COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF CIVIL AVIATION

AVIATION SAFETY DIGEST

No. 8

DECEMBER, 1956

Prepared by the Division of
Accident Investigation and Analysis

Published by Authority
of the Director-General

Printed by McBean Bros.,
48 Rankins Road, Kensington.

CONTENTS

PART I

AVIATION NEWS AND VIEWS

Aircrew Fatigue

The following is a condensation of a paper, "Aircrew Fatigue and Flight Time Limitations", by J. N. Newton, Chief, Flight Branch of ICAO Air Navigation Bureau, and is an extract from "Pilots' Safety Exchange Bulletin 56 - 107" *by courtesy of the Flight Safety Foundation.*

The following is from a report by the C.A.B. regarding an air transport accident in which fatalities occurred when the plane crashed into the pier supporting the approach lights.

". . . It is believed fatigue was a factor in this accident. It was not only present as a result of the time en route, but mostly a result of the additional extended hours devoted to four approaches and the high mental and physical demands made upon the pilots . . ."

What is fatigue? What causes it, what are its results and what can be done to prevent its occurrence or to minimize its effects?

It is simple to define physical fatigue resulting from over-exertion, but fatigue in the airman can hardly be considered solely a result of prolonged sustained activity. Sir Frederick Bartlett, who has conducted a number of studies, has developed a concept of skill fatigue in which he distinguishes between fatigue produced by hard physical effort and that occasioned by work demanding little in continuous muscular reactions but much in persistent concentration and a high degree of skill.

Aircrew fatigue may be divided into two stages: transient fatigue which is the normal fatigue manifest in a healthy individual following a period of exertion or excitement, and which responds to normal sleep, rest and freedom from such excitement; and cumulative fatigue which does not so respond but which may occur after transient fatigue when an individual has undergone stress of such intensity that normal recuperation does not occur, and which may result in a change of personality (aeroneurosis).

ANXIETY

In an attempt to discover the causes and results of fatigue in aircrew, a series of experiments (Cambridge Cockpit Studies) were conducted in England, in which actual flying conditions were simulated as the tests were in progress. These experiments were governed by the idea that a pilot anticipates the dangers in flying and responds to such "anticipatory tension" with responses intended to remove the danger and so relax the tension. It was discovered that pronounced anticipatory tension can be the equivalent of anxiety.

After long periods at the controls in these tests, a distinct deterioration in skill and accuracy became apparent and the subjects, as they became more fatigued, were willing to accept lower standards of accuracy and performance. The range of their attention diminished, with a significant forgetfulness of peripheral instruments. Landing gear switches were frequently overlooked. There was a sudden increase in errors at the end of the simulated flight, indicating that a tired airman has a tendency to relax when in sight of his destination.

Flying is a serious, responsible occupation requiring a high level of skill and intelligence. This degree of intelligence often makes a pilot more conscious of his surroundings and minor discomforts. He is

continually adding to his knowledge those things which he learns from each new flight and from accidents he may witness or hear about. He may have acquired financial, social and family responsibilities, and these, coupled with the responsibility he feels for his crew, his passengers and his aircraft, may begin to cause persistent, though unacknowledged, anxiety.

Such feelings of anxiety and responsibility are entirely normal so long as the individual can handle his problems constructively. But when such anxiety is unresolved, tension increases. Excessive work without frequent rest periods tends to affect the central nervous system as well as bodily resistance, and it has been found that cumulative and persistent anxiety, coupled with inability to escape the responsibilities to which he is constantly subjected, may finally result in aeroneurosis.

OTHER FACTORS

What causes fatigue in actual flight? Studies have produced many variables. The design of the aircraft itself, its size and weight, location of instruments, the effort required to activate the controls, the noise and vibration to which the crew is subjected, together with variants of altitude, pressure, temperature, noxious gases and oxygen—all have an influence upon fatigue. Load, i.e., the number of items that have to be dealt with simultaneously or nearly simultaneously, is also a factor. Much depends, too, upon the duration of flight, the frequency of the landings and take-offs, the weather encountered and the amount of instrument flying undertaken. Prolonged mental strain, anxiety or fear is known to result in a depleted reserve of energy.

Outside influences make themselves felt in the regions and climatic variations through which flights are made, the duration of stay in each climate, in poor aerodromes and inadequate ground services, in travel to and from the airfields as well as such minor factors as meals at outlying stations. The amount of time spent in pre-flight duty as well as delays in the planned flight with their resultant uncertainties and anxieties are significant contributors. Economic problems and personal worries relating to the pilot's home life also are factors in predisposing him to fatigue. Pilots with nervous or neurotic temperaments, aggravated by domestic troubles, cannot conduct crew coordination or give the necessary confidence required when the crew faces unusual conditions.

CRITICAL PEAKS DURING FLIGHT

What are the results of fatigue in aircrew? The Cambridge Studies showed that the effect of fatigue is greatest at the end of a flight when the demands for efficient performance are at their height. It is frequently necessary for the pilot to produce a reserve of energy and capacity at the end of a long flight in order to make an instrument approach which may be difficult. The deterioration of skill and the acceptance of lowered standards noted in the Cambridge tests are particularly significant in relation to overlooking landing gear switches, since misuse of the landing gear is a common cause of accidents.

First class vision, with particular reference to convergence and accommodation, is a primary requirement for flying personnel. Fatigue can noticeably impair such visual acuity. It is noteworthy that in several recent accidents where fatigue has been a contributing factor, visual errors (during final approach and landing) have been the primary errors leading to the accident. From the evidence gathered, it would appear that fatigue is cumulative and leads to errors of judgment which can endanger the safety of the aircraft, its passengers and its crew.

PREVENTIVE FACTORS

What can be done to prevent fatigue? Obviously, a great deal depends upon the individual. He must maintain good physical and mental health by following a programme of adequate exercise (too much is as harmful as too little), and good and adequate rest. He must abstain from excessive consumption of tobacco and alcohol, and follow a healthful diet.

The operator, for his part, must do all in his power to assist his aircrew by providing good, reliable aircraft, well maintained and serviced, together with all possible ground aids.

In his comment on studies of pilot error, Dr. Russell Davis, of the United Kingdom, states, "It is reasonable to expect that if pilots come to regard flying as safe, from confidence in the conditions in which they fly, the accident rate will decline. On these grounds alone, everything possible should be done to relieve pilots of anxiety about the

outcome of their flights. Traffic and other arrangements should be such that not only are the dangers reduced, but pilots should regard them as reduced. For the same reasons, careful briefing must be regarded as important".

Adequate health service and counsel for emotional problems to relieve anxiety and tension will assist the operator in keeping his crews at the peak of their efficiency.

Proper scheduling so that flight time is evenly divided, with no pilot assigned to successively long and tedious flights, can do much to keep fatigue at bay.

Ensuring adequate messing and other facilities at outlying stations and keeping pre-flight duty and stand-by time to the minimum also will help. Furthermore, it is the operator's responsibility to ensure the thoroughness of all maintenance work as a series of even minor mechanical difficulties can cause anxiety and uncertainty over the serviceability of the aircraft.

Operators should co-operate with aircraft designers to achieve the best possible arrangement of instruments, lighting, heating and other flight deck details, thus endeavouring to eliminate unnecessary or difficult manoeuvres during flight. Aircraft designers also should provide the best possible cockpit visibility, together with such instrument grouping as might best lessen the visual strain upon the aircrew.

Proper coding of controls by variations in position, shape, colour and size might reduce the likelihood of errors.

All these factors can help to prevent the incidence of fatigue and, together with frequent rest periods for recuperation, can do much to avert cumulative fatigue and aeroneurosis.

There has been a mistaken concept in many quarters that the only answer to aircraft fatigue is to lessen exposure time by flight time limitation. Actually, the limitation of flight time and corresponding "on duty time" is only one of the many methods that can be employed. The whole aviation industry and its associations have been working to improve safety, regularity and efficiency of air navigation, which in effect reduces the load on the aircrew and goes a long way toward reducing fatigue.

The problem of fatigue has received a great deal of consideration, and nations, principalities and powers, not to mention pilots and operators, have all contributed towards a solution.

A CASE IN POINT

"At approximately 1400 hours on an overcast December day in 1954, persons in the vicinity of Idlewild Airport, New York, were startled by a violent explosion followed by signs of an intense fire. Investigation revealed an incoming European aircraft had crashed into the pier supporting the approach lights to Runway 4, had been demolished by impact and had carried 26 persons to their deaths in the icy waters of Jamaica Bay. An inquiry was carried out by the Civil Aeronautics Board.

"The findings provided several interesting and pertinent pointers on fatigue in aircrew and it is proposed, in conclusion, to allow these facts to speak for themselves. It should be noted that this aircraft carried a large crew complement; a captain who had made 150 Atlantic flights—75 into Idlewild Airport, three other pilots, a radio operator and two flight engineers as well as a cabin staff. It would be reasonably assumed, therefore, that excessive duties were not undertaken by any individual. However, as the Civil Aeronautics Board report states: 'Company officials testified that on a normal North Atlantic flight the captain and one of the other pilots would fly the aircraft to Shannon and then would rest during the Atlantic crossing while the other pilots flew the aircraft. After reaching the more congested areas of the United States, the captain would again take control until the flight terminated. This procedure afforded each pilot nearly equal rest periods. The bunks on board the aircraft provided them with the best rest possible considering it would be under flight conditions and with continuing respective responsibilities for the flight . . .'

". . . There is no reason to believe that normal rest procedures were not followed. It is nevertheless believed fatigue was a factor in this accident. It was not only present as a result of the time en route, approximately 22½ hours, but mostly a result of the additional extended 2½ hours period devoted to the four approaches and the high mental and physical demands made upon the pilots. The element of fatigue is strongly suggested, especially during the last approach. Fatigue is evidenced by the pilot's poor adherence to the localiser path, the last descent to a very low altitude before the sharp pull-up, and the evidence of abrupt control action. It may also be noted to some degree in the pilot's slow response to the wind shift and the probable loss of airspeed which caused the sinking descent before the aircraft struck the pier. These factors lend credence to the belief that the pilot's efficiency and normal ability were seriously impaired by fatigue."

