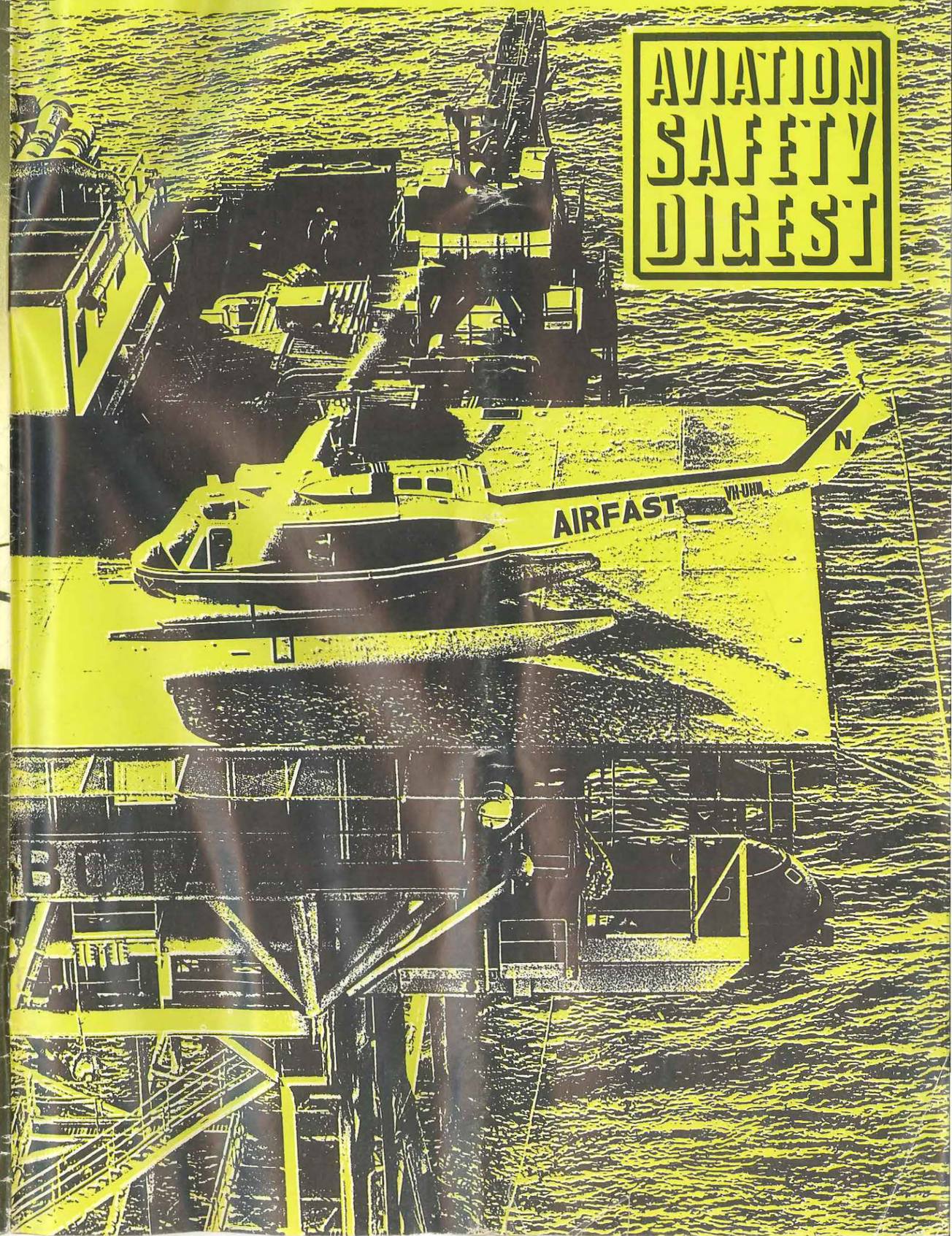
Number 86 September 1973 DEPARTMENT OF CIVIL AVIATION

AVIATION SAFETY DIGEST



Cover Story

Flying The Rigs

TOP:
The end of the day! With a capacity load of workers returning from the rigs, a Bell 205 crosses the coast enroute for a late afternoon landing at Longford.

LEFT and RIGHT:
Seeing both sides of the picture: A Bell 205 overflies the rig at Barracouta on its way to Marlin as another 205 prepares to lift off.

Scattered across the cold and often boisterous southern waters of Bass Strait, off the south-east coast of Victoria, stand six lonely oil and gas platforms, producing crude for Australian refineries as well as natural gas for domestic and industrial use in the city of Melbourne.

Servicing remote and inaccessible rigs with men and supplies is no new problem to the oil industry and, as in other parts of the world where sea conditions and unpredictable weather can seriously upset the schedules of surface vessels, the helicopter was the obvious answer.

When drilling of the Bass Strait field first began from the exploration ship "Glomar III" in the early sixties, Ansett-ANA were asked to undertake the task, and two 3-passenger Bell 47J helicopters were based at nearby Bairnsdale Aerodrome. But as the field developed, the demand for helicopter capacity increased vastly. So it was that, early in 1968, the specialist helicopter operations group, Helicopter Utilities Pty. Ltd. assumed responsibility for the work, with five aircraft operating from a specially developed heliport on the coast at Longford, the shore base for the Bass Strait field. A subsidiary of the Airfast group of companies, Helicopter Utilities at Longford, now operate one Bell 204, four Bell 205's and a Bell 206 in daily services to the offshore rigs. On their Longford staff are ten highly experienced pilots and sixteen licensed aircraft maintenance engineers.

Dawn comes early to the Longford base, with the first scheduled flight departing at 0645; others follow throughout the day and additional services to the different rigs are flown as required.

The base's "peak hour" comes each morning with the 0730 schedule, when the departure lounge is packed with work crews. In true commuter fashion, they either talk or read their newspapers. To these men there's nothing strange about being flown to work—it's just an efficient means of getting to the job. Passengers are booked on their flight as they enter the terminal and, as the departure time nears, all is ready. Then the PA system comes to life to announce the flights:

"Golf to Barracouta and Halibut, November to Marlin, and Alpha to the Kingfish platforms. Board your helicopters please!" Everyone stirs and quickly the lounge is deserted. Soon the whine of starting turbines pierces the stillness of the morning. Now rotor's are spinning up and the massive blades slice into the air with their characteristic "chop, chop, chop...." Gracefully, one by one, the aircraft lift into flight and set off towards the sun that is just breaking the eastern horizon.

The day has begun, and though all is now quiet at the base again, behind the scenes well-ordered preparations are going on for the rest of the day's flying. It is by no means a small operation—frequently 50 passengers and more are uplifted in this one morning sortie alone.

Statistics show the true extent of the operation. For the year ending last April the base handled 11,895 flights, amounting to an overall flight time of 5,084 hours. The passengers carried totalled 54,813, and as well 422,525 lbs. of cargo was uplifted—no mean achievement for any general aviation operation!

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OUT OF EVERYTHING

The investigation of the fatal accident discussed on these pages has brought to light some insights into what might well be common pilot attitudes to the operation of light aircraft on cross-country flights. Because it resulted in the death of two passengers, as well as serious injuries to the other two occupants of the aeroplane, the accident attracted a good deal of attention and discussion amongst the general aviation fraternity. Yet it has to be recognised that it is but one of a growing number of fuel exhaustion accidents and incidents that are occurring to light aircraft throughout Australia.

In many of these other cases it seems purely fortuitous that there have not been far more serious consequences. Indeed, it could probably be said that in every other instance, only the fact that the aircraft has happened to be over terrain on which some sort of forced landing could be made, has prevented similar catastrophes.

The fact that so many others have experienced fuel exhaustion in flight, yet escaped virtually scot-free, should not blind us from seeing that there may be mistaken but wide-held beliefs and attitudes contributing to this situation. At the very least, there are obviously a number of pilots, particularly those in the private category, who can learn much from the investigation of this particularly unfortunate accident.

THE circumstances of the flight itself are not of great significance in this context; rather the message of the accident concerns some vital aspects of what was entailed in the conduct of that flight. But before discussing these aspects, just a brief outline of the flight itself will help to set the scene in the reader's mind.

The pilot, the holder of a private licence, had planned to fly his Cherokee 180 non-stop from Bankstown N.S.W. to Archerfield Qld. The forecast he obtained at Bankstown indicated that the wind would be from the south-east at 20 knots, there would be five-eighths of cumulus cloud with bases between 2500 and 3000 feet, and the visibility was expected to be good but diminishing to five miles in showers. The flight departed at 0954 hours and its ultimate ETA Archerfield was 1358 hours. Three minutes before this ETA, and less than a mile short of its destination, the flight came to a disastrous end in the front garden of a suburban house. Two of the passengers were killed and the pilot and the other passenger were seriously injured.

The pilot said later that the fuel pressure had suddenly dropped to zero and the engine had lost all power, when he was on descent less than two miles short of Archerfield Airport. There were no suitable forced landing areas available and he had continued towards Archerfield. Two minutes later, when it became obvious that he would be unable to reach the aerodrome, he attempted to land in a suburban street, but the aircraft struck power lines and crashed.

An extensive examination of the engine and fuel system showed that they were capable of normal operation before impact and no evidence was found to establish that there was any more than unusable fuel in the aircraft's tanks at the time of impact. The factors emerging during the investigation which warranted additional attention fell within the categories of flight planning, fuel management, and forced landing technique.

Flight Planning

The pilot had planned the flight using a fuel consumption rate of eight Imperial gallons per hour at cruising levels of 5500 and 6500 feet. Reference to some of his earlier flight plans, showed in fact, that it was his practice to flight plan at this consumption rate, regardless of the height at which he would be flying. The pilot said that he had never experienced a fuel consumption rate of greater than eight GPH, and had flown the aircraft between Bankstown and Archerfield several times without refuelling enroute. Indeed, only two weeks before the accident, he had flown from Archerfield to Bankstown without refuelling and, at the conclusion of the flight, 33 gallons of fuel had been required to refuel the tanks. This meant that there would have been approximately eight gallons remaining at the conclusion of this flight.

During the flight on which the accident occurred, the flight time to the point of engine failure was 242 minutes and, at eight GPH, the aircraft should have used only 32 to 33 gallons. In other words, according to the pilot's calculations, there should have been nine gallons still remaining.

A detailed analysis of the flight from Archerfield to Bankstown two weeks before the accident, showed that although the aircraft's *average* fuel consumption would have been just on nine GPH, approximately half the flight was made at 7500 feet with the mixture leaned, during which the fuel consumption would probably have been about eight GPH. But as the remainder of the flight was made below 5000 feet with the mixture in the rich position, the fuel consumption during this time would have been considerably higher. A further detailed examination of other flying times and fuel consumption records kept by the pilot, showed in fact that, while the aircraft's actual average fuel consumption for flights above 5000 feet, with the mixture leaned, was 7.5 to eight GPH at 75 percent power which the pilot normally used, the average consumption on flights below 5000 feet with the mixture in the fully rich position, was nine to 9.5 GPH. But, as most of the pilot's more recent cross-country flights had been conducted at heights greater than 5000 feet, this could perhaps explain the pilot's belief that he had never experienced a fuel consumption greater than eight GPH.

It was learned that, from the time the aircraft was refuelled to full tanks at the conclusion of the flight from Archerfield two weeks before the accident, the aircraft remained hangared at Bankstown until the day before the flight on which the accident occurred. On this day the pilot carried out a brief circuit to test the radio, after which he inspected the fuel level,

and estimated that about two gallons would be needed to top up the tanks again. Because of the load he was carrying on the flight to Archerfield the following day however, the pilot decided not to refuel.

To accurately determine the amount of fuel actually on board the aircraft at the time of its departure from Bankstown, as well as the aircraft's likely fuel consumption during the different phases of the flight to the point of engine failure, a number of carefully controlled tests were conducted, using another Cherokee 180, loaded in a manner to simulate the load carried by the aircraft involved in the accident.

The tests indicated that, after refuelling was completed at Bankstown following the earlier flight from Archerfield, there would have been about 39.9 Imperial gallons of usable fuel on board the aircraft. The amount of fuel used for the brief circuit at Bankstown the day before the accident should have been slightly over one gallon, so that, on the day of the accident, there would have been a little under 39 gallons on board. The amount of fuel used during taxi, takeoff, and climb to 3000 feet on departure from Bankstown, would have been 1.5 gallons. During the flight the pilot had cruised at heights between 2300 and 3000 feet and it was determined that, at these heights the fuel consumption should have been just under 9.4 GPH with the mixture rich. It was found however, that by leaning the mixture, the fuel consumption at these heights could be reduced to 7.75 GPH. During its descent from 3000 feet to the altitude of 1400 feet at which the engine failed, the aircraft would have used slightly less than one gallon. It was also found that the amount of unusable fuel in the tanks would not have been in excess of the figure shown in the aircraft's flight manual.

Altogether, the tests showed that if the test aircraft had undertaken the same flight, under the same conditions, as the aircraft involved in the accident, it would have had only one gallon of usable fuel remaining when it reached the position of the other aircraft's engine failure. By contrast, if the test aircraft had made the same flight, but with the mixture leaned, it would have arrived at the point of engine failure with just over seven gallons remaining.