(A more complete account of this accident appears on page 8.)

Avoidable Collisions on Agricultural Operations

DURING the past few months there has been a large number of collisions with obstructions during agricultural operations. The investigation of these accidents reveals that in many cases, such as those listed below, these collisions would have been avoided if the proper precautions had been observed. Instead, five pilots were injured, two fatally, and ten aircraft substantially damaged, four beyond repair.

Date	Location	Injuries	Aircraft Damage	Type of Accident
5.10.55	Colac, Vic.	Fatal	Destroyed	Collision with power lines during spraying operations.
6.11.55	Horsham, Vic.	Serious	Destroyed	Collision with tree on spraying run.
12.11.55	Canaga, Qld.	Nil	Substantial	Collision with fence on take-off.
24.11.55	Collingullie, N.S.W.	Nil	Substantial	Collision with power lines during spreading operations.
2.12.55	Mareeba, Qld.	Fatal	Destroyed	Aircraft collided with tree at end of spraying run.
21.2.56	Warragul, Vic.	Nil	Destroyed	Collision with high terrain during spreading.
21.2.56	Bowral, N.S.W.	Nil	Minor	Collision with obstruction during take-off.
4.4.56	Maclaren Vale, S.A.	Nil	Minor	Collision with fence during take-off when full run available was not used.
8.4.56	Timor, N.S.W.	Minor	Substantial	Collision with high terrain after aircraft proceded too far up valley during spreading.
24.5.56	Stawell, Vic.	Nil	Minor	Collision with fence during take-off.
13.7.56	Walcha, N.S.W.	Nil	Substantial	Collision with fence during take-off.
20.7.56	Boorowa, N.S.W.	Serious	Substantial	Collision with power lines when returning to strip after spreading.
1.9.56	Mulgowrie, Qld.	Nil	Substantial	Collision with power lines during dusting operations.
24.10.56	Gatton, Qld.	Nil	Minor	Collision with electric light cables during crop dusting.

Note: In all these accidents DH82 aircraft were involved.

This list excludes those accidents where collision with obstacles or the ground have occurred through unwitting errors of judgment or piloting.

The collisions listed may be divided into two classes—

(i) Collisions with power lines, and
(ii) Collisions with obstructions that the aircraft could not outclimb.

Five of these accidents are in the first class, and with one exception these were due to pilots not knowing the location of the particular power lines. Careful ground inspection, supported by inspection from the air, prior to commencing operations in each location is absolutely essentially to avoid this type of accident. Operations manuals call for such inspections and these accidents

prove beyond all doubt the need for this precaution. You cannot afford to assume that you know an area from your last visit; make a thorough inspection both from the ground and the air before commencing each series of operations. In several accidents it has been established that pilots were unaware that new power lines were erected since their last visit to the area. It is obvious, therefore, that if an inspection was made in these cases, it was only of a very cursory nature.

In the second class there are nine accidents. Basically they amount to pilots expecting more performance than it is possible to obtain from their aircraft. All-up-weight and density altitude have a large effect on climb performance, particularly with engines that are not supercharged. Take-off runs are also effected by these factors and by varying aerodrome surfaces. The table hereunder on this page shows how the climb performance of a typical agricultural DH82 varies with weight and density altitude.

Incidentally, a density altitude of 5,000 feet exists at a pressure altitude of 2,000 feet when the air temperature is 98.6°F.

Density Altitude	1,825 lb. All-up-weight		1,600 lb. All-up-weight	
	Rate of Climb (Feet per min.)	Gradient of Climb	Rate of Climb (Feet per min.)	Gradient of Climb
Sea Level	330	1: 12.5	420	1: 9.9
5,000 feet	135	1: 30.7	225	1: 18.5

Pilots, know the performance you can expect from your aircraft and don't just hope that you will clear the fence on take-off or stagger over that rising ground ahead of you. If you are unable to determine what your aircraft will do under varying conditions, then you are ill-equipped for your work and you expose yourself and others to needless and costly consequences. Guesswork can be fatal.

Use of Antihistamines

At this time of the year a lot of people get hay fever and use antihistamine drugs to combat it. These drugs are also used for other illnesses due to allergy. Several of them are used to prevent air sickness. Pilots who have antihistamines prescribed for them should consider possible side effects, which vary with individuals and with different drugs.

There should be no harm in operating aircraft while you take antihistamines IF—and it's a big "if"—you have been observed for possible side effects and found to be O.K. This period of observation should cover at least a week because the effects are cumulative, and the checking should preferably be done by your doctor.

According to the Air Navigation Regulations you may *not* act as a crew member if your capacity to act as a crew member is impaired by any ". . . narcotic or stimulant drug".

If you need to take antihistamines, it's up to you to see that your fitness to fly is not impaired by the drug. By the way, antihistamines won't cure or prevent colds.

All these drugs are antihistamines:—

Actidil
Allercur
Ambodryl
Ancolan
Andramine
Andrews
Anthisan
Antistine
Avil
Avomine
Benadryl
Bonamine
Bromazine
Chloroprophenpyridamine Maleatic
Chlor-Trimeton
Diatrin
Di-Paralene HC1
Dramamine
Histadyl
Histantin
Histostab
Longifene
Marzine
Menhydrinate
Neo-Antergan
Neo-Hetramine
Perazil
Phenergan
Piriton
Pyranisamine
Pyribenzamine
Pyrilamine
Pyronil
Sandosten
Synopen
Tagathen
Thenfadil
Thenylene
Thephorin
Travamine
Vibazine

Serviceability of Licensed Aerodromes

(6/356/115)

During the past twelve months there has been quite a number of cases of aircraft landing on unserviceable areas at licensed aerodromes and also of aircraft landing on licensed aerodromes which were unserviceable.

Investigation of these incidents has revealed that in nearly all instances the instructions issued to aerodrome licensees regarding notification of aerodrome serviceability status and aerodrome unserviceability markings were not complied with.

Although an aerodrome licensee, or his nominee, is required to personally supervise the maintenance of the aerodrome concerned and report any unserviceability, it is apparent that this is not always being done. Therefore, it is suggested that, in addition to obtaining the latest available information on a particular licensed aerodrome, pilots should make it a rule to closely examine such aerodromes before landing.

So that we can help you, would you please report any deficiencies in the serviceability status of licensed aerodromes to the nearest Regional Office. This may be done by lodging an incident report at any Air Traffic Control or Communications Unit.

Help Others to Help You

AN incident summarised in this Digest deals with a flight from King Island to Melbourne where the pilot became uncertain of his position and requested assistance from Air Traffic Control. However, the pilot did not advise A.T.C. that he had reduced power and he did not pass all changes of course, times, fuel endurance or estimated position, and A.T.C. did not request these details. Following this incident controllers have been advised that where the pilot does not give these details, they should request the information and at the same time advise the pilot that a plot is being established and that a D/R position will be advised and a course of action suggested.

The investigation revealed that the pilot was not fully familiar with the information to be passed when declaring an emergency such as occurred on this occasion (see AIP/S.A.R.) or the assistance that can be provided by Air Traffic Control. In an emergency such as this, the alert phase of the emergency procedures is introduced which results in —

(a) The R.A.A.F. Rescue Co-ordination Centre being advised and search aircraft alerted.
(b) Ships, lighthouses and any other facilities which may be able to assist, being alerted.
(c) Other aircraft being shuffled to provide separation.
(d) Weather information on all aerodromes in the area of probability being obtained and passed to the pilot.
(e) A navigation plot being commenced, and continued until the emergency no longer exists.

Provided the pilot has passed details of courses, times, indicated airspeeds and fuel endurance, A.T.C. has the necessary facilities to prepare a reasonably accurate plot as quickly as possible and suggest a course of action. The accuracy of such a plot is of course dependent upon the information supplied by the pilot. The plot is particularly important in establishing the search area in the event of an emergency landing or the disappearance of the aircraft.

These situations are most likely to occur under difficult flying conditions. In such circumstances A.T.C. are in the most favourable position to make a detailed air navigation plot and suggest courses of action. But to do this A.T.C. must be in possession of all the details of the flight. The controller in charge of such a situation will be a senior officer thoroughly familiar with S.A.R. procedures and aware of your problems. He is there to help you. Help him to help you.

PART II

OVERSEAS ACCIDENTS

Landing Accident — DC.6B — Jamaica, New York

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (16/2/28)

AT approximately 1400 hours on 18th December, 1954, a DC6B crashed into the pier which supported the left row of slope line approach lights to runway 4 at the New York International Airport (Idlewild). The accident occurred during the flight's fourth instrument approach to the airport. The entire crew of 10, and 16 of the 22 passengers, were killed; four of the six survivors received serious injuries. The aircraft was demolished by impact and sank in Jamaica Bay. An intense fuel fire followed the impact and spread over the water surface and pier.

THE FLIGHT

The aircraft was on a scheduled flight from Rome to New York with scheduled intermediate stops. After an uneventful instrument flight from Boston, the captain reported at 1122 to the Idlewild Approach Control as being over the Mitchell Radio Range Station at 7,000 feet. The aircraft was then cleared to enter the Scotland holding pattern (located approximately 13 nautical miles south-west of the airport) and was subsequently "laddered down" to the number one position to approach.

Between 1147 and 1159 weather conditions deteriorated below the ceiling minimum of 400 feet for landing on runway 22—the runway then in use—and the aircraft continued to hold.

At 1159 reported weather conditions improved and the aircraft was cleared for an approach to runway 22 using the back course of the ILS (Instrument Landing System). At 1218 the captain reported he had discontinued this approach. He was then issued missed-approach instructions and returned to the Scotland holding pattern. Shortly after, weather conditions were again reported below minima for runway 22. They were then reported as: ceiling 300 feet, broken, 2,500 feet, overcast; visibility 2½ miles, light rain and fog: wind south-south-east 20 knots.

While holding, the captain was asked by Approach Control if he would be able to make an approach to runway 4, the ILS runway, considering the tail-wind component. The captain accepted runway 4 and was cleared at 1307 for an ILS approach. At 1313 the tower was advised by 451 that the approach had been missed.

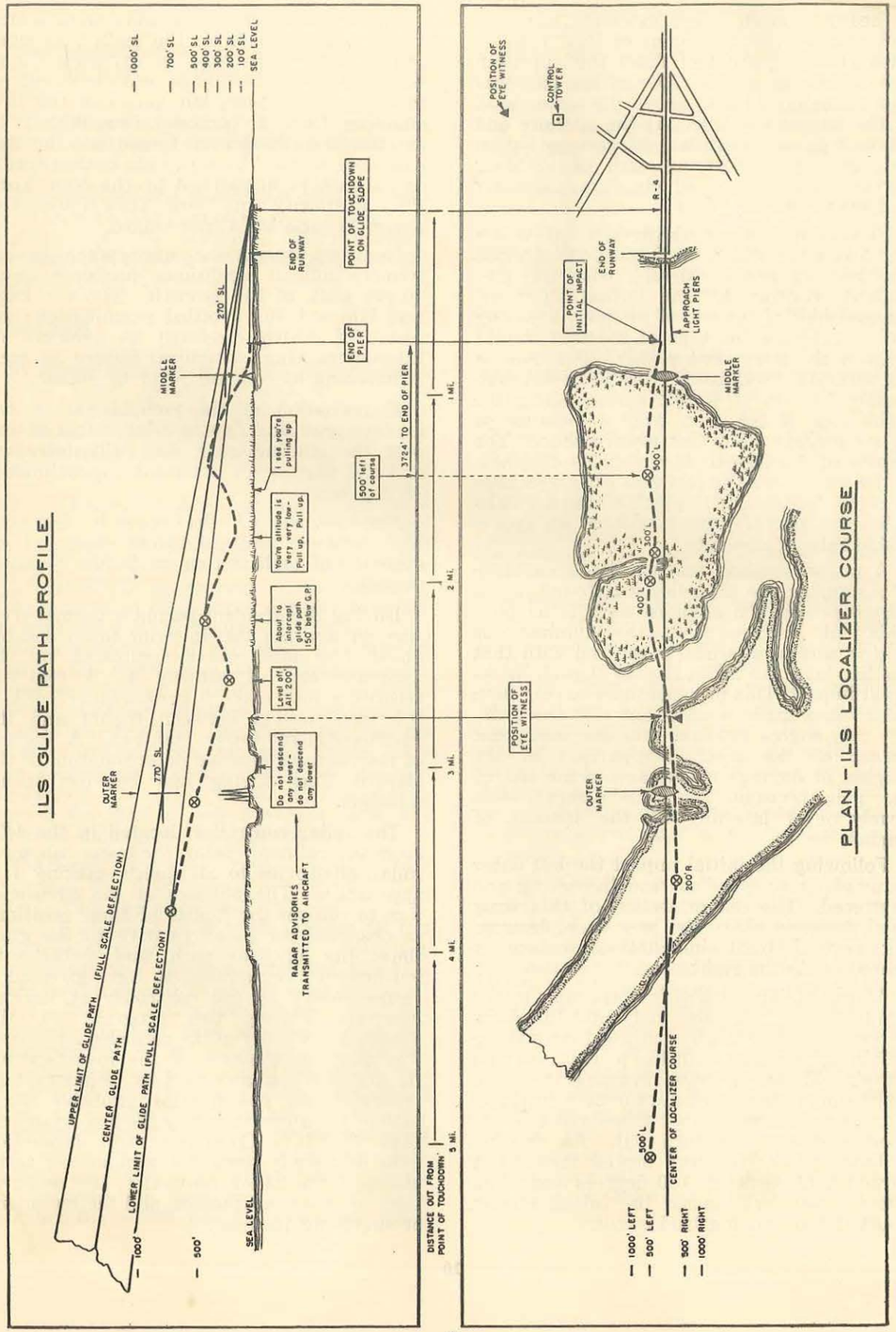
The captain was next offered, and he accepted, a GCA (Ground Approach). This approach was abandoned at 1324, a missed-approach procedure was followed, and the flight returned to the Scotland pattern.

At 1349 the aircraft was again cleared for an ILS approach, the third approach to runway 4 and its fourth to the airport. At approximately 1400 the aircraft struck the left pier. The impact was accompanied by a violent explosion and followed by an intense fire. Tower personnel immediately sounded the crash alarm and initiated emergency procedures.

At the time of the accident weather conditions were reported as: ceiling 200 feet overcast; visibility 2-2½ miles, light rain and fog; wind south-south-east 16 knots. The company minima for ILS approaches to runway 4 are ceiling 200 feet and visibility half mile.

INVESTIGATION

Investigation at the accident scene disclosed that the aircraft struck the left inbound pier. The pier, primarily constructed



of heavy wooden piles, extended approximately 2,000 feet into Jamaica Bay, with its offshore end 2,530 feet from the approach end of runway 4. The floor of the pier was approximately 14 feet above the water level in the Bay at low tide. At the offshore end there was a vehicular turnaround with numerous piles forming each of its four corners, the tops of which were about six feet above the pier floor.

First contact was with the pier only a few feet above the water. At impact the aircraft was moving nearly parallel with the pier towards runway 4. The impact shattered the east half of the end of the pier, breaking and splintering the tops of most of the 11 piles of the south-east corner. The bulk of the aircraft wreckage then sank in approximately 30 feet of water, mainly along the right side of the pier, over a distance of approximately 1,550 feet toward shore. The nature of damage to the pier, its closeness to the water, and the fact that little wreckage came to rest near the point of impact indicated the aircraft struck without an appreciable rate of descent.

A propeller slash mark made by a blade of a number one propeller was found in the centre pile at the offshore end of the pier. This cut disclosed that the number one engine nacelle was nearly centred with that position and the aircraft was slightly nose-up at impact. This propeller axis having been established made it apparent that the number two engine crashed into the south-east corner of the pier. Comparison of the heights of damage marks across the end of the pier revealed that the aircraft was nearly level laterally at the instant of impact.

Following the initial impact the left outer wing panel wrapped around the piling and shattered. The centre section of this wing went forward above the pier deck, destroying several light installations before it veered off to the right.

At initial impact the fuselage was to the right side of the pier and thus the main portion of the aircraft continued on making additional contacts with the pier during this travel. These impacts disintegrated the right wing outer panel and forward fuselage. During this time number three and number four engines were torn out. As the remainder of the fuselage moved forward it turned approximately 180 degrees and when about 1,300 feet beyond the initial impact point it was moving backwards.

The six surviving passengers were seated at various positions in the main passenger cabin. Two were able to extricate themselves from the wreckage and climb out on to the burning pier, but ahead of the fire, enabling them to proceed immediately to safety. The others were forced into the Bay and were rescued by a private boat operator or helicopters dispatched by the New York Port Authority, the New York Police Department, and the Coast Guard.

Recovery operations, undertaken in extremely difficult conditions, produced about 80 per cent. of the aircraft. The wreckage was laid out for detailed examination, the result of which disclosed no evidence of fatigue cracking, structural failure, or malfunctioning of controls prior to impact.

Examination of the components of the landing gear and flaps indicated that at impact the landing gear was fully retracted and the flaps were extended approximately 18 degrees.

Examination of the severely damaged ILS receiver and indicators disclosed no evidence of malfunction or failure prior to impact.

During the accident period a normal crew was on duty in the Idlewild tower located about one mile north-north-west of the approach end of runway 4. A two-way recording unit made a permanent record of the transmission between flights and the various control tower positions. A feature of the recorder enabled determination of the elapsed time during and between transmissions.

The radar controller, located in the IFR room several floors below the tower cab, gave radar advisories to all flights making ILS approaches. The purpose of the advisories was to inform the flights of their positions as observed on radar relative to the glide slope, the localizer path, and distance to touchdown. The advisories were given as a responsibility of the controller at various intervals during the progress of the approach. A study of the recorded advisories was made as a phase of the investigation. Its purpose was an effort to reconstruct as accurately as possible the probable flight path of the aircraft during the last approach. (See sketch.) Considered in conjunction with this study were the explanatory testimony of the radar controller, the observations of two eyewitnesses, and the testimony of surviving passengers.

It was learned that before the instrument approach was started positive radio contact had been established and the flight had been given the latest weather and altimeter information.

The fatigue aspects of this investigation have already been mentioned in Part I of this issue.

The crew of the flight was qualified and experienced; the captain had made 150 flights over the Atlantic, 75 of which terminated at the New York International Airport.

ANALYSIS

Weather conditions during the accident period were greatly influenced by the velocity of the surface wind. The resultant turbulent mixing probably kept the ceiling and visibility from deteriorating to near zero.

During the first three approaches the crew adhered to the established minimum altitude and apparently maintained some margin above it. The decision to discontinue these approaches was an exercise of the captain's judgment when he was not entirely satisfied to continue. It is believed that the tail-wind component and windshift encountered during the approaches to runway 4 were important factors which influenced these decisions. Although landings were being made down-wind this was necessary because no other runway was equipped with ILS and weather conditions prevented the use of runway 22. This factor also probably caused the pilot to use a slower indicated airspeed during the last approach.

Evidence indicates that on the last approach the pilot began a descent before intersecting the glide path and continued to descend, although repeatedly advised by the radar controller to level off. Altitudes throughout the approach indicate the ILS glide path indicator would have shown a full scale fly-up indication. This evidence strongly suggests that the pilot was not attempting to follow the glide path but decided to descend until visual reference was established. The pilot apparently descended below the overcast in the area between the outer and middle markers, probably in an attempt to proceed visually below the overcast to the runway. While attempting to do so, however, he may have encountered a drifting fog which was not recorded. Such procedure is not in accord with good operating practice, and the reasons for it in this instance have not been definitely ascertained.

When the aircraft broke out below the overcast in the vicinity of the outer marker, the pilot possibly saw the surface of the water and swamp without seeing the approach lights and reacted quickly, pulling up into the overcast. In order to arrest the ascent, or again descend to establish visual contact, it is believed the pilot lowered the nose of the aircraft and in so doing got very low. As a result he apparently again pulled up sharply, the aircraft drifting slightly left. The ascent seemingly continued, during which the aircraft lost airspeed and began turning right. The nose of the aircraft was then lowered and power was applied. The landing gear was probably retracted at some time during this series of events. These movements of the aircraft are strongly supported by the testimony of the surviving passengers, and the path of the aircraft as observed by the radar controller.