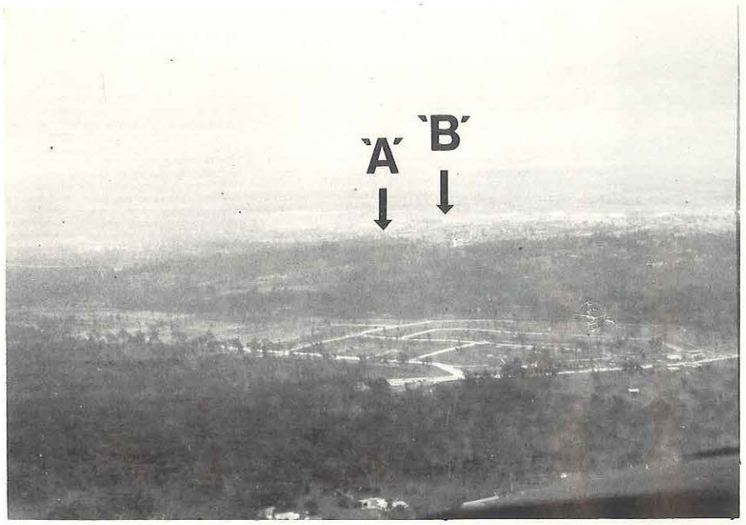
Another significant point noted during the tests, was the response of the fuel gauges on the test aircraft. During one test, in which slightly over four and a half Imperial gallons were used, the fuel quantity gauges indicated a decrease of only about one US gallon. On another test, during which four Imp. gallons were used, the fuel gauges indicated a decrease of only between half and one US gallon.

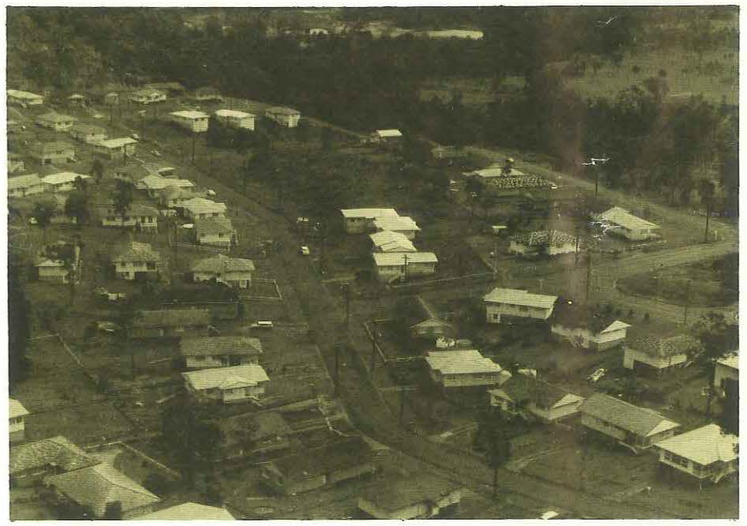
Fuel Management

If the enroute fuel consumption was significantly greater than planned, it must now be asked why the pilot did not detect the approaching critical situation, and refuel at one of the enroute airports such as Coffs Harbour, Casino or Coolangatta. There was no sense of urgency associated with the flight, so that the extra time for refuelling would not have inconvenienced anyone. In such circumstances, it seems hard to imagine that the pilot would have continued with the flight if he had been the least bit apprehensive about the fuel remaining. Surely the only possible explanation is that, at no stage, or at least not until some distance past Coolangatta, did the pilot consider that he would have less than adequate fuel to complete the flight.

Apparently when the pilot was undergoing his initial training on Cessna 150 aircraft, he had been told, or had interpreted an instructor's comments to mean, that the mixture should not be leaned below 5000 feet. This had influenced his flying of the Cherokee and when cruising below 5000 feet, it was his practice not to lean the mixture. As already mentioned, the pilot had planned to cruise at heights of 5500 feet and 6500 feet with a fuel consumption of eight GPH. Presumably if he had in fact cruised at those heights, he would have leaned the mixture and would have achieved a fuel consumption of that order. In the event however he cruised at a lower altitude, and the transcripts of the aircraft's communications indicated that this varied between 2300 and 3000 feet.

It seems the pilot believed that, in cruising below 5000 feet with the mixture rich, the fuel consumption would not differ greatly from that to be expected above 5000 feet with the mixture leaned. This belief was based not





OPPOSITE PAGE – TOP:
Photograph taken during investigation from point at which engine failed, showing (A) accident site and (B) Archerfield aerodrome. Note the lack of suitable forced landing areas within gliding distance.

CENTRE:
Aerial view of street in which pilot attempted to land. The direction of approach was towards the camera. The point at which the wreckage came to rest was in the front garden of the house in the very centre of the picture, outside which a car can be seen parked at the kerb side.

BOTTOM:
The scene of the accident shortly after it occurred. Note the proliferation of power lines surrounding the area in which the forced landing was attempted.

only on the fuel consumption figures he believed he had experienced on past flights, but also on the fuel consumption figures he obtained from the Piper Cherokee C owner's handbook, and he pointed out that the owner's handbook specified a fuel consumption of eight Imp. GPH for a 75 percent-3000 foot cruise power setting.

It was found however, that the pilot had obtained a copy of the owner's handbook only the day before the flight on which the accident had occurred and he erroneously believed this figure of eight GPH was for a cruise power setting with the mixture rich. The fuel consumption charts in the handbook show that the figures quoted are for operation with the mixture leaned. There is little doubt that the pilot was well and truly conditioned to the belief that the aircraft's fuel consumption was in the order of eight Imp. GPH when cruising at 75 percent power, regardless of whether the mixture was leaned or not. Thus in deciding to cruise at about 3000 feet, in full rich rather than at 5500 to 6500 feet with the mixture leaned, it is unlikely that the pilot would have given a great deal of consideration to the increased fuel consumption.

But regardless of the precise quantity of fuel on board the aircraft on departure from Bankstown, or the fuel consumption the pilot expected on route, the fact remains that for at least the last hour of the flight, the fuel gauges should have given some indication of approaching fuel exhaustion.

If, as indicated by the tests. the enroute fuel consumption was about 9.5 GPH, the total fuel remaining when the aircraft would have been abeam Coolangatta should have only been a little over three gallons. From Coolangatta on to Archerfield there was still another 23 minutes to be flown, and in these circumstances it is difficult to understand any pilot continuing past an aerodrome where fuel was available. The question must therefore be asked, why was the situation not apparent to the pilot? During his account of the flight, the pilot said that he had kept an eye on the fuel gauges, making mental calculations of the quantities indicated against the time flown, and he believed the fuel consumption to be fairly normal. The investigation therefore set out to determine if there could be any ex-

planation for the pilot not detecting the aircraft's low fuel state.

As well as the possibility that inaccurate fuel gauge indications, as suggested by the flight tests, could have misled the pilot during his enroute fuel consumption checks, another likely source of error was discovered during the investigation.

On the instrument panel of the aircraft, below the fuel gauges, there was a placard which had been placed in the aircraft some four years before the pilot purchased it. The placard was apparently intended to be a US-Imp. gallons conversion card but was ambiguous because, while the gauges were each marked with six graduations of five US gallons each, the placard made reference to only five graduations, thus: E — 5.25 — 10.5 — 15.75 — 21 IMP GALS. (See photograph.) The gauges showed the capacity of each tank as 25 US gallons, but only the first, third and fifth graduations from the empty positions were marked in figures, reading 0, 10 and 20 respectively. The pilot had correlated the five placard references to the first five graduations on the fuel gauges, therefore any enroute fuel consumption and fuel remaining checks he made would have been dangerously optimistic. In other words when the pilot thought the tank contained 21 Imp. gallons, it would have in fact contained only 16.6, and only 12.45 when he thought it contained 15.75 and so on. Naturally this error would have been further compounded if the fuel gauges did not accurately indicate fuel usage, as in the aircraft used during the tests.

If it is accepted that the aircraft's actual average fuel consumption for the flight was 9.5 Imp. GPH, it is possible to calculate the probable fuel remaining when the aircraft reached Grafton, at which point the pilot decided to divert from the direct route via Casino to proceed coastal via Coolangatta because of cloud on the ranges. In making this decision, he would have had to be sure that he had sufficient fuel for the extra flying time involved. At Grafton therefore, even if at no other point during the flight, he would probably have made some sort of calculation of the fuel required to complete the flight as well as the actual fuel remaining in the tanks.

Using the figure of 9.5 GPH, the fuel remaining at Grafton would have been 12.1 Imp. gallons, giving a total fuel indication of 14.5 US gallons on the gauges, distributed between the two tanks. But if, as has already been suggested, the pilot was misled by the placard, he could have interpreted the total fuel remaining as a little over 15 Imp. gallons, to cover the remaining 79 minutes of flight. At this point, the pilot would probably have either calculated his remaining endurance at his flight planned consumption of eight GPH, or worked out an enroute fuel consumption in order to calculate the remaining endurance. In either case, he could have gained the impression that he had a margin of fuel for the remaining flying time, which included a descent from 3000 feet at reduced power.

Another point to be considered during the investigation of these aspects was the matter of parallax error, and the width of the fuel gauge needles. The needles are each equivalent in width to 1.6 US gallons on the gauge and gauge graduations are half the width of the needles. As the fuel gauges are mounted on the right hand side of the instrument panel, almost directly in front of the front seat passenger, any parallax error would produce an apparent increase in the fuel indication as seen from the pilot's seat. A practical test indicated that if the pilot did not lean across in order to eliminate parallax error, a feat difficult with the right hand seat occupied by a large passenger, he could overread each gauge by as much as one to 1.5 US gallons. The parallax error was greatest when the fuel needle was in its central position, indicating about 12.5 US gallons.

It seems by no means improbable that the factors mentioned, either singularly or together, could have resulted in an over-assessment of the fuel remaining and led the pilot to believe during his enroute calculations, particularly those made at about his Grafton position, that he would land at Archerfield with his 45 minutes fuel reserve intact. Later during the flight when the aircraft was over Coolangatta, there would have been about 3.3 Imp. gallons remaining and the gauges would probably have read 4 to 4.5 US gallons. To the pilot, using the placard, this could have meant about five Imp. gallons or even six if the possibility of parallax error is accepted. In these circumstances, bearing in mind that less than an hour earlier, the gauges had indicated sufficient fuel plus 45 minutes reserve, and that by this time the aircraft was, in the pilot's own words 'not behind the flight plan', it is possible that the pilot would have disregarded the gauge indications.

Once he had continued past Coolangatta towards Archerfield, any further misgivings he might have had regarding the fuel gauge readings, would tend to be dismissed because he was now committed to either continue to Archerfield or return to Coolangatta. But as there was quite a strong wind from the south-east and the pilot knew that the latter part of the flight would be made on reduced power as the aircraft descended, the temptation would have been to continue and hope that the fuel gauges were incorrect. Calibration tests conducted on the aircraft's left hand gauge after the accident showed that it actually read 1.5 US gallons when it was empty, which to the pilot, because of the placard, probably meant 1.5 Imp. gallons or even two, allowing for parallax error, and it is probable that at no stage from Coolangatta onwards did he think he was going to run out of fuel. Certainly the pilot might have thought that he was going to 'cut it fine', if the gauges were correct, but he obviously did not think there was sufficient reason to carry out a precautionary landing. Together these factors could explain why the pilot was misled to think that he had adequate fuel with which to complete the flight.

RIGHT:
Portion of the aircraft's instrument panel showing the ambiguous fuel conversion placard affixed below the fuel gauges.

Forced Landing Aspects

The final question to be resolved is whether, after experiencing a complete power failure, the pilot should have disregarded any thought of continuing towards Archerfield and spent the limited time available carrying out a forced landing on the most suitable site available in the immediate area. As events proved, his attempt to reach the aerodrome was in vain, but this decision is perhaps understandable even though one of the fundamental requirements when faced with a forced landing is that the selected field must be within easy gliding distance. From the evidence, it seems likely that by the time the pilot realised that the engine failure was not one which could be easily remedied, his aircraft was at some 1400 feet descending at about 70 knots approximately three miles from the aerodrome. Looking at the photograph taken from this position, it is evident that the surrounding terrain is anything but good for a successful forced landing, and as the pilot estimated that he was only one and a half miles from the airport, it was not an illogical decision, taking into account the strong following wind, to continue towards the only really suitable forced landing area. There is little doubt that his decision would have been coloured by the thought that a forced landing on the area immediately available would probably be more in the nature of a 'controlled crash'. Indeed, had the aircraft actually been at the distance the pilot estimated, it is possible that he may have just 'scraped in', and the fact that he did not attempt to make a forced landing on the terrain available, can thus be attributed to an incorrect assessment of gliding distance, rather to any disregard for the principles of forced landing procedure.