The final descent obviously continued until the aircraft was a short distance from the pier but too close to avoid it.

During the Board's investigation and analysis of this accident careful consideration was given the possible misinterpretation of the approach lights or an illusion associated with them. Evidence regarding misinterpretation or illusion would be primarily the testimony of the crew. This was not available for consideration, the entire crew being fatally injured. The Board recognizes these as possible factors; however, from all the available evidence the Board was unable to determine whether or not the lights were a factor.

Although the entire crew was lost and actual rest periods are unknown, there is no reason to believe that normal rest procedures were not followed. It is nevertheless believed fatigue was a factor in this accident. It was not only present as a result of the time en route, approximately 22½ hours, but mostly a result of the additional extended 2½-hour period devoted to the four approaches and the high mental and physical demands made upon the pilots. The element of fatigue is strongly suggested especially during the last approach. Fatigue is evidenced by the pilot's poor adherence to the localizer path, the last descent to a very low altitude before the sharp pull-up, and the evidence of abrupt control action. It

may also be noted in some degree in the pilot's slow response to the wind shift and the probable loss of airspeed which caused the sinking descent before the aircraft struck the pier. These factors lend credence to the belief that the pilot's efficiency and normal ability were seriously impaired by fatigue.

PROBABLE CAUSE

The Board determined that the probable cause of this accident was an erratic approach which resulted in a descent to an altitude too low to avoid striking the pier.

A contributing factor to this accident was pilot fatigue due to the particular and difficult circumstances.

DC.3 Landing Accident — Yakima, Washington

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (18/27/80)

A DC.3 was substantially damaged when it collided with a power line pole during an attempted go-around at Yakima Airport, Washington State. None of the fifteen occupants was injured.

THE FLIGHT

Whilst the aircraft was en route from Seattle, Washington, a storm passed in the vicinity of Yakima, with heavy rain on the airport and wind from the south. When about twenty miles north-north-west of Yakima, the flight contacted the control tower, and was cleared for an approach to runway 22. On base leg the tower reported a surface wind at 10 knots from the south. Approach clearance to runway 16 was then requested and received and the flight path was altered accordingly. At this time the storm had passed to the north of the airport, and the ceiling and visibility were well above V.F.R. minima.

The aircraft touched down in the first quarter of the runway 1,040 feet from the approach end, but a go-around was started when about three-quarters of the runway length was used. The aircraft settled to the ground 110 feet beyond the runway end and rolled 219 feet before again becoming airborne. Fifty-nine feet beyond this point the right wing struck a powerline pole 15 feet above the ground, tearing off portion of the wing. The aircraft then flew across a half-mile wide pasture, and struck a ten-foot willow tree. The wheels again contacted the ground 55 feet beyond this tree, and the aircraft came to a braked stop after rolling 575 feet. All passengers left the aircraft safely and promptly by the stair-type cabin door.

INVESTIGATION

The storm passed over the airport from the south-west to the north-east and was over the field for not more than ten minutes. During the storm maximum gusts of 40 knots with no windshift were noted. Eight points of rain fell on the aerodrome in very short time, leaving the sealed runway quite wet, which resulted in poor braking.

The captain stated that the touch-down was at an indicated airspeed of 70 knots and that brakes were applied repeatedly with no braking effect. This created a definite possibility of overrun, and the captain's decision to go around was considered proper. He advised the first officer of no braking effect and advanced the throttles to take-off power to commence the go-around. The aircraft became airborne at 70 knots I.A.S. and as it passed the south end of the runway at an altitude of approximately 25 feet and an I.A.S. of 75 knots, the captain ordered "gear up". Instead of raising the gear the first officer pulled both throttles back to the closed position. The captain testified that he then lowered the nose to hold airspeed and re-applied full throttles. He did not land immediately after striking the pole because of numerous cattle in the pasture.

The first officer, aged 30, had accumulated a total of 3,400 pilot hours, including 1,200 hours in DC.3's. He testified that he was not advised of the go-around and that the order for gear up was the only thing said by the captain after power was applied and the go-around started. He stated: "At the time the command was given I was expecting an order to reduce power and inasmuch as it looked like a crash was inevitable—when the order came, I moved them by spontaneous action." The first officer's left hand was resting on the control pedestal but not touching the throttles as the go-around started. He estimated the aircraft's altitude as ten feet or more above the ground when near the end of the runway, and was then

waiting for the captain's order to reduce power and cut switches.

The captain had made previous go-arounds on the same runway during his twelve years' piloting for the operating company. There is no reason to doubt that this one would have been successful had it not been for the unexpected power interruption caused by the first officer's action of closing both throttles instead of retracting the landing gear as ordered by the captain.

PROBABLE CAUSE

The Board determined that the probable cause of the accident was the co-pilot's action in closing the throttles which subsequently resulted in the aircraft striking a powerline pole.

Viscount Training Accident— Blackbushe, England

(This summary is based on the report issued by the Minister of Transport and Civil Aviation, U.K.) (18/27/85)

A VISCOUNT type 701 crashed during take-off on a training flight from Blackbushe Airport, England. The aircraft sustained major impact damage and fire broke out which almost completely destroyed it. All five occupants were slightly injured.

THE FLIGHT

When the aircraft was lined up on runway 26 the training captain, occupying the right-hand pilot's seat, informed the pilot under test that he intended to simulate an engine failure during the take-off sequence which was to be purely visual. The training captain stated that upon reaching the V_2 speed of 106 knots when the aircraft was just becoming airborne, he carried out manual feathering of No. 4 propeller by the three movements prescribed by the operator, namely:—

(i) moving the high pressure (H.P.) cock lever to the feather position;
(ii) pulling back the throttle lever; and
(iii) pressing the feathering button.

The gauges showing r.p.m. and torquemeter pressure for No. 4 engine were checked as showing zero, signifying to him that feathering was completed.

By this time the pilot under test was experiencing difficulty in maintaining directional control as the aircraft was turning to starboard despite application of rudder and aileron controls. As he selected the undercarriage up, the training captain took over control because the rate of turn was increasing and the right wing was dropping. He then noticed that the aircraft was not accelerating beyond 106 knots, and, believing that he would still gain control, he put the nose down slightly in an endeavour to increase the speed, but as a height of about 30 feet only had been reached, the aircraft hit the ground. Impact was at a point some 250 yards from the runway in a steeply-banked, nose-down attitude. The aircraft cartwheeled and slid along the ground backwards for 200 yards, coming to rest just inside the north-west boundary of the aerodrome.

INVESTIGATION

Evidence was obtained from eye-witnesses that Number 3 propeller stopped rotating. One of these witnesses was a supernumerary pilot who was looking out of a cabin window. Not only did he see Number 3 propeller feather but he also noticed a sudden cessation of noise from the starboard side of the aircraft.

Three of the blades of Number 3 propeller were in the feathering range, whilst three of the Number 4 propeller were in the fine pitch range. Damage to the blades indicated that Number 3 propeller was almost stationary on impact and that Number 4 propeller was rotating.

Examination of the control cabin revealed that Number 3 H.P. cock lever was selected to the feathering position, to attain which the latch must be raised and the lever moved right back through the gate. The other three H.P. cock levers were forward of the gate. The throttles were all nearly fully open but these positions were considered to be unreliable owing to the effects of crash damage.

Inspection of Numbers 3 and 4 engines and propellers established that Number 3 propeller actuating piston was in the position to be expected if the H.P. cock lever had been moved to the feathering position and the feathering button not operated. Number 4 propeller piston was so positioned

that the blades would have been in fine pitch and giving approximately 10,000 r.p.m. at the moment of impact. No functional abnormality was found in the Number 4 propeller feathering system.

The following observations were recorded by the investigator:—

(i) Consideration of the evidence in conjunction with the operator's drill for manual feathering makes it apparent that the training captain had moved Number 3 H.P. cock lever (which was two inches longer than Number 4) to the feathering position instead of Number 4, and had then throttled back Number 4 engine and pressed Number 4 feathering button. These actions cut off the fuel from Number 3 engine and feathered its propeller and also reduced Number 4 engine to idling conditions. Pressing Number 4 feathering button had no effect on Number 4 propeller however as the H.P. cock lever was not in the feathering position. The aircraft was thus deprived of all power on its starboard side at the moment of becoming airborne and the situation was made worse by No. 4 propeller idling in fine pitch.

(ii) The training captain believed he had completed feathering of Number 4 engine and to confirm this glanced rapidly at the gauges showing r.p.m. and torquemeter pressure for Number 4 engine, both of which he read as zero. Because the engine was throttled right back the torquemeter pressure would have been zero but the small pointer of the two pointer r.p.m. gauge would have been indicating 10,000. In his rapid glance at this gauge he must have misread it.

(iii) Movement of the throttle in the feathering drill on this occasion was not necessary as watermethanol injection was not being used. The movement was included in the feathering drill only to cut off watermethanol injection when that system was being used. Following this accident, the operator issued instructions that simulated engine failures on take-off during training flights would only be made when the use of watermethanol was unnecessary. The drill was altered accordingly to exclude movement of the throttle.

PROBABLE CAUSE

The accident is considered to have been due to an error by the training captain who operated Number 3 high pressure cock lever instead of Number 4 when simulating a failure of Number 4 engine during take-off. This resulted in the loss of all power from both starboard engines at a critical point of the take-off.

Martin 404 Take-off Accident — Pittsburgh, Pennsylvania

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.)

A MARTIN 404 aircraft crashed and burned immediately after taking off from the Greater Pittsburgh Airport on 1st April, 1956. The hostess and 21 of the 33 passengers were killed; both pilots survived. The aircraft was destroyed by impact and fire.

HISTORY OF THE FLIGHT

The aircraft was engaged on a regular scheduled flight from Pittsburgh, Pennslyvania, to Newark, New Jersey. The pilot requested take-off clearance and about one minute later the aircraft was observed to carry out a seemingly normal take-off and initial climb, followed immediately by a left turning descent, a crash and an errupting fire just beyond the south-west boundary of the airport.