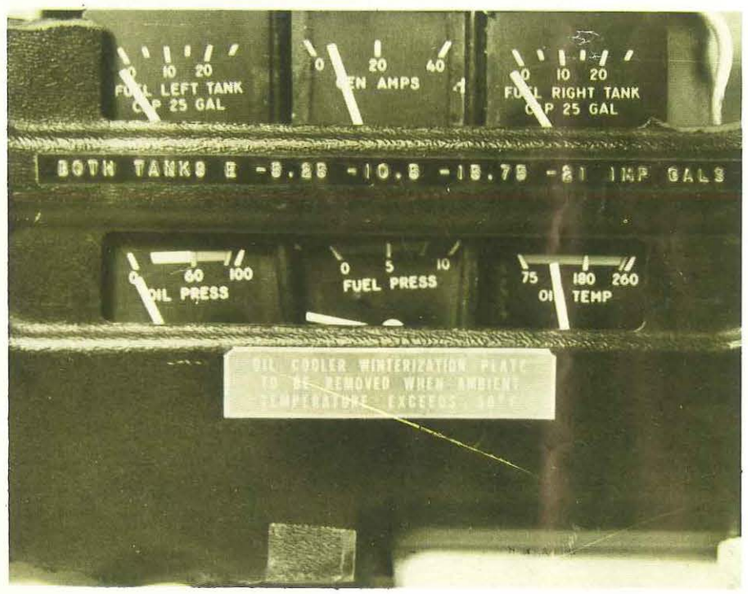
Lessons to be learned

This sudden catastrophic ending to what seemed a normal, pleasant, and uneventful cross-country flight, like other, fortunately less tragic, accidents and incidents that have occurred in recent months, demonstrates how important it is to have an accurate knowledge of an aircraft's fuel consumption under various operating conditions.

Whenever possible, it is obviously desirable for pilots and operators of light aircraft, to carry out fuel consumption checks at different operating powers, altitudes and mixture settings, in order to gain a full appreciation of the variations in fuel consumption rates. The advantages of such an appreciation, enabling pilots to quickly detect inaccurate fuel gauge indications or abnormal fuel usage, should need no further emphasis.

There is also an obvious need for pilots to have a thorough understanding of the mixture leaning procedures applicable to the aircraft they fly. Most modern light aircraft engines are equipped with manually operated mixture controls, and pilots have a responsibility to understand the fundamentals of engine operation in order to use the mixture control properly. It is proposed to cover this subject in some detail in an article on engine handling in the next issue of the Digest.

The ambiguous fuel conversion placard installed in the aircraft involved in the accident, draws attention to the need to ensure that the data contained on such placards is not only accurate, but also that it is presented in a manner which allows no possibility of being misinterpreted.



Cause

The probable cause of the accident was that the pilot did not apply fuel management and fuel mixture control procedures essential to the safe conduct of the flight in the existing operating conditions.

CATASTROPHIC CORROSION

While cruising normally at flight level 190, a Vickers Vanguard sustained a major rupture of the rear pressure cabin bulkhead. The escaping air pressurised both tailplanes from within, causing them to break up, and the aircraft entered a steep dive from which it was impossible to recover. It subsequently struck the ground at high speed in a near-vertical attitude, and all 63 occupants were killed.

THE aircraft was operating a scheduled passenger service from Heathrow to Salzburg and had departed at 0934 hours. After a period of radar vectoring, the aircraft reported over the Dover VOR at 0954 hours, climbing through 14,200 feet. Seven minutes later, when the aircraft was approximately in mid channell, control was handed over to Brussels ATC and, at 1004 hours, the aircraft reported passing over the Wulpen VOR, immediately inland from the Belgian coast near the French border. Just over five minutes later at 1009 hours 46 seconds, with no previous warning, the aircraft transmitted 'We are going down, we are going down', which was followed immediately by a Mayday call repeated several times. Fragmented and garbled transmissions, which included the words 'we are going down vertically', and 'out of control', continued for 54 seconds, accompanied by a marked increase in propeller and aerodynamic noise, then ceased abruptly at 1010 hours 40 seconds, the approximate time of impact.

* * * *

The aircraft had crashed in a flat grass field with soft clay sub-soil, adjacent to a drainage ditch bordered by a line of trees. The aircraft was in a steep diving attitude at impact. A crater some six metres deep was formed, in which were embedded the remains of the mainplanes, engines, and a large part of the fuselage, all in a disintegrated state.

Scattered around the impact crater, up to a radius of about 300 metres, were fragments of disintegrated structure, mainly from the fuselage and empennage. Fire broke out following impact, severe burning taking place within the crater with localised patches of splash burning amongst the scattered wreckage. The fuselage, including the flight deck and passenger cabin, was almost totally destroyed by fragmentation. Such portions as survived were mainly from the tail area and included a portion of lower fuselage structure to which the rear pressure bulkhead was attached.

The outer two thirds of both tailplanes and port elevator, together with the whole of the starboard elevator, were missing from the aircraft when it struck the ground. Major portions of both port and starboard tailplanes and elevators were found several kilometres from the main wreckage area, and their distribution on the ground was consistent with the aircraft's heading and the wind direction. A wind drift plot, constructed from the positions of the separated pieces and the wind data, indicated that the components had separated from the aircraft at a height of not less than 18,000 feet.

After a preliminary examination at the accident site, a reconstruction and detailed examination of the rear fuselage and empennage was carried out at the Administration de l'Aeronautique establishment at Haren. This showed the damage to be consistent with the near vertical attitude of the aircraft at impact. The fin and rudder had been grossly crushed and broken up, as had the dorsal fuselage structure. The fuselage frame, to which the rear pressure bulkhead is attached, had been broken into three main portions, and the rear pressure bulkhead itself crushed and torn into many pieces. The tail cone, with its access panel, was attached and in position at ground impact. Examination of the flying control circuits in the fuselage aft of the rear freight bay, revealed no evidence of any in-flight defect or malfunction.

Examination of the skin, rib, and spar structures of both tailplanes showed a mode of separation which could not be attributed to any externally applied loading. Both upper skins had been lifted and detached between rear and front spars by separation of the rivets and pulling through of the countersunk rivet heads. The separation of the top skin appeared to have originated at the rear spar, where rivet impressions in the skin showed that movement of the skin occurred before any distortion of the spar took place. Similar evidence was found on the under surface of the top skin in the region of the centre spar. Towards the tailplane roots, the upper skin had been peeled and torn from the structure.

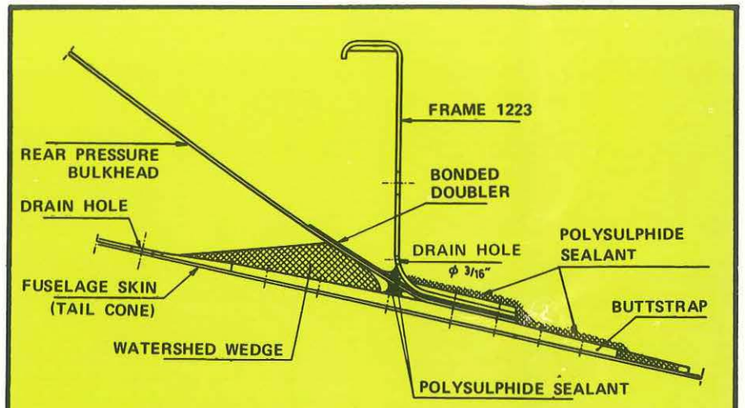
The overall sequence of separation of the tailplanes and elevators appears to have originated with the detachment of the top skin, followed by the rearward and downward separation of the front outboard spar sections, accompanied by the break up of the lower skin and rear spar. The appearance of the upper skin strongly suggested that internal pressure had been responsible for its separation and tests were accordingly carried out to determine the behaviour of the tailplane structure when internally pressurized. The test produced severe distortion of the tailplane upper skin, the worst damage being along the chord at the elevator hinge rib, where rivet heads pulled through the skin. Internally, there were extensive failures of cleat-to-stringer rivets.

A satisfactory printout of the data from the aircraft's flight recorder was produced and showed that the aircraft had conformed to ATC instructions and had levelled out at about 19,000 feet, some six and a quarter minutes before the recorder stopped. During this period of cruising flight, the IAS had increased from 210 knots to 250 knots, where it had remained throughout the last minute of recording. No abnormal pitch or roll angles or acceleration levels were evident during this time, and the aileron and elevator channels of the auto pilot were recorded as having been engaged. The recording terminated whilst the aircraft was in a steady cruise condition at an altitude of 18,930 feet.

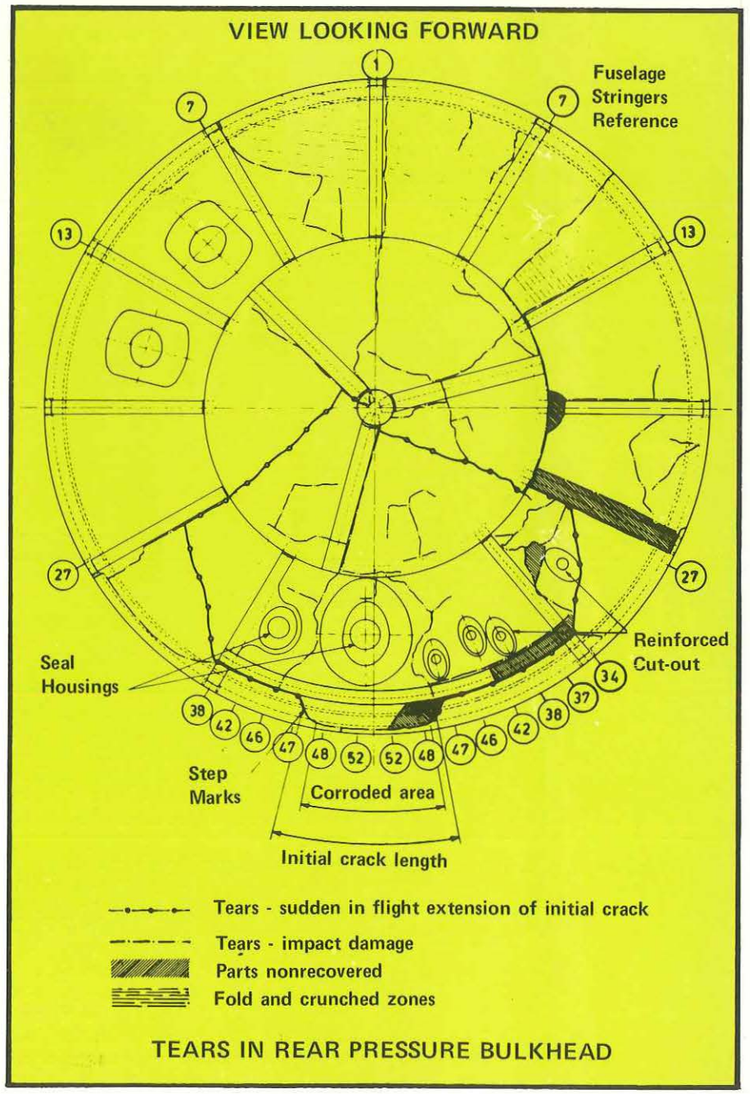
The recorded magnetic heading and IAS data were used as basic parameters to produce a plot of the aircraft's ground track, which indicated that the flight recorder had stopped when the aircraft was about three kilometres west of the crash site.

Examination of the last half second of the recording showed that the frequency and amplitude characteristics of the wave form of the recording signal were highly abnormal, but it was found that the recorded data was valid and the underlying parameters indicated no significant diversion from the previously established flight path. The auto pilot, elevator and aileron channels were still engaged at the end of their recording sequence.

A number of tests were made in an attempt to establish the precise nature of the recording signal abnormality, and it was conclusively proved that this particular type of deterioration could take place only if the power and data supplies from the processing unit to the recorder unit were interrupted in a given sequence. This required firstly the separation of the servo supply to the cassette drive unit, followed by that of 115V power supply. It was also necessary that, during



CROSS SECTION OF STRUCTURE ASSEMBLY AT STN 1223. IN CENTRE LINE OF FUSELAGE.



TEARS IN REAR PRESSURE BULKHEAD

TOP:
Sectional diagram showing fuselage structure at frame 1223, the frame to which the rear pressure bulkhead is attached.

BOTTOM:
Diagram of rear pressure bulkhead showing nature of damage sustained in flight and at impact.

these separations, the two wires transmitting data should remain intact. The cable loom carrying these supplies passes through the rear pressure bulkhead, and examination of the loom indicated that separation of these wires had occurred in a manner not inconsistent with the sequence required.

In order to determine what structural damage or failure could have occurred in flight to cause internal pressurisation of the tailplane structure, a reconstruction of the rear pressure bulkhead was undertaken.

The fuselage structure at frame 1223, the frame to which the rear pressure bulkhead is attached, comprises a fuselage skin plating joint with doubler, the rear pressure bulkhead itself with a doubler plate bonded to its periphery, and frame 1223. The complete joint thus comprises six layers of metal riveted together (See diagram). The pressure bulkhead extends rearward in the form of a dome, and is built up of 22swg aluminium alloy sheet with doubler plates at the joints. The whole of the frame joint at station 1223 is liberally coated with polysulphide sealant on top of the finishing paint, leaving no untreated edges. This coating is not normally extended to cover the edge of the doubler plating joint.

The reconstruction established that corrosion had occurred at the base of the pressure bulkhead, beneath the peripheral doubler plate bonded to its forward face. For a distance of 48 cm, roughly about the centre line, the bond was completely delaminated and bulkhead material corroded away. From the ends of the corroded area at each side, tears ran upwards and outwards, then upwards and inwards,

across the lower centre panels of the bulkhead, terminating at the central hub fitting. (See diagram). The effect of the tears was to separate the lower quarter of the bulkhead containing the glands and seals through which pass the electrical services and flying controls, from the remainder, except for about 15 cm of metal at the central hub fitting. It was evident that the tears in the bulkhead had occurred before the aircraft struck the ground.

A second area of corrosion was found when the remains of the bulkhead plating were removed from frame 1223. This was located on and beneath the bracket attaching a radial bracing member to frame 1223 and the fuselage structure on the lower starboard side. The corrosion had not progressed to the point where any crack had appeared in the bulkhead or frame structure and it had played no part in the failure of the bulkhead.

No other area of corrosion was found either on the bulkhead surface itself or in the frame 1223 joint nor, superficially, was there any evidence of contaminating liquids or substances. On the fuselage frame immediately behind station 1223 however, there were a series of 'tide marks' suggesting that liquid had been trapped between the rear of the bulkhead and this frame to a depth of several inches on at least twelve occasions.

The aircraft's maintenance records showed that fluids had been present in the tail cone on a number of occasions in the more recent service life of the aircraft. Since the last major inspection, eight entries, extending over a period of nearly nine months, had been made indicating that water, ice or hydraulic fluid was present in the tail cone and that the seal of the tail cone access panel required attention. Shortly before this time, an entry indicated the presence of fluid in the rear toilet area, but no leak was found. Six months before the accident, there was a further entry concerning a leak in the rear toilet container.

The region aft of the pressure bulkhead is drained by pipes leading to atmosphere. The drain located immediately aft of the bulkhead and adjacent to the 'tide marks' was blocked by dried mud similar to that from which this piece of wreckage was retrieved, and its pre-impact condition could not be determined. The drain hole in frame 1223, located at the lower centre line, was found blocked with polysulphide sealant, which had been painted on the forward face. An area of surface corrosion of some four square centimetres was found on the rear face of frame 1223, 15 cm from this blocked drain hole.

* * * *

It was evident from the aircraft's radio transmissions and the flight recorder read-out, that its operation had been normal and without incident from the time of take-off at Heathrow to the point where the recorder ceased to function. Throughout this time, the aircraft had followed the intended flight path and the crew had responded promptly to ATC instructions.

As the flight recorder had stopped in level flight at cruising altitude, and there was reasonable accord between the last position plotted from the recorder data and the wind drift plot of the tailplane wreckage, there was no reason to doubt that it was the rupture of the rear pressure bulkhead that had caused the flight recorder to cease operating.

The investigation showed conclusively that the failure of the rear pressure bulkhead started the sequence of structural failures leading to the accident. The rapid inflation of the tailcone and empennage imposed a high differential pressure across the tailplane skin, causing the upper panels to become detached from the main structure. The existing flight loads then caused a rapid breakup and separation of both tailplanes and elevators. The loss of the aerodynamic download normally provided by the horizontal tail surfaces in cruising flight, caused the aircraft to pitch rapidly nose-down, with no possibility of recovery from the ensuing dive.

An examination of the pressurisation histories of the aircraft and subsequent calculations, showed that the volume of air passing through the pre-existing crack in the rear pressure bulkhead was not large enough to prevent the pressurisation control system from maintaining the desired cabin differential pressure.

The severe corrosion present at the joint between the fuselage skin and the rear pressure bulkhead had been present unseen for an unknown period of time before the accident. From the condition of other aircraft inspected as a result of the accident, it seems likely that the extent and severity of the corrosion required a relatively long period to develop. It is doubtful whether the corrosion could have been seen from the rear during the visual inspections made at 400 hourly intervals because it was concealed within the joint, and the convergence of the bulkhead and fuselage structure restricted access to it. When the crack progressed into uncorroded material, it would have become visible from the rear, but the period of time between when the crack had progressed to this extent and the rupture of the bulkhead was comparatively short, probably of the order of 14 pressurisation cycles.

The approved maintenance schedule assumed that the bonding paint and sealing schemes remained intact and effective, and provided for visual inspection of the bulkhead only at relatively long intervals. As the investigation showed however, delamination accompanied by corrosion can occur between the bonded doubler plate and the front face of the pressure bulkhead, and may be severe before any visual indication is apparent.

A radiographic examination had been made of the lower portion of the rear pressure bulkhead lap joint before the accident, but the corrosion was not detectable with the inspection technique then in use, because of the difficulty of interpreting the photographic plate detail resulting from the complex structure.

Because the extent of the problem at this bonded joint was not appreciated, no effective technique had been devised for inspecting the area. Since the accident however, improved inspection techniques, together with a modification to the aircraft to improve access for these inspections, have been introduced. It must be accepted that where hidden areas exist, corrosion is more likely to develop with increased age, and it is essential that techniques employed to inspect such areas, effectively detect any corrosion at its onset.

Cause

The accident was caused by the rupture of the rear pressure bulkhead, which led to the separation of both tailplanes in flight and caused the aircraft to dive into the ground. —

BEYOND THE LIMIT

Accidents involving the overloading of aircraft have appeared in the Digest many times in recent years. Most of these have occurred when the take-off distance available proved inadequate for the load the aircraft was attempting to lift.

But as well as the performance and structural implications of overloading there is another, less obvious side to the problem which is frequently overlooked. In addition to maximum take-off weight considerations, the disposition of the load and its affect on the aircraft's centre of gravity is of the utmost importance. Careless or incorrect distribution of the load can result in an out-of-balance flight condition and, in extreme cases, can lead to loss of control. The discussion of the Twin Comanche accident that follows provides a tragic illustration of the high price that can be paid for neglecting weight and balance limitations.

* * * *

THE aircraft, owned by a NSW company involved in the installation and maintenance of conveyor belting, and flown by a professional pilot, was used to convey personnel and equipment to and from mining installations in the more distant parts of Australia. A flight was planned to take one of the company's maintenance men and belting repair equipment from Maitland, NSW, where the aircraft was based, to Groote Eylandt, NT. The aircraft was to remain overnight at Groote Eylandt then continue to Gove next morning with two more company employees who were already working at Groote Eylandt.

While the pilot was collecting the equipment from the factory a request was received from another firm to carry several additional parcels to Gove and the pilot agreed. The pilot and his passenger loaded the aircraft themselves and after a normal take-off, flew uneventfully to Mt Isa, where they remained overnight, and then on to Groote Eylandt next day, arriving late in the afternoon. In preparation for an early departure for Gove the next morning, the pilot had the aircraft refuelled. The pilot and his passenger then collected their light luggage from the aircraft and were driven into the camp to their overnight quarters.

Next morning, at about 0715 hours, a company employee called for the pilot and his passenger. The other two men who were to travel to Gove had also been picked up and the four men, with their luggage and a further quantity of heavy belting were driven out to the aerodrome. They stopped alongside the aircraft, and the pilot climbed aboard. After he had rearranged the gear already in the cabin, he called to the others to pass him the luggage and other pieces of equipment. These he stowed in the rear of the aircraft, starting from the very back of the cabin and working forwards. When he had filled the compartment behind the rear seats to the roof, one of the passengers boarded the aircraft and was seated in the left rear seat. A large suitcase was then placed on end in the narrow aisle beside him and one of the other passengers moved into the right hand seat. After the pilot had settled himself, the third passenger then climbed in the front right hand seat and a large metal tool box was stowed under his legs. Odd items of clothing, a gallon container of resin, the pilot's brief case as well as maps and other papers filled the remaining cabin space. There was not room for all the equipment that had been brought to the aerodrome and the driver was asked to return it to a shed on the construction site. At the request of the pilot, who had remained inside the aircraft the whole time it was loaded, the driver wiped the condensation from the windscreen, and then stood clear as the pilot closed the door and started the engines.

The main runway at Groote Eylandt lies in an east-west direction, has a sealed surface, and is 6,240 feet long. The driver watched the aircraft enter the runway and back track towards the eastern end until it was lost from his view behind low scrub. About four minutes later, he heard the engines running at high power and the aircraft came into sight again well into its take-off run. Reaching a point opposite where he was standing, about 3,000 feet from the end of the runway, it left the ground and began a shallow, steady climb. Moments later, the nose began to rise. At first, the aircraft's attitude changed slowly but then the nose pitched up and the aircraft climbed in an increasingly steepening nose-up attitude to about 300 feet. Abruptly, the port wing dropped and the aircraft fell away in a near vertical dive. When only about 75 feet above the ground, the nose came up again and the aircraft entered a flat spin to the left before striking the ground.

When he realised the aircraft was in difficulty, the driver had run to his utility and started the engine. Moving off at the moment the aircraft struck the ground, he reached the crash site just as the dust was subsiding. But when he went to assist the occupants, he found that all four had been killed instantly.

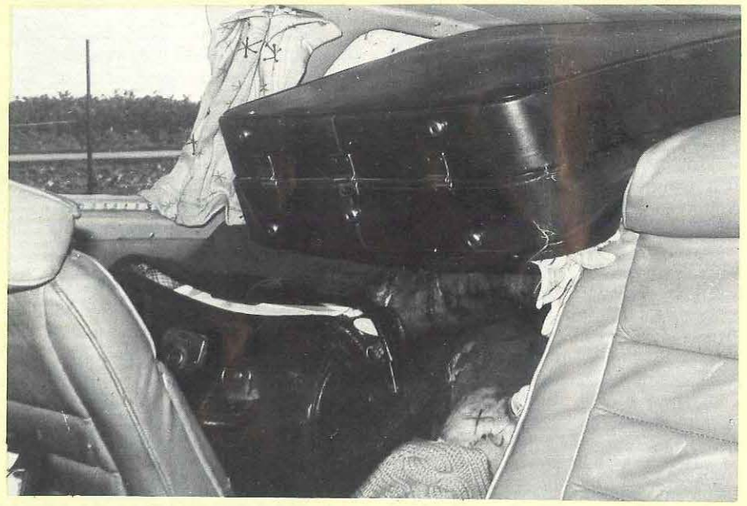
* * * *

The aircraft had come to rest just off the side of the runway and 4,480 feet from the eastern threshold. The structure, though badly crushed, had remained largely intact and examination of the wreckage confirmed that the aircraft had struck the ground with virtually no forward motion while rotating to the left. The aircraft's attitude at impact had been only about five degrees nose-down. Further detailed investigation revealed no evidence of any airframe, control system or engine malfunction that could have contributed to the accident in any way and no damage other than that which had resulted directly from impact forces. At the moment of impact, the aircraft had been in the take-off configuration. The undercarriage was extended, and the flap and elevator trim settings were within the normal take-off ranges. Although all the aircraft's fuel tanks had ruptured, and fuel had been spilt, fire had not broken out.

The pilot was 29 years old and held a senior commercial licence. His total flying experience amounted to more than 1,400 hours, a little over 140 hours of which had been gained in the Twin Comanche. He had commenced flying with the company that owned the aircraft five months before the accident and was familiar with operations into Groote Eylandt and Gove, having flown there on at least three previous occasions. There was nothing to indicate that he was other than fit and well on the day of the accident and a pathological examination disclosed no evidence that he had suffered any form of incapacitation.

When the contents of the cabin were removed and weighed, it was found that the aircraft had been seriously overloaded. Taking into account the known quantity of fuel on board, it was calculated that the gross weight of the aircraft had been 4,433 lb, or 708 lb in excess of the maximum permissible take-off weight. Furthermore, the disposition of the load had been such that the aircraft's centre of gravity position would have been 3.9 inches aft of the approved rear CG limit. The freight and baggage had not been secured or restrained in any way.

Such an extreme rearward displacement of the centre of gravity would have had a serious effect on the aircraft's longitudinal stability. At the calculated CG position, the aircraft would have become unstable in the lower airspeed ranges and it is likely that the CG was sufficiently far aft to make it impossible to lower the nose at certain speeds, even with the control



TOP:
The wreckage of the Twin Comanche lying beside the runway at Groote Eylandt. The structure shows unmistakable evidence of high vertical impact forces.

BOTTOM:
The overloaded rear compartment. The baggage was packed on top of heavy tools and rolls of belting.

column fully forward. At the speed at which the aircraft left the ground, it probably would have been marginally stable, but even so, the control column would have needed to be almost on the forward stop to prevent the nose rising. However, as the speed built up, the stability would have decreased and eventually the point would have been reached where there would have been insufficient nose-down elevator control. In these circumstances, the aircraft would have been virtually uncontrollable and once the nose started to rise, the pilot would have been unable to correct even with full elevator deflection.

It is difficult to understand how the pilot could have disregarded the weight and balance limitations of the aircraft to the extent he did. During his conversion to the Twin Comanche and his familiarisation with the company's operating practices, the pilot had been thoroughly briefed on loading procedures and the use of the Piper load computer for the aircraft type. The company operations manual and the approved flight manual carried in the aircraft were quite specific with regard to loading, and the load computer was found in the front right seat back pocket, within easy reach of the pilot.

It is possible that the pilot was misled to some extent by the high-density nature of the materials he was carrying. Although the maximum permissible load in the Twin Comanche's rear baggage compartment is limited to 250 lb, it was found during the investigation that the total weight in this compartment was only slightly less than 600 lb. But though the heavy rolls of rubber belting and the other materials carried in the aircraft from Maitland comprised a major part of this load, they only covered the floor of the rear compartment to a depth of about nine inches. This left a considerable volume of unused space and the compartment was filled to the ceiling with baggage at Groote Eylandt.

Although it was not possible to determine accurately the loading of the aircraft at the time of its departure from Maitland, there was evidence to suggest that even at this early stage of the flight, the aircraft was overloaded. The fact that the aircraft operated satisfactorily on this part of the flight no doubt engendered a false sense of confidence that the aircraft was safely loaded and probably contributed to the very serious overloading at Groote Eylandt.