Passengers extricated themselves from the wreckage through and ahead of the fire, and a few were thrown out through tears and rents in the shattered fuselage. The airport based fire fighting equipment was despatched promptly but because of the necessity of traversing circuitous country lanes, the wreckage was almost consumed by the fire before its arrival.

INVESTIGATION

The first officer was flying the aircraft from the left hand seat, and after becoming airborne, and at the time when he was making the first power reduction, he experienced a sharp yaw to the left. Almost simultaneously he saw the left engine Number 1 zone fire warning light flash on and off and then stay on. He did not hear a fire warning bell. The captain, on the right, was performing the duties of the first officer, and he stated that at the time he had operated the gear up handle and was toggling the r.p.m. to the proper engine speed following the first power reduction. The captain, at the time of feeling the aircraft yaw left, did not observe the zone 1 fire warning light or hear an alarm. However, he did observe a rapid drop in the left BMEP gauge, which went to zero, and he reached under the right arm of the first officer, then on the throttles, to retard the left engine mixture control to idle cut-off. The first officer stated that he then removed his right hand from the throttles and reached for the manual feathering button, whereupon the captain informed him that the automatic feathering device would cause the propeller to feather. The first officer then, without actuating the feathering button, placed his right hand on the control column and reached forward with his left hand for the zone 2 firewall shut-off lever. The aircraft continued to yaw to the left and stayed banked sharply to the left despite attempted strong corrective control. At about that time the left wing struck the ground and the crash resulted. The maximum altitude reached from take-off to impact was variously estimated as in the neighbourhood of 100 feet; the total elapsed time was about 40 seconds, of which about 25 seconds were used in the take-off roll. The time interval from the start of the difficulty to the crash was only approximately 10 seconds.

The Martin 404's automatic feathering system is actuated by a substantial drop in BMEP sustained over a period of at least two-tenths of a second. The principal reason for the use of autofeathering is to provide a nearly instantaneous feathering upon significant power loss during or immediately following take-off. It is an extremely important safety device to reduce quickly the insurmountably heavy drag associated with a windmilling propeller during take-off. It is ordinarily deactivated except during take-off.

The autofeathering toggle switch on the overhead panel when placed in the on position supplies electrical current to the arming switches in the throttle quadrant. The movement of the throttle forward from closed position beyond these switches arms the system for autofeathering. Movement of the throttle aft of the switches unarms the system (at about 42 in. manifold pressure). The switches are located at a point in the throttle travel approximately one inch rearward of where the throttles normally would be after the first power reduction.

An attempt to reconstruct the flight from the testimony of witnesses leads to the belief that the aircraft banked to a near 45-degree position prior to ground contact and that recovery from the bank and turn was under way at impact.

First impact with the ground was with the tip of the left wing while the aircraft was steeply banked to its left. A study of wreckage and ground marks indicated that this bank was approximately 35 degrees. The general direction of impact was about 180 degrees or about 50 degrees to the left of the direction of take-off from runway 23. As the aircraft cartwheeled up a small incline, the left wing disintegrated and the wreckage came to rest with the right wing elevated. This resulted in fuel from the ruptured fuel tanks of the right wing flowing down and under the shattered fuselage, feeding a fierce gasoline fire and quickly trapping many occupants. Investigation revealed no evidence of fire prior to impact, and there was no indication of a mechanical failure prior to impact with the ground. Tests of the engines propellers, and their components did not disclose any indications of mechanical failure or malfunction that would have resulted in a power loss.

The exhaust system was inspected for indications of any burned section or openings and the only discrepancy noted was the left lower "Y" section exhaust connector clamp which was fractured and gaping open adjacent to the welded area of its securing belt bosses.

ANALYSIS

It is not possible to determine just when the subject exhaust connector clamp failed. It is possible that this clamp could have failed during a flight from Newark on the day of the accident, and then have shifted so that during the take-off at Pittsburgh the collector ring mating connections separated just enough for escaping exhaust to impinge on the Fenwal unit scoop deposit the observed soot, and signal a fire warning.

The first officer saw the fire warning light flickering. He either reduced the left throttle or diverted his attention from throttle movement to the fire warning light and inadvertently pulled the throttle sufficiently rearward to unarm the autofeathering. Because he testified that he did not recall

moving the throttle rearward it seems more than likely that he did so intuitively when his attention was diverted by the fire warning light.

The captain, on the right, did not see the zone 1 fire warning light and only noted the BMEP gauge indicate power loss. He pulled the mixture to idle cut-off. The throttle having been retarded did not allow automatic feathering, only windmilling, thus setting up excessive drag and yaw to the left. Since the captain attempted to obtain autofeathering by pulling back the mixture lever, it is apparent that he neither knew the left throttle had been retarded to a point where autofeathering was inoperative nor did he expect this action by the first officer.

It is believed that the yaw to the left was first experienced when the left throttle was pulled aft and this yaw was violently aggravated by the windmilling of the left propeller brought about with the captain's movement of the left mixture control to the idle cut-off position.

It must be concluded that each pilot reacted to the emergency as he understood the emergency, but, as the two pilots had not full common knowledge of what was happening nor precisely what the other was doing, their joint and unco-ordinated actions resulted in a windmilling propeller making the aircraft unflyable under the circumstances.

PROBABLE CAUSE

The Board determined that the probable cause of this accident was unco-ordinated emergency action in the very short time available to the crew, which produced an airplane configuration with unsurmountable drag.

PART III

AUSTRALIAN ACCIDENTS

Accident to Avro Anson near Hawkstone Peak, Western Australia, on 4th February, 1956

(6/656/16)

SUMMARY

ON 4th February, 1956, at approximately 2000 hours, an Avro Anson crashed 3½ miles north of Hawkstone Peak, Western Australia. At the time of the accident the aircraft was under charter to the Royal Flying Doctor Service of Australia, and was on an emergency medical flight from Tableland to Derby, Western Australia. The occupants of the aircraft were the pilot, a sick child, her father and two nurses. All the occupants were killed in the accident.

THE ACCIDENT

On 1st February, the medical practitioner at the Derby Hospital was advised by radio of the child's illness. Despite treatment, her condition deteriorated, and on 3rd February arrangements were made to fly her to Derby Hospital. However, a sudden improvement caused these arrangements to be cancelled before the aircraft left Derby. The improvement was sustained until 1500 hours on the following day, 4th February, when a relapse occurred and it was decided again that she must be transferred to Derby as soon as possible.

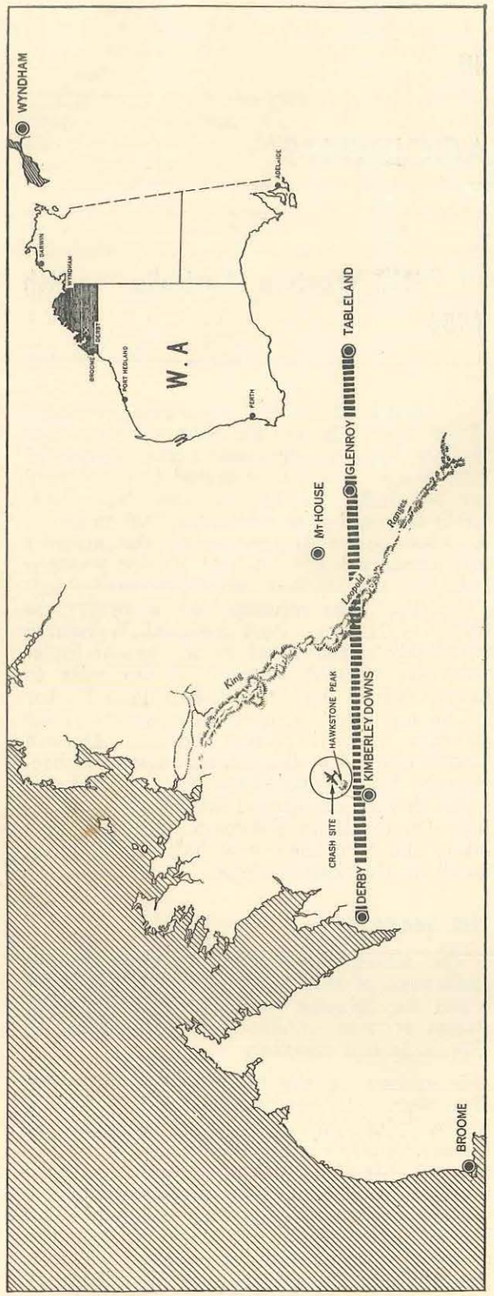
The Anson was fuelled to capacity and it departed Derby at 1625, arriving at Tableland at 1814 hours after an uneventful flight from its base at Derby, 185 miles away. The route and terminal forecast for the flight from Derby indicated that the weather throughout the flight would be 5/8ths Cb. Cu. cloud with a base of 5,000 to 7,000 feet, isolated thunderstorms, visibility 15 miles, reduced to six miles in thunderstorms, and wind below 5,000 feet from the south-west at 14-16 knots.

At 1834 hours, Wyndham aeradio recorded a message from the aircraft advising that it had departed Tableland for Derby at 1832 hours and the estimated time interval for the flight was 100 minutes, flight level 4,000 feet and fuel endurance 205 minutes. At 1903 hours Broome called the aircraft and broadcast the current Derby weather but did not receive an acknowledgment. From this time onwards the aircraft was called by Broome, Port Hedland, Wyndham and Derby aeradio stations at regular intervals but without success. Radio calls to homesteads in the area on the Flying Doctor frequency failed to obtain any reports of the aircraft and Wyndham advised Darwin Traffic Control of the circumstances. Subsequently the Distress Phase was declared and a search was commenced the following morning. On the 22nd February, eighteen days later, the wreckage was located 3½ miles north of Hawkstone Peak.

THE SEARCH

The search was one of the most intense operations of this nature conducted in Australia for missing aircraft. In its closing stages it was conducted in the face of extremely bad weather.