Nevertheless, it is difficult to accept that the pilot could have been totally unaware of the weight of the materials on board the aircraft. He had personally carried the various items of equipment from the company's storeroom to the truck he had driven to the aerodrome at Maitland and, so far as is known, he then loaded them into the aircraft himself. He had also personally stowed in the aircraft the additional gear taken on board at Groote Eylandt. Although he would have had to walk past a set of industrial scales in order to collect the repair equipment from the company storeroom, there is no evidence that he made any attempt to weigh the materials he was carrying.

The pilot was under no pressure, operational or otherwise, to carry all three repair men and their equipment to Gove on the one flight. It had already been arranged to transfer the repair gear from Groote Eylandt to Gove on two separate trips and, as the equipment was not needed urgently, there was no reason at all why the load could not have been spread over the two flights. Before starting the engines at Groote Eylandt, the pilot said he would be returning for the equipment he had to leave behind. Furthermore, he knew that another company aircraft, which could easily have taken on the equipment left over, was due to arrive at Groote Eylandt only a few days later.

* * * *

Other accidents involving the same type of aircraft have occurred overseas in surprisingly similar circumstances. In one instance, a Twin Comanche was taking off on a ferry flight across the Atlantic Ocean from Newfoundland to Ireland. After becoming airborne it continued in level flight for a few moments and then entered a rapid climb which became progressively steeper until the aircraft stalled and crashed to the ground. The aircraft was destroyed by fire and impact forces, and the two pilots on board were killed. In this case, temporary long range fuel tanks had been installed in the position of the rear passenger seats. Subsequent investigation disclosed that the tanks were not an approved installation and the weight and balance data provided with the aircraft contained significant errors both in the capacity and moment arm of the tanks. It was determined that, at the time of this accident, the aircraft's weight was 350 lb over the maximum permitted for a ferry flight of that nature and the centre of gravity was 3.9 inches aft of the rear CG limit. As a result, like the accident at Groote Eylandt, the pilots encountered a rapid nose-up pitch which they were unable to correct.

Because of the errors contained in the weight and balance information made available to the pilots in that case, it was unlikely they were aware of the fact that their aircraft's centre of gravity was beyond the allowable limit. But with the accident at Groote Eylandt, the pilot had loaded the aircraft himself and the requirements for correct loading were known to him, both from his training on the aircraft and instructions contained in the aircraft's manuals. Clearly, the pilot gave little thought to the weight of the equipment he was carrying or its disposition and in so doing he loaded the aircraft with its centre of gravity so far aft that it was incapable of normal balanced flight.

It is ironical that, while the company employee who had driven the party to the aerodrome at Groote Eylandt was helping to load the aircraft, the thought occurred to him how similar it was to 'driving up to another car, stowing all the gear, and then driving off again'. It is difficult to escape the conclusion that much the same attitude was held by the pilot, in that he simply transferred the equipment from the utility to the aircraft without considering the effect this could have on the aircraft's gross weight or centre of gravity.

Cause

The cause of the accident was that the pilot loaded the aircraft without adequate regard to the limits of gross weight and the position of the centre of gravity.

NEWS & VIEWS

HELICOPTER SAFETY

IF you are not complying with the inspection requirements, then it is a good bet that one of your Hughes 500 tail rotor drive shafts may wind up looking like the one in the accompanying photo. The pilot flying the aircraft in which this drive shaft failure occurred is no longer with us. Chances are that he would have been if an inspection of the drive shaft had been performed after a previously reported tail rotor blade strike occurred.

Unfortunately, not all tail rotor strikes are reported by flight crews. A tail rotor strike can also occur without the knowledge of the pilot and with no apparent visible damage. This is where the danger lies!

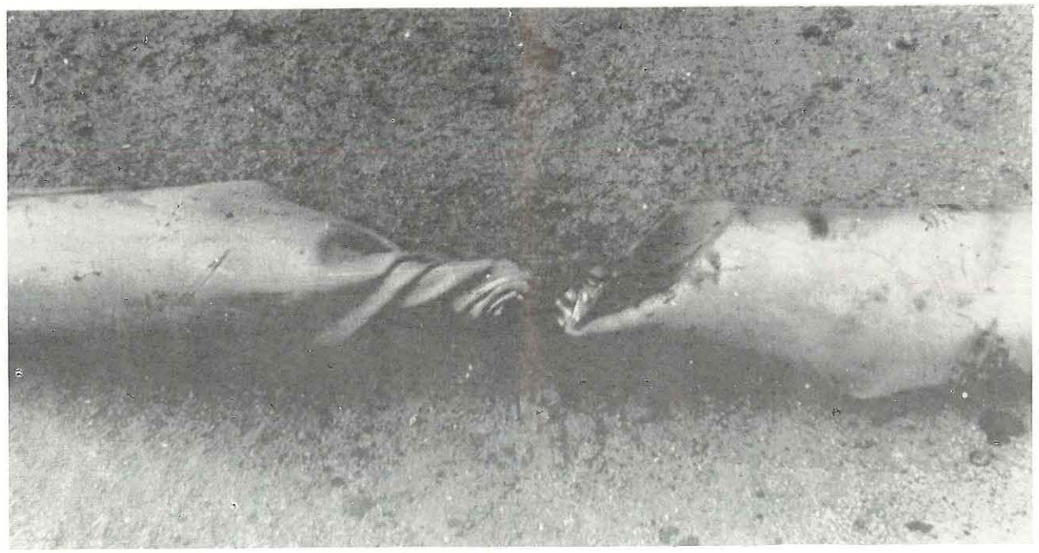
Tail rotor strikes, even if minor, can cause twisting of the drive shaft and torsion fatigue at the couplings. Special Inspections, requiring tail rotor shaft removal and inspection are required immediately after:

- *A heavy landing or major damage*
- *A main rotor blade strike*
- *Sudden stoppage of the power train*
- *A tail rotor blade strike*

An accident occurred this month when a tail rotor drive shaft coupling failed on a Hughes 500. This aircraft, like many other Hughes 500's, had previously suffered a tail rotor strike. During the course of the accident investigation, it was determined that the required inspection had not been performed after the strike occurred. A good way to avoid accidents is to stay ahead of the game. Comply with published instructions which state: 'Inspection intervals herein are the maximum and should not be exceeded. When unusual local conditions, such as environmental, utilization, type of mission, experience of flight and maintenance personnel, periods of inactivity, etc. dictate, it is the prerogative and responsibility of the maintenance officer to increase the scope and frequency of maintenance or inspections as necessary to ensure safe operation'.

Now that winter weather is upon us in full swing, caution must be applied in all areas. One area often overlooked when maintenance personnel are handling aircraft is parking. A 'crash facts' message received this month on another Bell 206 went like this: 'Immediately after starting the engine, the aircraft swung to the right. Left pedal was applied with no response. The aircraft continued to turn to the right and struck the auxiliary power unit used in starting.' The aircraft was being positioned in an area covered with ice. Now that you know it can happen, don't get caught short!

Monthly Maintenance Summary, USAAAVS.



LEARN FROM THE MISTAKES OF OTHERS YOU MAY NOT LIVE LONG ENOUGH TO MAKE THEM ALL YOURSELF!

INTERRUPTED CHECKS

ONE can only guess at the 'misses' that have resulted from interruptions in ground checks, whether walk-around or cockpit checks. But 'skips' have occurred, and in some instances they can pose serious problems. . . if they are not caught.

An airline recently reported an incident of just such a 'catch-in-time'. A few minutes after takeoff, the 727 flight engineer reported all oil temperatures were in the 'caution' range. The captain obtained a clearance to return to the airport but, in the meantime, asked the flight engineer to check all engine bleeds. He did so and found that all Fuel Heat switches were on. After selecting heat off, the oil temps returned to normal and the flight continued to its original destination.

It was established that during the flight engineer's preflight check, his testing of the fuel heat valves had been interrupted by the arrival in the cockpit of a ground engineer who had been asked to rectify an instrument fault. When the flight engineer went back to his preflight check, he did not notice that he had not reset the heat-valves to 'off' and had continued the check with the next item of the list. In addition he had misread the position of the switches on the pre-takeoff check.

The hazards that may result from an interrupted walk-around, cockpit check or any itemized drill, are well known. If going-back-to-the-beginning is too time consuming, for security's sake make certain there is a generous overlap.

Flight Safety Foundation

H HHHYPNOTICC C WIPERS

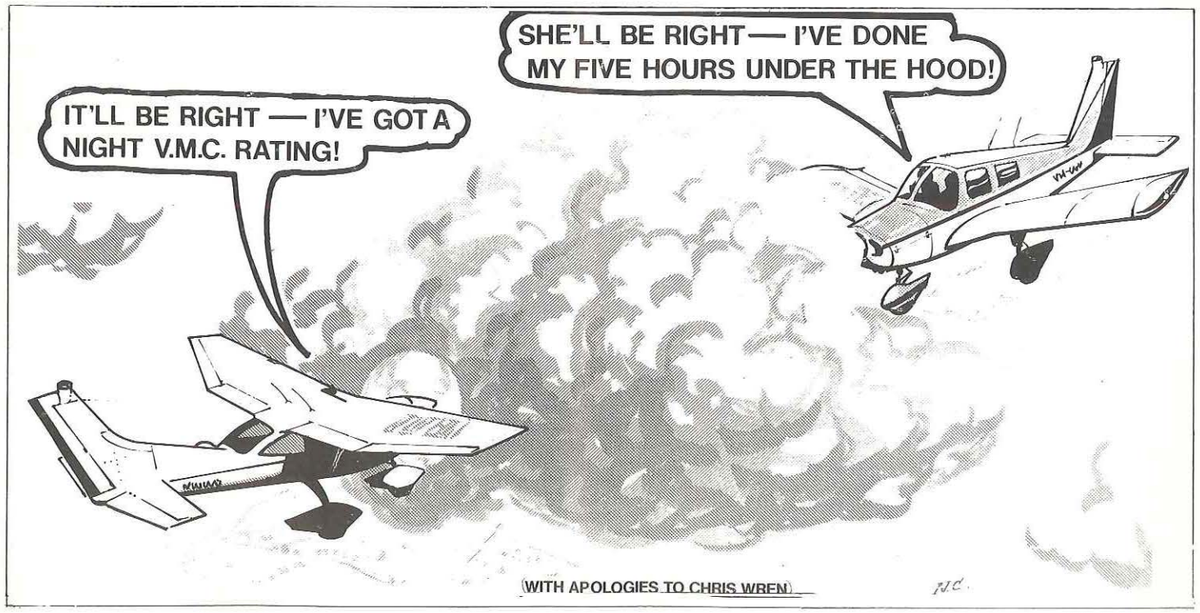
THE flickering light effect of rapidly oscillating windscreen wipers has been shown to cause a lowered state of alertness amounting occasionally to drowsiness or even worse in susceptible persons. Nausea and dizziness are also occasional symptoms. It is a good principle, therefore, to keep the speed of the windscreen wipers to the lowest which will provide effective clearance. In addition, do not stare ahead through the wiped windows for too long a time, but take occasional glances through one of the unwiped side or centre panels.

BOAC

LIFE OR DEATH DECISION?

THE difficulty of deciding to abandon plans to reach one's destination, in this age of urgency, is familiar to all of us. How many motorists have continued to drive, even though too tired to drive safely, because they 'just had to get there' without further delay? For a pilot not qualified to fly by his instruments, this decision to continue or turn back far more often places his life in the balance.'

National Transportation Safety Board (USA)



IN BRIEF

NOT what it seemed

The pilot of the Cessna 210 in the picture was the manager of a team of pilots engaged in geological surveying, based at Wyndham, W.A. To enable the team's turbine powered helicopters to continue operating in a remote coastal area 200 miles west of Wyndham, it was necessary to position a dump of turbine fuel in the area.

Intending to fly in a drum of fuel in the Cessna 210, the pilot enquired about the position and state of airstrips and was told that a strip has been constructed the previous year, but had not been used for some months because of the wet season. The pilot decided to inspect the strip from the air and to land if it looked satisfactory.

After an uneventful flight in fine and calm conditions, the aircraft arrived over the strip and the pilot saw that although the surface had extensive areas of long grass, its length was adequate and the approaches were good. The boundaries of the strip were marked by half 44 gallon drums cut lengthwise. After making an inspection run downwind along the strip at 200 feet the pilot climbed to 500 feet, then turned back for a long low approach in the opposite direction. On final approach he lost sight of the strip markers amid the long grass, so he selected a landing path roughly in the centre of the cleared area in which the strip was situated.

Touching down 200 feet in from the threshold, the aircraft rolled straight ahead for about 500 feet, but when it had slowed to about 30 knots there was a loud bang from the undercarriage and the aircraft gradually heeled over to port until the port wing tip scraped the ground, swinging the aircraft around as it came to a stop. The pilot and his engineer passenger were unhurt and after climbing out, found that the port undercarriage leg had been torn off when it struck one of the boundary markers in the long grass. Shortly afterwards the starboard leg had struck an anthill, also concealed in the grass, several feet outside the strip boundaries.

The pilot and passenger were located the following morning as a result of SAR action taken when the aircraft became overdue and were rescued later in the day.