It opened, on the morning following the disappearance of the aircraft, with a R.A.A.F. Lincoln and a DC.3 searching in the immediate vicinity of the track of the aircraft. At the end of this first day there was no result, but a large number of reports were received from residents who believed they had either heard or seen the missing aircraft along the track, along a line roughly from Derby to Wyndham or



in the general area of Wyndham. The reports in the Wyndham area appeared to be so definite that on the following day, the available aircraft were divided, some searching along the track and others searching in the Wyndham area. On the third day all aircraft were concentrated in the Wyndham area because the initial interrogation of some of those who reported sighting the aircraft in this area seemed to indicate that it had diverted to Wyndham at some time during its flight to Derby. Meantime supporting aircraft of the Department of Civil Aviation had joined the R.A.A.F., who had now increased their force to three Lincolns and a Dakota. Additional airline aircraft were also chartered by the Department to assist in the search. With this large force of aircraft an extensive area based on the Wyndham sighting reports was searched, while teams from the R.A.A.F., the Department, and the Western Australia Police investigated each report of sighting or hearing of the aircraft and then discussed their findings at Wyndham. At the end of this fourth day these teams were satisfied that none of the reports of the aircraft having been seen or heard in the Wyndham area had any foundation and it was decided to switch the search aircraft back on to the track area and the general surrounds of Derby.

It was while this action was taking place that a carrier signal with the characteristics of an Anson transmitter was heard by stations over a wide area throughout Australia. The signals were intermittent with short unintelligible bursts of keying. Some HF/DF bearings were taken and they indicated that the probable source of the signal was in the area around Wyndham. The search authorities meantime had learned that the Anson was carrying food and fruit, and this, along with the signal being heard, created the possibility that there were survivors who could hold out for a period and who were trying to draw attention of the search forces to their position.

This possibility suggested that the Anson was not extensively damaged and should be found somewhere in the search area. Therefore for the next three days, using all available aircraft, the entire area of probability calculated on the distance the Anson could fly with the fuel it was carrying, was searched. Meantime every effort was made to track down the mystery signal, and at last, by generating a signal from an identical set in another Anson located in the area of

probability of the signal source, it was proven beyond doubt that the mystery signal did not come from the missing aircraft.

By this time eight days had passed and crews and aircraft had been subject to such concentrated flying that it was decided to rest all crews and make a complete review of all available information. Accordingly the various authorities working in the search joined together at Darwin. All reports of sighting or hearing the aircraft were sifted and only one was accepted as authentic—that from Mount House, a homestead about half-way along the track. The whole area of probability had been searched to the degree which satisfied the authorities that a reasonably whole Anson was nowhere in it. It was therefore decided to concentrate on the track between the last sighting position and Derby. This area except for the last 30 miles, comprised the rugged King Leopold ranges. On the 10th day a search of a saturation type using Lincoln aircraft was carried out in this area, but with no success. The reports of the crews indicated that the speed of their aircraft would make it difficult to see wreckage in the deep valleys. It was therefore decided to base a fleet of light aircraft at the Glenroy Abbatoirs backed with the two DC.3's from the Department and with ground parties equipped with Land Rovers and radio equipment. The R.A.A.F. aircraft were withdrawn from the search.

The action with the light aircraft was planned to be completed in four days but in fact it took 10 days due to the interference of a cyclone, and was then never carried out to the original plan. As the organisation was assembled at Glenroy a cyclone of considerable intensity developed, isolating the advance party at Glenroy, where the aerodrome and camp area were flooded to a depth of four inches; the light aircraft were marooned at Port Keats and Wyndham on successive days.

After attempting for three days to get the light aircraft in, all except one, a Proctor aircraft which had gone with the advance party, were withdrawn from Wyndham to Darwin during the midday period of fine weather which usually occurs during cyclonic conditions in that area. After saturating the country with rain for six days the centre of the cyclone moved from over the search area to a few miles east of Derby and the weather over the search area improved. It was decided to continue the search with the Department's DC.3's and the Proctor based at Glenroy. On the second day of the operations by these aircraft the wreck of the Anson was located a few miles to the north of its track and in the foothills of the King Leopold ranges. The wreck lay about 15 miles north of Kimberley Downs homestead, separated from that aerodrome by three rivers in flood and with most of the intervening country covered in water. Nevertheless, a land party assembled at Kimberley Downs, and equipped with rubber dinghies, made a difficult journey to the wreckage over a period of 2½ days. It found no survivors, but identified the wreckage as that of the missing Anson and then returned to Kimberley Downs.

THE INVESTIGATION

At the time the land party visited the scene of the accident it was not possible to conduct a thorough examination of the wreckage. For this purpose a further expedition was made late in April at the conclusion of the wet season and all important components of the aircraft were recovered from the ground and examined.

The aircraft virtually disintegrated on impact and the wreckage was confined to a relatively small area. It was apparent from the impact marks, wreckage distribution and nature of the damage that the aircraft had struck the ground in an almost vertical attitude at a high speed. It was established that both engines were operating at the time of the accident. All the components of the airframe were located at the wreckage site but it was impossible to ascertain the serviceability of these components immediately prior to the accident because of the extensive damage they sustained.

The pilot held a third class airline transport pilot licence, a second class instrument rating, and a second class flight radiotelephone operator licence. His total aeronautical experience amounted to 4,830 hours, of which 203 hours had been flown as pilot in command of Anson aircraft. He had flown regularly in Western Australia since 1949 and was fully familiar with the area in which the accident occurred.

The weather was substantially as forecast, fine at Derby, Mount House and Tableland, with a line of thunderstorms extending in approximately a north-south direction about half-way between Mount House and Derby, i.e., at right-angles to the track of the aircraft. The base of the thunder-

storm clouds was forecast to be 5,000 feet above mean sea level, which is about 2,000 feet above the highest terrain along the route. These clouds, associated with the inter-tropic front, would reach their maximum peak of activity shortly after sunset. This activity, which is normally of short duration, results in a lowering of the cloud base, squalls of considerable severity below the cloud and extreme turbulence in the cloud. Myroodah Homestead, 55 miles south of the scene of the accident, reported gale force winds, which uprooted trees, shortly before 1930 hours. During the examination of the wreckage, a number of trees in the vicinity were found to be uprooted evidently by a storm and it is probable that this storm occurred on the night of the accident.

The aircraft, a Mark 1, Avro Anson, was equipped with a full instrument flying panel, navigation lights, fluorescent instrument lighting and command radio equipment. It was also fitted with a manual radio compass used in conjunction with the low frequency receiver. However, the aircraft did not meet the Department's equipment requirements for instrument flight mainly because it did not have duplicate pitot-static operated instruments, duplicate gyroscopic instruments, or adequate navigation aids.

From the distribution of the wreckage and the nature of damage to it, it appeared that the aircraft struck the ground when out of control. There was no evidence of disintegration in flight and in view of the extreme severity of the storm, through which the aircraft was flying, in the vicinity of the accident, it can only be concluded that the pilot lost control whilst endeavouring to fly on instruments in extreme turbulence. No evidence was found which in any way conflicted with this conclusion. However, it is possible that other factors could have contributed to the pilot's inability to maintain control, such as erratic airspeed and altimeter readings arising from the effect of heavy rain on the pitot head, loss of the gyroscopic instruments as a result of the aircraft being thrown into attitudes beyond the toppling limits of these instruments, momentary blindness from lightning flashes, etc. Although these possibilities are conjectural, the possibility that some circumstance beyond the pilot's control contributed to his inability to maintain control of the aircraft is indicated by the manner in which it hit the ground with the engines under power.

On arrival at Tableland, the pilot was faced with the decision to continue or terminate the flight, having regard to the safety of the aircraft and occupants on one hand, and the condition of the patient who was requiring urgent medical attention on the other. In view of the weather and limited navigational aids in the aircraft, it is now apparent that the return flight subjected the five occupants to grave hazards which the purpose of the flight did not justify. The pilot was undoubtedly influenced by strong humanitarian concern for the patient, but it is believed that he made an error of judgment in deciding to continue the flight and this was a probable contributory cause of the accident.

The conclusions of the investigation included the following:—

(a) The aircraft departed Tableland at 1832 hours, at the beginning of night, and the weather along the route, particularly in the vicinity of the scene of the accident, comprised extensive thunderstorms of unusual severity.

(b) The aircraft was restricted to flight under visual flight rules conditions by the terms of the operator's charter licence.

(c) The aircraft was fitted with a full instrument panel, cockpit and navigation lights, two-way radio communication and a manual radio compass but did not meet the minimum equipment requirements prescribed by the Department for operations under instrument flight rules.

(d) The pilot held a current third class airline transport pilot licence and a second class instrument rating but was not authorised to act as the pilot in command of an aircraft on a flight under instrument flight rules.

(e) Radio communication with the aircraft was poor throughout the flight primarily due to extremely high atmospheric noise and apparently due to the failure of the pilot to transmit on CW. The last message from the aircraft was received at 1832 hours, immediately on departure from Tableland.

(f) The flight planned altitude did not provide a terrain clearance of 1,000 feet as required by Air Navigation Regulation 157 (1).

(g) *CAUSE*: Having regard to conclusions (a), (b), (c) and (d) above the probable cause of the accident was that the aircraft encountered a thunderstorm of such severity that control of the aircraft could not be maintained.

(h) A contributory cause of the accident was an error of judgment on the part of the pilot in attempting the flight under the existing weather conditions.

(i) The pilots decision to attempt the flight was undoubtedly influenced by a strong humanitarian concern for the patient.

It is the policy of the Department to recognise that pilots in command of mercy flights may depart from prescribed safety standards where this is necessary to save some person from grave or imminent danger. In exercising this discretion pilots should carefully assess the risks involved to ensure that the exposure of human life to danger is not being increased beyond the level that would exist if the flight were delayed until more favourable conditions prevailed.

Ryan Forced Landing — Bankstown, N.S.W.

(6/255/463)

WHEN the engine failed on final approach, the pilot of a Ryan S.T.M. was forced to land among trees about twenty-five feet short of the western boundary of the Bankstown Aerodrome. The pilot and passenger suffered minor injuries and the aircraft was extensively damaged.