The pilot was unfamiliar with bush operations in the northwest of Australia, most of his flying having been done in Victoria. Although he had made enquiries about the strip and had been told it had not been used for some months, he did not know that anthill growth can be a hazard on strips in this area. Further, in conducting a long low final approach he lost sight of the strip markers, and failed to realise that the strip boundaries were not parallel to the sides of the cleared area in which it was situated.

Pilots operating in remote areas have a special responsibility to ensure that the strips they intend to use are safe and are suitable to the type of aircraft they are flying. In this case the half drums used as strip markers obviously constituted a serious operational hazard in themselves.

Student Caught in Heavy Rain

A FLYING instructor at Cambridge, Tasmania, had authorised a student pilot to carry out some solo practice in steep turns and forced landings. During the day there had been showers and low cloud to the south of the aerodrome and so he specified that the training was to be carried out in the Orielton area to the north of the airport.

Soon after the student departed, however, the instructor, while taxying for circuits with another student, saw a sharply defined line of large cumulus clouds with a much lower base, and heavy rain, approaching. Seeing that this would also pass through where the student pilot was operating, he requested Hobart Tower to recall her aircraft. This the tower did and the aircraft acknowledged.

Four minutes later, when the tower had heard nothing more from the aircraft, the controller requested it to report position. Informed that the aircraft was still in the Orielton area, the tower again instructed it to return and land because of the bad weather approaching. The student pilot replied that she could not get back to Cambridge as she could not find it. At this stage the tower cleared the instructor in the other aircraft to communicate directly with his student. Obviously frightened she called, 'I can't find Cambridge — I don't know where I am'. Asked if she could 'see the water', the student replied 'No I can't — I got lost in the clouds and I don't know which way I'm heading'. After several more exchanges with the student, during which both the tower and the instructor passed advice to the student, the weather behind the rain squall cleared rapidly and the student caught sight of the ground again. The instructor, who by this time was in the student's area then sighted her aircraft heading back towards Cambridge. Despite her unnerving experience she made a safe landing.

It was found that the student had misunderstood Hobart tower's first transmission recalling her to Cambridge. The student said that she had misunderstood the call, thinking it to be circuit information for the other aircraft and, after completing one steep turn in the area she found herself surrounded by heavy rain and she had become disorientated and didn't know in what direction to fly to reach Cambridge. Once she had emerged from the rain shower however, she was able to locate herself over Richmond and return to Cambridge without further difficulty.

The instructor said afterwards that he had made a practice of including short periods of instrument flying in the private pilot training syllabus. This experience had been introduced during a students' second dual check after solo, and before their first solo practice in the training area. The instructor believed that in this case the student had only entered the fringes of cloud, but she had encountered heavy rain and had lost her sense of direction as a result.

RUNNING OUT OF ROAD

Landing at Marble Bar, after a flight from Derby, the pilot of this Cessna P206 refuelled his aircraft, then took off for Nullagine with an ETA of 1802 hours. Last light at Nullagine was 1830. The weather was fine, with about three eighths of cumulus cloud at about 3,000 feet.

After leaving Marble Bar, the pilot did not track direct to Nullagine but followed the main road, arriving over the town at 1804. He cancelled his SAR watch with Port Hedland and, after flying low over the town to attract attention, continued on down the road to look for the airstrip. But when six or seven minutes had elapsed and there was no sign of the strip the pilot decided he must have missed it in the fading light and turned back towards the town. Arriving overhead, he saw a straight stretch of road running between the town and a low hill a short distance away and, as its length seemed adequate, he decided to land on the road. In the poor light, the section of road on the town side of the hill looked flat and he planned to touch down before the hill, then run on over the top and follow the road down the other side.

Closing the throttle and trimming the aircraft, he lowered the flaps and began an approach over the town at about 60 knots, bringing the speed back to about 50 knots as he neared the ground. The aircraft touched down about 100 yards from the hill and ran straight ahead up the slope. When the aircraft reached the top however, the pilot saw to his dismay that the road turned sharply left before running up another hill. By now the pilot was committed to the landing and had no alternative but to brake hard and try to swing the aircraft round the bend. But the speed was too high and the aircraft left the road and ran down an embankment. The nose leg collapsed and the aircraft came to rest on its nose. It was 1827 and almost dark when the pilot climbed out of the aircraft and went to obtain assistance.

NOWHERE ELSE TO GO

AFTER an uneventful private flight from Bankstown, the pilot of this Debonair, with two passengers arrived at a private airstrip near Oberon NSW, for a brief visit. Frontal weather had been forecast and, at about 1630 hours while the party were at the homestead a heavy storm broke.

Realising that if they were to return to Bankstown before last light, an immediate assessment of the weather would have to be made. The party returned to the aircraft where the pilot endeavoured to contact Sydney on the radio without success. He then listened for some time on the area frequency in the hope of gaining a weather report from another aircraft, but this also was unsuccessful.

By 1720 hours the weather had improved with the passage of the front, and the three occupants boarded the aircraft and took off for the return flight to Bankstown. Only a few minutes later however, over Jenolan Caves, the aircraft encountered light drizzle and the pilot saw that the ranges ahead were covered by heavy cloud. Notifying Sydney FSU that he was returning to Bathurst, he enquired if lights would be available there, but before an answer could be obtained, a revised terminal forecast for Bathurst was passed to him and because of the deteriorating conditions he decided to return to the station property. By the time the aircraft reached the area again however, the pilot saw that the airstrip and its surrounding terrain was obscured by low cloud. Now, with only seven minutes to the official time of last light, the heavily overcast conditions were advancing the onset of darkness quickly, and the pilot realised that he had little time left in which to make a precautionary landing. After briefly assessing the area to the south-east of Oberon, he selected a large ploughed paddock, lowered the undercarriage and flaps, and made an approach for a short field landing. The aircraft touched down heavily, ran a short distance into a marsh area and entered a shallow water-filled ditch. The nose leg collapsed and the aircraft skidded to a stop on its nose.

DECISION— BUT TOO LATE

WHILE making a private flight from Tottenham to an airstrip several miles south-east of Yass, the pilot of this PA22 encountered deteriorating weather in the vicinity of Grenfell and diverted south of his planned track. Approaching Goondah, 10 miles north-west of Yass, about 50 minutes later, he saw that the cloud to the east on the ranges was almost down to ground level, and that the tops of the hills ahead of him were also in cloud.

He turned back on to a reciprocal heading in an attempt to find a clearer area, but finding that the cloud had lowered in that direction also, he began to search for a suitable area in which to make a precautionary landing.

After selecting one of several paddocks and making a low run across it towards the west, he saw there was a gully at its eastern boundary and that there were two diverging powerlines crossing its western boundary, but judged it suitable for a landing. He therefore climbed, carried out a circuit, and approached to land into the west. The aircraft approached over the gully, touched down about 100 feet in from the paddock boundary, and ran up a rise as the pilot applied gentle braking on the wet surface. As the aircraft passed under the first set of powerlines near the crest of the rising ground, he sighted the western boundary fence not far ahead and realised that he would not be able to stop the aircraft before reaching it. He applied full power and after passing under the second set of powerlines the aircraft lifted off, but too late to clear the fence. The undercarriage struck the fence, the nose pitched down and the aircraft struck the ground heavily, demolishing two more wire fences in quick succession before running across a road and tearing its way through a fourth fence. The aircraft then ran up an embankment, passing between two trees as it did so, slid over the top and overturned. The pilot, still hanging by his seat belt, was unhurt and, after turning off the master switch and fuel, released himself and climbed out of the wreckage without assistance.

The first leg of the flight was uneventful and after circling Benambra as planned the pilot set course again for Bairnsdale. But after passing Omeo, he could see that the weather ahead was deteriorating and by the time he reached Swift's Creek another 10 miles further on, it was raining and he saw there was no hope of reaching Bairnsdale in VMC. The pilot turned back intending to land again at Benambra, but after doing so he saw that it was raining on the Divide and the weather was closing in there also. Knowing that there was an agricultural strip at Swift's Creek, the pilot flew to it and circled it at about 500 feet before making an approach to land uphill. In calm conditions, with two stages of flap selected, the pilot aimed to cross the threshold at about 60 knots, but the aircraft floated further than he intended. Unable to go around because of high ground beyond the end of the strip the pilot pushed the control column forward to try and place the aircraft on the ground. The nosewheel struck the ground first and collapsed, and the aircraft skidded to a halt as shown in the picture.

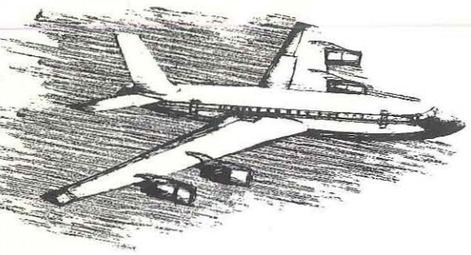
AG Strips are for EXPERTS

WITHOUT consulting a forecast or preparing a flight plan, a private pilot took off from Bairnsdale, Vic. late in the afternoon in overcast weather to fly to Benambra in this Piper Cherokee. Benambra is 55 miles almost due north of Bairnsdale in the heart of the Great Dividing Range.

THE PRICE OF SURVIVAL

How would the passengers and crew of an aircraft fare if forced to ditch at sea on one of our long ocean air routes? To answer this question and test the search and rescue capacity actually available in such an emergency, a full scale exercise was run recently in Perth, with the co-operation of SAR authorities in Mauritius, South Africa, Singapore and Indonesia.

The aircraft, Boeing 707 'VH-SRX', with its operating company and hapless occupants, are fictitious, but were introduced to simulate, as realistically as possible, the difficulties involved in a search and rescue operation on the long ocean crossing between Perth and Mauritius. The other aircraft, ships, personnel and equipment involved are factual, and although not diverted or deployed as described, were available to do so had they really been required. For the purpose of the exercise, it was assumed that a crippling malfunction had forced the 707 to ditch in the most inaccessible section of the route. It was also assumed that the ditching was successful, and that all 145 occupants were able to leave the aircraft before it sank. The resulting action is as close as can be estimated to what would have actually been involved if the emergency had been a real one.



ON the 9th April 1973, an Australian charter company notified the Department that a Boeing 707, VH-SRX, would be flying to Mauritius the following day. This advice was passed to Mauritius and Cocos Island, both of which have operational responsibilities on the route. Cocos acts as a radio link between Perth and Mauritius and, where necessary, provides air to ground communications during the long oceanic crossing. Mauritius would be responsible for providing the terminal forecast as well as the route forecast for the portion west of the common Flight Information Region boundary.

At Perth Airport, early in the morning of the flight, the captain of VH-SRX was given a weather briefing. After considering the forecast, which was quite favourable, he decided to fly a rhumb line track and submitted a flight plan on this basis. On this route, the aircraft would leave controlled airspace 150 nautical miles west of Perth, and would cruise at flight level 320. The estimated time interval for the flight was seven hours and seven minutes.

The 707 subsequently took off normally and its departure time of 1820 hours was passed to both Perth and Cocos Island Flight Service Units, which were to be responsible for the aircraft's position reports as it crossed the Indian Ocean. Twenty minutes later, after passing the 150 NM west position, the 707, now outside controlled airspace, established contact with Perth FSU. Throughout the next four hours, the flight proceeded according to plan, the aircraft continuing to report position as it crossed each five degree meridian of longitude and, at 2238 it reported at 80°E, flight level 320, estimating 75°E at 2315.

* * * *

As is well known, the high frequency radio band on which all the aircraft's communications were now being made, is often affected by ionospheric conditions. This phenomenon is particularly noticeable around sunset and sunrise, and as it happened, the flight was due to cross the 75th meridian when dawn was only two hours away to the east. At 2315, the ETA for the 75E position, both Perth and Cocos Island waited in vain for the aircraft to report and at 2318, Perth FSU began calling it in accordance with standard procedures. When the aircraft did not reply, the operator tried to contact Mauritius, but when this was also unsuccessful, he realised that a fade-out had occurred. The radio teletype to Cocos Island was unaffected however, and Perth established that Cocos had not heard from the aircraft, and had also lost contact with Mauritius. Although it seemed highly likely that the fade-out was also responsible for the aircraft's apparent failure to report, Perth still held primary guard for the aircraft and so, with Cocos Island, continued calling the aircraft and Mauritius on all appropriate frequencies.

At 2330 hours, when no further information had been received, the Uncertainty Phase was declared and passed to the SAR Mission Co-ordinator in the Perth Rescue Co-ordination Centre. The SMC immediately put in hand preparations for all possible assistance to be rendered to the aircraft if this became necessary. Action was to be taken to determine what other aircraft would be able to assist by relaying communications, and if necessary, by intercepting and escorting VH-SRX, but there were no other flights operating in the Southern Indian Ocean. A ditching weather report was also requested and was given very high priority by meteorological staff.

At 0011 hours, the aircraft's ETA at the 65E position, there was still no news of it, nor contact with Mauritius, and the SAR phase was upgraded to the Alert stage. By this time the ditching weather report was available and was broadcast at 0025 hours and repeated at 15 minute intervals. Meanwhile aircraft operators and authorities throughout Australia were contacted, as were SAR authorities at Singapore and Djakarta, and a further message was prepared for transmission to Mauritius as soon as communications could be restored, requesting the call for assistance to be relayed to South Africa.

* * * *

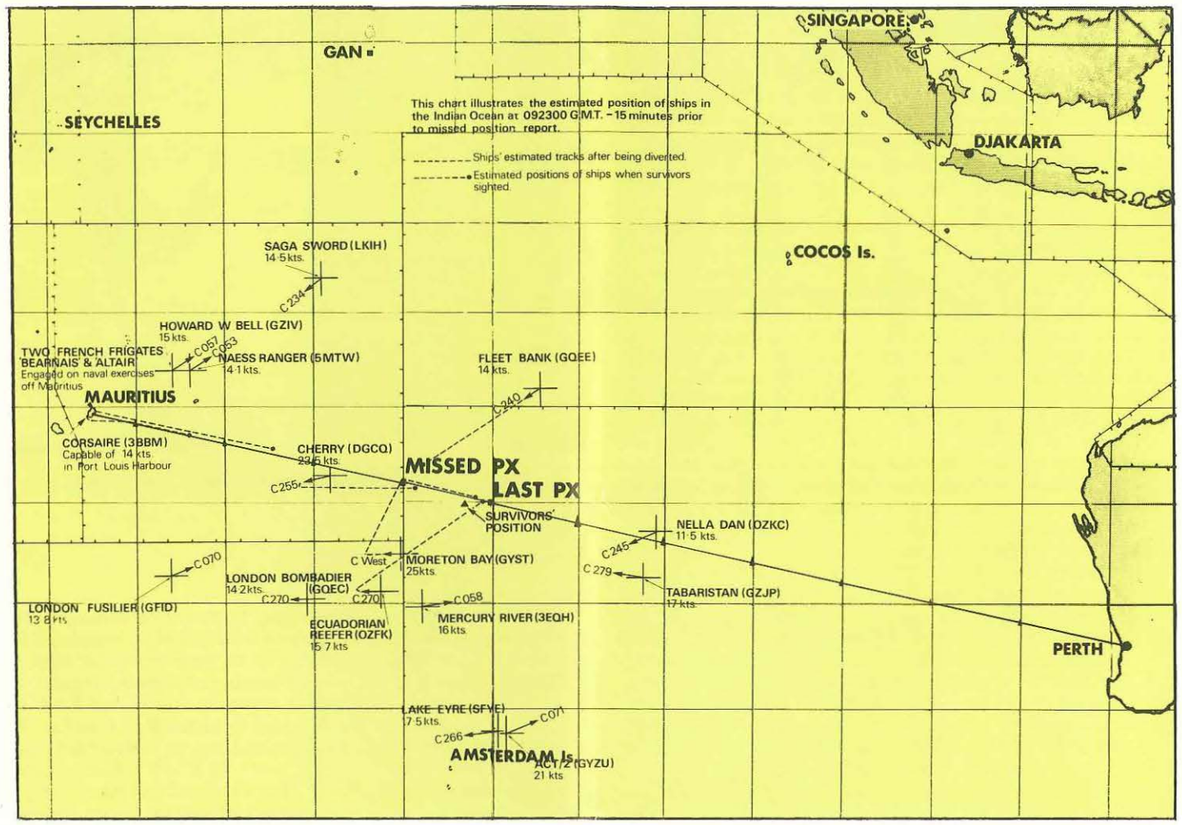
As in any maritime search and rescue operation, it was essential to know precisely what shipping was in the area. The United States Coastguard operates a service called AMVER (Automatic Mutual Assistance Vessel Rescue System), a computer forecast of the position of all ships whose masters volunteer their sailing details. Although the computer is at the US Coastguard Centre in New York Harbour, it can be interrogated from various points. The SMC therefore despatched a message to the Coastguard Centre at Honolulu, requesting an AMVER surface picture with a radius of 999 nautical miles, centred on 24°S, 78°E. At the same time he notified the Australian Department of Transport's Marine Operations Centre at Canberra, and the Centre commenced a detailed assessment of all shipping which could possibly be of assistance.

At 0025 hours, radio contact was at last re-established with Mauritius and the grave news was learnt that Mauritius also had heard nothing more from the aircraft. It was found in fact that the Mauritian personnel, being unsure of just what communications had taken place between the aircraft and either Cocos or Perth, had been in the same quandary as their Australian counterparts, and had carried out almost identical emergency procedures, up to and including the broadcasting of a ditching report. The Mauritian operators had also contacted their communication station at Rodriguez Island, a small atoll approximately 350 nautical miles east of Mauritius and about 110 nautical miles north of the aircraft's inbound track, to see if the missing aircraft had been sighted there. If a serious malfunction had occurred necessitating a ditching and preventing the aircraft from transmitting, the captain might have headed for Rodriguez as the closest speck of land in that vast area of ocean. An hour later at 0129 hours, when the aircraft's ETA Mauritius passed with no further news, the Distress Phase was formally introduced, and SAR authorities in South Africa, Reunion, Malagasy, Singapore, Djakarta and all major Australian centres, were notified.

* * * *

Because it is essential in any marine rescue operation, that survivors be sustained with flotation equipment, drinking water, first aid and food, until rescued, the Department maintains marine rescue equipment at all its major coastal centres, and when required, an appropriate sea rescue kit is prepared for dropping from the air by specially trained personnel. In this case, equipment at Perth had been prepared before the Distress Phase was introduced, and similar equipment was being made ready at Darwin.

By this time, information on the availability of search aircraft was to hand, and some of these were now requisitioned. These included an RAAF Hercules on the ground at Darwin, which was immediately requested to load the droppable equipment and proceed to Cocos Island. Another Hercules, inbound to Darwin from Indonesia, was alerted to prepare for an immediate turnaround for Cocos after arriving at Darwin. A little



later, the RAAF advised that a third Hercules was due to arrive at Pearce, WA from Richmond, NSW. A Singapore Airlines Boeing 707, enroute from Melbourne to Singapore was diverted from over Leigh Creek, and expected at Perth at 0410, but would require a 40 minute turnaround before it could be available for the search. Another Boeing 707, belonging to BOAC, on the ground at Darwin, was diverted to Cocos Island with an ETD of 0215.

Immediately the Distress Phase was declared, the coast radio station in Perth activated its auto alarm, which was relayed from ship to ship across the Indian Ocean, and a general message was also despatched to coast radio stations and ships in the area, advising that the life rafts on board the missing aircraft were equipped with 'Gibson Girls' which could transmit on 500 kHz and 8364 kHz. Ships were also requested to maintain a visual lookout for life rafts, wreckage, oil slicks or even survivors in the water.

By this time, it had been established that as well as Perth, Cocos and Mauritius, neither Darwin, nor Gan in the Maldive Islands, had heard any transmissions from the missing aircraft, and arrangements were made to play back all available tapes of the area frequencies to ensure that no transmission had been missed.

By 0200, two hours forty-five minutes after the aircraft's 80 east position report had first been missed, the operation of a large scale oceanic search was well under way. The Singapore Airlines 707 was loaded at Perth with as much droppable SAR equipment as possible and despatched to Cocos. The 707 cannot be used for dropping, but this enabled the equipment to be moved as quickly as possible to the base from which the RAAF's Hercules would be operating. From Cocos, a Hercules could cover any point in the search area and continue to Mauritius with two hours fuel still remaining, and as no weather problems were likely to preclude this action, the operation was planned on these lines.

Qantas Airways now advised that another 707 could be despatched from Sydney with two crews by 0440. Arrangements were therefore made for it to carry droppable equipment, together with two relief SAR mission co-ordinators from the Sydney SAR staff to Mauritius, to provide support for the SAR organisation there. A further Qantas 707, engaged in crew training at Avalon, Victoria was also requisitioned and was to proceed to Melbourne Airport to load all droppable equipment available, including a Marine VSB, before departing for Perth. This aircraft was also to carry a reserve crew. As well, the crew of a BOAC VC10 inbound to Perth from the eastern states, were requested to report to the RCC as soon as they arrived, and another Qantas 707,

enroute from Sydney to Singapore, was diverted from over Moomba, to Perth, with an ETA of 0530.

In the meantime, the RAAF's Headquarters Operational Command, responsible for the service's maritime and transport aircraft, had been alerted to the gravity of the situation and were making an accurate assessment of the aircraft they could make available. An Orion reconnaissance aircraft at Edinburgh, South Australia, was already on one hour's standby for SAR duties, and its crew were alerted for an ETD of 0330.

At the Marine Operations Centre in Canberra, shipping plots for the Indian Ocean were being updated, but a print-out of naval shipping in the area had produced no additional information. Also, advice from the Japanese Embassy, which had been asked for details of fishing fleets in the Indian Ocean, indicated that none of their vessels was close to where the aircraft had disappeared. Back at the Perth RCC however, the computer surface picture received from AMVER showed there were nine ships within the area specified. There was also advice from Mauritius, that the rescue vessel *Le Corsaire*, was expected to depart by 0700. As well, two French frigates, *Bearnais* and *Altair*, engaged in exercises off the Mauritian coast, had been made immediately available. Each of these naval vessels had a medical officer on board and were directed to begin backtracking the aircraft's inbound track. The French Embassy in Mauritius also offered the assistance of a C47 and Nord RD502 aircraft. Even though the range of the C47 was limited to 350 nautical miles, it could at least cover a small portion of the missing aircraft's inbound track. By this time too, two more merchant vessels had responded to the auto alarm with offers of assistance, and instructions were now issued to three ships, diverting them to strategic postions in the search area.

At 0313 hours, BOAC's 707 departed Darwin for Cocos with marine supply containers and a 30 man life raft. Its ETA Cocos was 0701. Shortly afterwards, advice was received from the RAAF that the first Orion aircraft was about to depart from Edinburgh and its crew were briefed to proceed direct to Cocos. The Orion's ETI was seven hours thirty six minutes and the aircraft could be turned around at Cocos in about an hour. It was estimated that the Orion could spend seven hours 30 minutes in the search area if it was to return to Cocos, or eight hours 30 minutes if re-deployed to Mauritius. The Orion was carrying two sets of Lindholme equipment, each consisting of two ten man life rafts and two marine packs. The Orion subsequently departed Edinburgh for Cocos at 0401 and the RAAF advised that a second Orion would be ready to leave within an hour, also carrying two Lindholme sets. Two more Orions would be ready for despatch by about 0700, each with one Lindholme set on board. Further aircraft now becoming available from the RAAF were two additional Hercules from Richmond, which would be ready for departure at 0445 and the next day at 0200 respectively. Meanwhile the Hercules from Darwin departed for Cocos at 0315. Its ETA was 1106.

At 0326, advice was received from Singapore that a Royal Air Force Nimrod aircraft would be available later in the day. As well as this, the Marine Operations Centre in Canberra now had information on another ship in the search area, the container vessel, *Moreton Bay*, which was heading west at 25 knots. By this time the BOAC VC10 inbound to Perth, had landed and the captain was briefed to carry out a high level track crawl to Mauritius to establish if a VSB had been activated. It departed Perth soon after 0315 hours.

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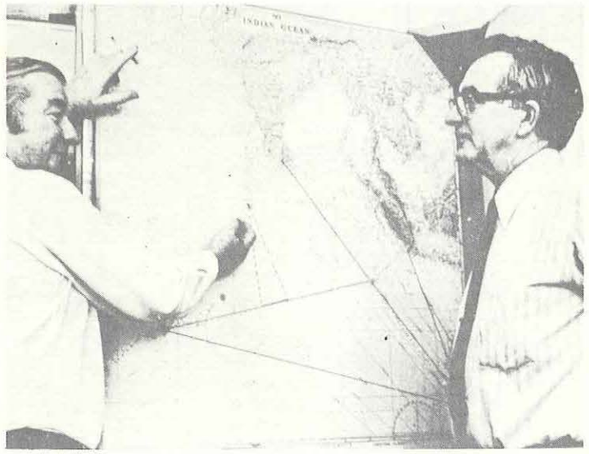


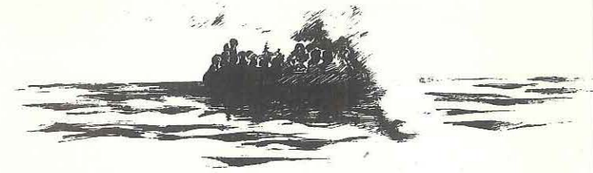
SAR mission co-ordinators reviewing progress of the search.

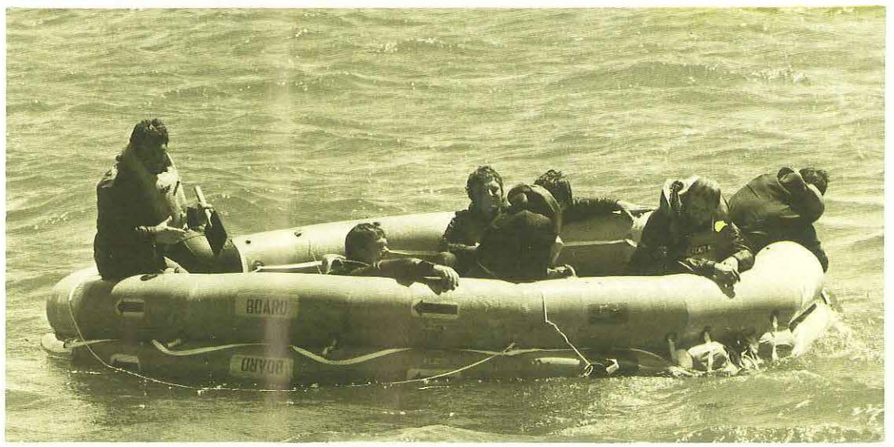
At this stage of the operation, both the Australian and British Broadcasting Commissions were asked to broadcast to shipping on any frequency likely to be received in the Indian Ocean, requesting advice of any hearing or sighting reports of the missing aircraft. A message was also sent to the RAF in Singapore requesting their Nimrod to proceed to Gan on the western side of the Indian Ocean as soon as it was ready for departure. The aircraft was to carry as much marine rescue equipment as it could. Shortly afterwards, advice was received from Mauritius that a Piper Navajo, at present on the ground at Rodriguez Island, could also search 350 nautical miles out into the Indian Ocean. The Navajo was subsequently despatched, first to check the beaches of the atoll for wreckage, then to intercept the missing aircraft's inbound track and backtrack it as far as possible before returning to Rodriguez. By this time also the Qantas 707 from Avalon was ready to depart from Melbourne with two thirty-man and eight ten-man life rafts, together with three marine supply containers.