The aircraft departed from Bankstown for Penrith, but after travelling about ten miles the engine faltered and the pilot decided to return to Bankstown. On the return journey the engine faltered occasionally and during the final approach for landing, when at a height of about 200-300 feet and some 600 yards from the aerodrome, the engine cut out and picked up twice before failing completely. The pilot then concluded that the trouble was fuel starvation and selected "reserve" fuel, but the engine stopped rotating before fuel could reach the engine.

The pilot was committed to a landing among trees on the approach area and the aircraft struck the top of a 15 feet high tree located a short distance outside the aerodrome boundary and came to rest in a nose down attitude wedged between two trees.

In this aircraft the fuel is contained in one tank of 19 gallons capacity. Two gallons of this fuel are held in reserve by a standpipe outlet and are available for use by placing the cockpit fuel selector to "reserve". The total fuel carried at the commencement of operations was 15 gallons and seven circuits and landings were carried out prior to the aircraft departing for Penrith.

The engine and fuel system were examined but no fault which could account for the engine failure was found. The duration of flying was 1 hour 50 minutes, in addition to a period of running-up prior to commencing the flight. Throughout this time the engine was operated entirely on the main fuel supply of 13 gallons and it could be expected that on the basis of consumption rate of 7 gallons per hour, this fuel would be exhausted about the time the engine failed.

At the time of the accident, the main fuel supply was exhausted. Therefore the amount of fuel remaining could not have exceeded 2 gallons, the capacity of the "reserve" supply. The amount of fuel necessary to provide the reserve of 45 minutes, required by AIP/RAC-1-7, is 6 gallons; it is apparent that on departure for Penrith the fuel was less than the minimum required, in contravention of Air Navigation Regulation 226.

It was concluded that:—

The cause of the accident was that, having failed to realise that the fuel supply in use was exhausted, the pilot did not select the reserve supply in time to keep the engine operating.

Helicopter Take-off Accident, New Guinea

(6/455/46)

A BELL 47D helicopter was extensively damaged at Morehead heliport, New Guinea, when it crashed almost immediately after taking off for a test flight following replacement of the aft section of the tail rotor pitch control cable. The pilot, who was the only occupant, was uninjured.

The pilot tested the tail rotor controls during the pre-flight engine run-up and, as subsequent events show, he wrongly con-

cluded that they were functioning properly. In fact, the cable had been crossed during installation resulting in the flight controls operating in the reverse sense. As the helicopter lifted from the landing platform it commenced to turn right, the turn steadily developed into a violent rotation as left control, which would normally have corrected the situation, was progressively applied.

At the same time, as the helicopter was drifting away from the landing platform towards nearby buildings the pilot decided to attempt a landing. In so doing the port float fouled the landing platform and the aircraft tipped over on its left side.

The pilot held a valid commercial helicopter pilot licence with a total of 424 hours on helicopters.

The investigation revealed that a new cable had been installed and connected by an engineer inexperienced in helicopters. Later he was joined by a senior engineer, who completed the locking of the turnbuckle connections and made other final adjustments. The control pedals were operated in specific sequence whilst the senior engineer carried out a check of the pitch change of the tail rotor blades but he failed to recognize that the system was operating in the reverse sense.

Prior to the accident it was a common belief of pilots of the operating company that correct functioning of the tail rotor could be determined by operating the control pedals during the pre-flight engine run-up, which, on a float equipped helicopter on the ground, produces a rocking motion. However, such a check will only confirm that a pitch change is taking place and determination of the sense of operation of the system is not certain. The pilot followed the accepted practice during his pre-flight check and it is considered that in so doing he took what were considered at that time to be reasonable precautions to ensure that the aircraft was safe for flight.

The cause of the accident was that the senior engineer, in carrying out a functional check of the tail rotor pitch control system, failed to detect that the control cable had been installed in such a maner as to reverse the sense of operation of the directional flight controls.

Norseman Forced Landing: Minj, New Guinea

(6/455/69)

SHORTLY before midday, a Norseman taxied to the south-east end of Minj airstrip, New Guinea, preparatory to departure on a charter flight to Ogelbeng, New Guinea, 28 miles west of Minj. The pilot stated that he carried out a pre-take-off engine run-up and cockpit check, which included selecting the port fuel tank for take-off. The weather was fine with unrestricted visibility.

The aircraft took off into the north-west and soon after becoming airborne, when climbing power had been set, the pilot noticed a drop in fuel pressure and as a result turned back to the airstrip. At the same time he operated the hand fuel pump; however, whilst still some distance from the airstrip the engine failed and the pilot was committed to a landing in a swamp. The aircraft contacted the ground with the starboard wing and engine simultaneously, and cartwheeled; it was broken into several pieces and the pilot, the sole occupant, was thrown clear and received minor injuries.

The pilot held a senior commercial pilot licence and at the time of the accident his total flying experience amounted to 7,466 hours, of which 562 hours had been flown on Norseman aircraft in New Guinea.

An examination of the aircraft revealed no defects or malfunctioning which could have been responsible for the engine failure. However, the fuel selector was found turned to the starboard fuel tank, which was undamaged and in such a position that fuel could not have drained away after the accident; this tank was empty. Further investigation revealed that 50 gallons of fuel had been placed in the port tank and 25 gallons in the starboard tank prior to departure from Goroka for Minj, and the aircraft had been operated on the starboard tank for some 60 minutes. The normal fuel consumption of a Norseman aircraft is 24-26 gallons per hour and as this was the quantity of fuel in the starboard tank on departure from Goroka, very little would have remained in the tank on arrival at Minj.

The pilot did not realise that the fuel selector was turned to the empty starboard tank. Despite the pilot's belief that he carried out a "normal cockpit check" before take-off it is clear that this check could not have been properly conducted.

It was concluded that:—

The cause of the accident was that the pilot failed to select a fuel tank with a safe quantity of fuel for the take-off.

A contributory cause of the accident was that the pilot neglected to carry out a proper cockpit check when the fuel pressure began to fluctuate shortly after take-off and so failed to determine that an empty fuel tank was selected to the engine.

Fatal Chipmunk Accident — New Park Siding, New South Wales

(66/197/6)

ON a December afternoon a DHC-1 Chipmunk crashed in a large open field at New Park Siding, 17 miles south-west of Narrandera, New South Wales, during recovery from inverted flight at a low altitude. The pilot and his sister, who was a passenger in the aircraft, were killed instantly and the aircraft was destroyed.

The aircraft was engaged on a private flight in the vicinity of the pilot's home. After taking off the aircraft climbed to 1,000 feet, and the pilot performed a loop, half roll and full roll in rapid succession. The aircraft then circled to a height of 1,500 feet where it was looped into the inverted attitude. Inverted flight in a glide was maintained until a height of approximately 300-500 feet, where the pilot appeared to attempt to regain normal flight by pulling under in the second half of a loop. This was almost completed when the aircraft struck the ground just as it gained the level flight attitude.

The pilot was the holder of a private pilot licence with a total aeronautical experience of 174 hours of which 36 hours had been flown on Chipmunk aircraft.

The engine of the DHC-1 Chipmunk will not deliver power in sustained inverted flight which must, therefore, be a glide. As a degree of positive control by ailerons is required to maintain laterally level flight when inverted, it appears most improbable that there was any jamming or obstruction of aileron control which would have either forced the pilot to maintain inverted flight or prevented him half rolling to the normal attitude. A half roll can be executed in the DHC-1 with little or no loss of height at speeds very little above the stalling speed.

It is evident that the half loop from the inverted position was not the result of a stall caused by jamming or obstruction of elevators because 180 degrees of a loop were completed in the space of 300 to 500 feet indicating that considerable elevator control was applied.

There is no evidence to suggest that the manoeuvre was not intentional and it was therefore concluded that:—

(a) The accident was caused by the pilot attempting to recover from inverted flight by means of a half loop when the aircraft was too close to the ground.

(b) By engaging in aerobatic flight below below 3,000 feet the pilot acted in contravention of Air Navigation Regulation 131(3) (a) and 124(2).

Fatal Auster Accident

(6/255/99)

THE weather was fine with little cloud when a pilot and four passengers took off in an Auster from Forbes aerodrome. Approximately 35 minutes later the aircraft stalled and crashed into the grounds of the Marist Brothers Agricultural College, 2½ miles south of Forbes, New South Wales. All the occupants were killed on impact.

Statements from eyewitnesses revealed that the aircraft was observed at a height just above tree tops flying straight and level towards the college. As it neared the college, the pilot commenced a climbing turn to the left. However, whilst still at a low altitude, the nose of the aircraft dropped, the aircraft entered a spin and crashed in the college grounds 600 feet east of the main building.

The flight was conducted so that a passenger could take photographs. In addition, three boys were given a free "joy flight"; as two of them were seated on the floor adjacent to the rear seat, they could not be provided with seat belts.

The aircraft was a standard Auster J5 "Autocrat" fitted with seats for a pilot and two passengers; the certificate of airworthi-

ness restricted the number of persons to be carried to three. The pilot was the holder of a commercial pilot licence and a current "B1" flight instructor rating. An examination of the wreckage revealed no pre-crash defects or evidence of malfunctioning.

It was ascertained that the aircraft approached the college at a height of between 150 and 250 feet. A climbing turn was commenced at a relatively slow airspeed and although power was possibly increased, the pilot made too steep a climbing turn for the airspeed available. The aircraft stalled and entered a spin at an altitude too low for recovery to be effected.

The all-up-weight was approximately 50 lb. below the maximum permitted and the centre-of-gravity was at or near the aft limit.

It was concluded that:—

(a) The probable cause of the accident was loss of control at a low altitude due to poor technique in the execution of a steep climbing turn.

(b) The pilot engaged in unauthorised flight at a height lower than 500 feet above the ground in disregard of Air Navigation Regulation 133(2).

Overloaded DH.84 Crashed at Togoba, New Guinea

(6/455/65)

A DH.84 carrying a pilot and three passengers and a quantity of freight crashed, immediately after take-off, approximately one mile north of the northern end of the Togoba airstrip, New Guinea. The pilot was killed and the three passengers received serious injuries; the aircraft was rendered a total loss by damage sustained on impact.

Togoba airstrip is situated between the Turuk and Nebilyer Rivers in the Nebilyer Valley, Western Highlands, New Guinea. It is a single airstrip running approximately north and south, 4,000 feet in length and 200 feet wide, with a clay surface lightly grassed.