* * * *

By 0615, seven hours after the missing aircraft's position report was first overdue, the SMC was considering the possibility of a night search and was assessing the availability of crews and aircraft to continue the search into the second day. The weather forecast for the search area was favourable making a night search practicable and it was possible that survivors could activate signal flares or that wreckage or life raft reflections could be picked up on radar. Sea conditions were such that good radar returns could be expected. Plans were therefore made for the RAAF Orions to conduct a radar-pyrotechnic search.

By last light in the search area, the planned coverage for the first day had been completed, achieving a probability of detection of less than 50 per cent. The area had been overflown by the Singapore Airlines 707 which had carried out one parallel

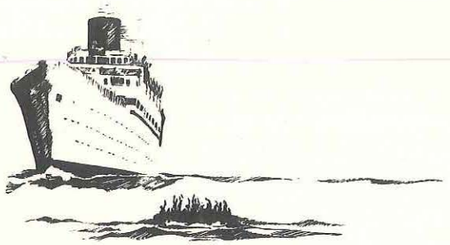




TOP:
Marine rescue equipment prepared for dropping from a search aircraft.

CENTRE:
Sea rescue kits about to be dropped from the rear loading platform of a Hercules aircraft.

BOTTOM:
"Survivors", manning a dinghy dropped from the air during a supporting exercise to demonstrate the effectiveness of airborne sea rescue kits, patiently await "rescue".



sweep of track at 2,000 feet. The BOAC VC10's high level beacon detection search had also been completed without result, and a Qantas 707 had completed a parallel sweep at 1500 feet along the route together with another sweep to the north at 1500 feet. As well, the BOAC 707 had carried out part of its allotted search by last light. It completed the remaining portion after dark. Meanwhile the Department of Shipping and Transport's HF/DF Station at Troughton Island, off the north-western coast of Australia, had been maintaining a continuous watch on the missing aircraft's Gibson Girl frequencies.

After consultation with the various authorities and operators, it was found that nine of the aircraft used on the first day's search, which had been deployed from Australia, would be available for the second day's operations. As well as this, the C47 and the Piper Navajo from Mauritius, would be available, as would a further Qantas Boeing 707 yet to depart from Sydney with a spare crew. Also at 1136 hours, a message was received from Cape Town, South Africa, that two Shackleton aircraft of the South African Air Force's Marine Command had departed Cape Town at 1000 hours for Reunion, where they would refuel before joining the search.

The search continued throughout the night, using firstly the remaining search time available from all the Boeing 707s. The first Orion was turned around as quickly as possible after reaching Cocos and departed for the search area at 1209. It subsequently arrived at Mauritius after completing its detail just before dawn on the second day. A further Orion, which had arrived at Pearce at 0902, also joined the night search after refuelling. It completed its allocated task about an hour before it reached Mauritius just before dawn at 2355 hours.

* * * *

By the beginning of the second day, the search and rescue operation had developed into a well organised action. Aircraft to be used had been positioned, and their crews refreshed, for the long, slow process of visually scanning the search area, which had now been expanded to 36,000 square miles, and the droppable survival equipment was on board most of the Hercules aircraft. Ships diverted to the search area were being positioned, and the whole operation being arranged so that aircraft departed from their various bases to be in their allotted search areas at specified times. In this way the aircraft would be separated in the search area by both geographic and time factors. It was expected that by 0500 on the second day, a probability of detection of 74 percent would have been achieved.

By 0430 on the second day, more than half of the search area had been covered without success, and the RAAF Orion, which had joined the search that day from Pearce, had been nominated to act as on-scene commander. The command aircraft would maintain contact on 2182 kHz with the four merchant ships that had been diverted into the area. By now, planning was well advanced to provide aircraft and crews for the third day's search, intended to raise the probability of detection to well in excess of 80 percent. An additional aircraft, a South African Airways 707, which had been scheduled for a flight from Mauritius to Perth, had now become available and instructions were issued for it to wait at Mauritius to be ready for use on the third day. But at 0508 hours, further planning became unnecessary.

At this time, one of the RAAF Hercules, carrying out a creeping line ahead search at 25° 21'S, 78° 58'E, sighted two life rafts in the water. Both rafts appeared to be filled to capacity, with some survivors apparently still in the water. The Hercules had two 30-man life rafts on board as well as marine stores, and its captain immediately set his aircraft into a supply-drop circuit and began dropping operations. The position of the survivors was also marked by dropping a marine VSB which activated on impact, making it a comparatively simple procedure to pass the position of the survivors to other rescue aircraft. Contact was established between the Hercules and the RAAF Orion acting as on-scene commander on 123.1 MHz, and *Moreton Bay,* the ship closest to the survivors, together with another merchant vessel, *Ecuadorian Reefer,* were given courses to steer to the survivors' position. Meanwhile the bulk carrier *Cherry,* one of the other ships in the area, reported the actual weather, which was ideal for supply dropping and rescue operations. Aircraft engaged in the search, other than the on-scene commander and those required to drop supplies, were now instructed to return to their bases, where most were requested to stand by for further possible search duties.

The two frigates, each with a medical officer on board, were to continue eastwards towards the survivors' position in order to intercept the merchant ships as soon as possible after they had recovered the survivors from the water. Having taken the survivors aboard, the French vessels would return to Mauritius, where hospital authorities had been alerted to provide for up to 150 casualities.

The rescue operation continued with the arrival of other supply dropping aircraft at the survivors' position and sufficient supplies were dropped to support them for several days. Although this was unnecessary in the circumstances, the supplies form part of the standard sea rescue kits with the life rafts, and it was decided to drop all that were available to ensure that adequate floatation equipment was provided to the survivors in the water.

Once all the survivors had been picked up, and all who had been aboard the lost 707 had been accounted for, the air operation was scaled down. All but the RAAF and South African Air Force aircraft were now released from the search and rescue action, these latter aircraft being kept on standby in the area to provide guidance to the four ships and assist the intercept, which was calculated to take place at 112300.

* * * *

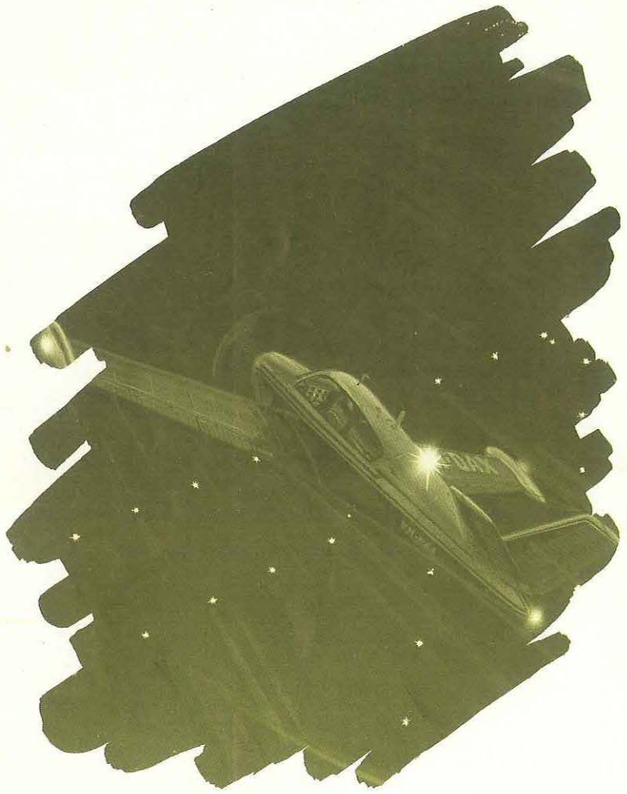
The exercise showed that from the time the fictional VH-SRX transmitted its last position report, to when its survivors would have first been sighted in the water, 31 hours ten minutes would have elapsed. The total time the survivors would have been in the aircraft's life rafts, or the water, before supporting equipment could have been dropped to them, would not have exceeded thirty two hours. As the exercise turned out, only a further three hours would have passed before they would have been picked up by either *Moreton Bay* or *Ecuadorian Reefer,* though of course it could be said it was fortuitous that these vessels were in close proximity to the assumed position of the survivors at the time.

But even if this had not been so, the survival equipment available to be dropped from the air would have been sufficient to sustain the survivors for several more days. In the event, the survivors would have been receiving medical attention on board the two French frigates in only another 14 hours. This would have been precisely 48 hours 22 minutes from the time of the aircraft's last position report at the 80°E meridian.

All times quoted in this article are GMT. Mauritian time is four hours ahead of GMT and Perth time (WST) is another four hours ahead of the time in Mauritius.

FATIGUE IS INSIDIOUS

We normally associate pilot fatigue with service pilots in wartime, and agricultural pilots during a busy season. There are cases of actual exhaustion resulting from over-exposure to flight conditions. But what of fatigue from external causes, which become manifest only under the stresses of flight? This must be of increasing concern in Australia as more hours are flown by the business pilot sector.



THE business community is gradually accepting the light aircraft, not as an expensive luxury, but as an economic necessity. There are economic advantages in hiring, or owning, as opposed to charter. But what can occur when the company pilot also happens to be deeply involved in executive functions? It is very difficult to serve two masters, as the episode I will describe shows.

I am employed in research by a major producer of agricultural chemicals, and undertake developmental programmes throughout WA. We currently fly a V35 Bonanza, but have used Baron, Cessna 210, Cessna 180 and 182, and PA28 series aircraft during the past three years. Our annual utilisation is about 200 hours. I hold a Commercial licence with Agricultural and Instrument ratings, and have over 2000 hours with about 50 night hours.

I had flown the Bonanza from Jandakot to Albany early on the first day, then to Manjimup. Late in the day I flew back to Albany, picked up other staff, then back to Manjimup, about 25 minutes before last light. At this point I had been working for 12 hours. After dinner, I became involved in business discussions for a further 3 hours.

Rising at 0700 hours next morning after seven hours rest, I spent the entire day in the field under hot, sunny conditions. At 1830 that evening I flew to Bunbury to pick up staff and left there at 1920, about five minutes before official last light. The flight to Jandakot was pleasant at 4000 feet OCTA, ground speed 180 kts, and conditions CAVOK. With careful trimming, the Bonanza settled into cruise nicely, and using the wing leveller, I was then free to converse with my passengers. The discussions were involved, and I was mentally absorbed in the subjects raised.

I contacted Jandakot Tower five miles out and was advised runway 24, wind etc. Entering over the top at 1500 ft, we had an IAS of 150 kts and a rate of descent of about 250 fpm. I checked the lighted windsock and confirmed the wind given. I then rolled into a 20 degree turn left and could feel the G force increase. Rolling out of the turn early, I then saw a lighted runway, and after joining crosswind at 1000 ft, flew a normal approach until on final.

At 300 ft on final, just after turning on both lights, I noticed several impossible events happening! First, we were laying off loads of drift. Then other runway lights became obvious to starboard. Worse still, an aircraft was departing from the other runway! I initiated a go-round, simultaneously with a disturbed tower controller advising that I was in fact on final for runway 30. Would we please rectify the situation!

The Bonanza is a tremendous performer, and thus with a 1000 fpm climb, we were quickly clear of the other aircraft. A normal circuit was made and one rather shaken pilot landed on runway 24!

Why did the situation develop? I believe that there are several reasons:

- I was suffering from fatigue. Seventeen hours of work on the first day plus 13 hours on the second, amounts to 30 hours in two days. The work is fatigue inducing, not so much physically as mentally.
- I became absorbed in conversation with my passengers, and was thus distracted. Furthermore, conditions were smooth and the auto pilot was engaged.
- Over the top at Jandakot I was probably a little too fast, considering my tailwind component.
- The turn was too steep, too tight, and I did not cross check the heading required for roll-out.
- I simply did not interpret my vision. It is normally very obvious that runway 24 is toward the Kwinana lights and runway 30 towards Fremantle
- With two runways meeting in a V arrangement, it is not so difficult to confuse them. The out-of-wind runway lights should, in my opinion, be switched off except for crosswind training.
- I failed to check headings on all circuit legs, any of which should have 'shouted' that I was making the wrong circuit.

There are probably more reasons. Complacency can be just as fatal in the air as on the road. My mistake was inexcusable on any airport, let alone at my home base on a fine night with no panic!

Since that unhappy episode I have literally 'slowed down' when conducting country trips. Productivity may be down a little, but at least there are now less mistakes in my research, as well as my flying. A super-efficent employee who is dead is of small value to the company!

So business pilots, take that rest — you may one day be thankful!