The aircraft was on a charter flight to Wabag, New Guinea, and was loaded with 670 lb. of freight and three passengers who boarded the aircraft at Togoba. The all-up-weight of the aircraft was 4,520 lb. The weather was fine, with unrestricted visibility and wind from north northeast at 15 knots as the pilot taxied to the southern end of the airstrip.

The aircraft took off after travelling three-quarters of the length of the strip but settled back onto the ground several times before passing over the northern end of the strip some 10 to 20 feet above the ground. After leaving the airstrip the aircraft commenced to lose height into the Turuk River Valley and a few moments later it crashed into relatively thick vegetation approximately one mile north of the northern end of the strip.

At the time of the accident, operations at Togoba were governed by a NOTAM authorising operations in both directions with a maximum all-up-weight of 4,200 lb. for a DH.84 taking off into the north. The actual weight on this take-off was therefore 320 lb. in excess of that permitted, and calculations indicate that under the prevailing aerodrome surface and meteorological conditions this aircraft could not have reached the maximum flying speed in the length of strip available using the optimum take-off technique with full power. It is apparent from the circumstances of the take-off that the aircraft was "bounced" into the air and height could not be maintained in this condition even with full power. After leaving the airstrip the height of the aircraft above the ground was insufficient to enable the pilot to lower the nose in an endeavour to gain the airspeed to climb away.

The pilot held a commercial licence and the last entry in his log book, which had not been maintained for the five years prior to the accident, indicated that he had flown a total of 5,077 hours mostly on DH.84's. He had been engaged as a pilot on commercial operations in New Guinea since September, 1947, and was recognised as the most experienced pilot on DH.84's in that country, and was particularly familiar with the airstrips in the area in which the accident occurred.

It was concluded that:—

The cause of the accident was the attempt by the pilot to take-off at an all-up-weight in excess of that at which a take-off could be successfully executed under the existing aerodrome surface and meteorological conditions.

Auster Collides with Tree whilst Spraying

(6/355/380)

WHILST engaged in the aerial spraying of a tobacco crop in a field three miles west of Mareeba, Queensland, an Auster J5/B struck a tree and crashed. The pilot, the sole occupant, was killed instantly and the aircraft was destroyed.

The field, situated in flat terrain, was approximately rectangular in shape, running east-west, some 1,150 feet in length and 600 feet wide. It was bounded on the southern side by a road and surrounded on the other three sides by trees 30 to 60 feet high. The weather was fine with nil wind and unrestricted visibility.

The first spraying run was carried out 17 feet inside the southern boundary from west to east. The succeeding runs were made on parallel tracks 34 feet north of the previous runs. On the fourth run, made into the west, the approach was made over a 60 feet high tree adjacent to the eastern boundary of the field. After passing over this tree the aircraft descended to a height of approximately seven feet above the crop which was 4 to 5 feet high, and a spraying run was carried out at this level. As the aircraft neared the western boundary it commenced to climb to clear the trees immediately outside the fence; however, the port wing struck a 54 feet high tree, at a point 11 feet from the top. The wing passed through the tree but almost immediately afterwards the aircraft rolled to the left and then descended on a steadily steepening turn to the left. The aircraft continued in this manner until it struck a second tree and then crashed to the ground.

The pilot held a commercial pilot licence. His total flying experience amounted to 3,017 hours of which 1,000 hours had been flown on Auster aircraft. His flying experience on aerial agriculture operations totalled 31 hours all of which had been flown in the preceding 90 days.

The examination of the aircraft did not reveal any pre-crash defects or evidence of malfunctioning.

The height, and proximity to the field, of the trees significantly reduced the area of the crop that could be sprayed at the best spraying height. Thus in an endeavour to obtain the maximum spray coverage, the pilot apparently made his approaches close to the trees, then descended steeply to the optimum spraying height and subsequently climbed out of the field at the maximum climb gradient of the aircraft as close as possible to the trees near the end of of the run. The spraying run in which the accident occurred was made towards trees higher than on previous runs. Assuming that the previous climb out of the field was made as close as possible to the trees, the climb on this run would need to be commenced earlier to clear the trees. As the pilot was relatively inexperienced in aerial agriculture operations it is possible that, whilst attempting to obtain the maximum spray coverage, he failed to appreciate the increased height of the trees on this run and commenced the climb from the same position as on the previous run.

The probable cause of the accident was that the pilot, when attempting to climb the aircraft at a steep angle in close proximity to the tree, misjudged the distance from the tree at which to commence the climb.

Fatal Aerial Spraying Accident — Collision with Power Lines

(6/155/451)

THE failure of the pilot to inspect thoroughly the intended area of low level operations prior to the commencement of operations, resulted in a fatal accident in a field at South Dreeite, 10 miles northwest of Colac, Victoria.

The aircraft, a DH.82, was engaged in the aerial spraying of a property at South Dreeite. The terrain in the vicinity is undulating with large outcrops of granite rising 20 to 30 feet above the ground. The field being sprayed was approximately rectangular in shape, lying in a northwest-southeast direction, 2,000 feet by 1,000 feet, fenced and bounded at the south eastern end by a road. Running along the opposite side of the road to the field is an electric power line on 30 feet high poles, 500 feet apart. A line of trees approximately 20 feet high was immediately below the power lines.

The weather was fine with scattered cumulus cloud, nil wind and unrestricted

visibility. The aircraft made two low level circuits of the field and then carried out a spraying run along the northeastern side of the field. The spray runs were made at a height of about 7 to 8 feet above the ground but as the aircraft neared the end of the second run, which was being made towards the road, it passed over a granite outcrop about 20 feet higher than the road. The aircraft continued to fly straight and level and struck the electric wires on the south-eastern side of the road. The pilot was killed instantly on impact with the ground and the aircraft was destroyed.

Eyewitnesses reported that the aircraft appeared to be functioning normally during spraying runs and prior to the impact the aircraft was flying straight and level. As the spraying run had been completed, there was no necessity for the pilot to attempt to clear the wires by a small margin, therefore it appears that he failed to see them, at least, until he was dangerously close to them.

The pilot held a commercial pilot licence with a total flying experience of 1,450 hours. His experience on agriculture operations amounted to 30 hours, all of which had been accumulated in the 90 days preceding the accident.

It was concluded that the cause of the accident was that the pilot failed to thoroughly inspect the intended area of low level operations to ascertain the nature and location of obstructions.

By failing to familiarize himself with the operating area prior to commencing operations, the pilot disregarded a requirement of the operator's approved operations manual, contrary to Air Navigation Regulation 212(6).

Collision with Wires near Maffra, Victoria

(6/155/470)

A DH.82 engaged on a pilot navigation training flight, crashed and burnt after striking high voltage electricity cables located along the leeward boundary of a field in which a landing was being attempted after the pilot had become lost. The pilot, who was the only occupant, suffered serious injuries including severe burns. The aircraft was destroyed by fire which started immediately on impact with the ground.

Seven aircraft departed Moorabbin for West Sale, a distance of 114 miles. A few light showers over the route with a substantially overcast sky, base 4-5,000 feet, were forecast. Six of the aircraft reached the destination without incident but the pilot of the other aircraft became uncertain of his position after flying through a heavy shower and decided to land.

The field selected was approximately 1,200 feet long in the direction of intended landing and had along the leeward boundary a row of timber poles spaced about 300 feet apart carrying high voltage electricity cables at a height of about 20 feet above the ground. The field itself was approximately 300 feet shorter than the minimum for a DH.82 prescribed in AIP/AGA-4, and its effective operational length was further reduced by the presence of the elevated electricity cables across the approach. However, it was the most suitable field in the locality and it is probable that, after clearing the high tension wire, a DH.82 could be landed in the space available.

At the time of the attempted landing there was overcast low cloud, but the visibility is considered to have been adequate. The pilot determined the wind direction then executed an approach run over the field for inspection purposes during which he noted the cables across the approach path. On the second approach, from which it was intended to land, the undercarriage struts struck the cables and the aircraft plunged to the ground in a nose down vertical attitude 80 feet beyond the cable alignment and came to rest in a vertical position.

Because of the serious injuries sustained by the pilot, his evidence was relatively brief and incomplete. It was not ascertained whether he had the electricity cables in sight during the final approach but it appears that he did, but misjudged his height. The limited run available in this field required that touchdown be made as short as possible and therefore, the cables would need to be crossed with the minimum clearance. The pilot saw the cables when making the preliminary approach and, as there is no indication of a deterioration in visibility occurring between the two approaches, it is considered that the aircraft collided with the cables because the pilot misjudged his flight path.

The pilot held a student pilot licence and had accumulated a total of 43 hours experience, all in DH.82's, during the preceding 90 days.

The cause of the accident was that the pilot misjudged his height in relation to the electricity cables.

The limited experience of the pilot and the small dimensions of the field are considered to have contributed to the accident.

Collision with Power Lines

(6/255/185)

THE failure of the pilot of a Cessna 180 to inspect the area of low level operations was the probable cause of a collision with electricity transmission cables spanning the Clarence River, 26 miles north-west of Grafton, N.S.W.

The aircraft was engaged in distributing fertilizer on flats bordering the river. Electricity cables crossed the river suspended from 45 feet high pylons on rising ground about 80 feet above the water level. Due to sag, the cables came to within 100 feet of the flats being top-dressed. Large trees formed an effective camouflage against detection of the pylons from a low flying aircraft, and the cables were not readily discernible against the background of timber and undulating terrain.

On this spreading run the aircraft maintained a constant height until it struck the cables, when it slewed to the left and dived to the ground. The port tailplane, elevator, fin and rudder were severed by the cables and dropped off the aircraft before it struck the ground. The pilot suffered serious injuries and the aircraft was damaged beyond repair.

The pilot was the holder of a commercial pilot licence and had extensive experience in aerial agricultural operations. His total aeronautical experience amounted to 5,775 hours of which 230 hours had been flown on Cessna 180 aircraft. After the accident he was unable to recall any of the events about the time of the accident, even from the time he boarded the aircraft. He had flown on fertilising operations in this locality some 12 months previously and he stated that he should have remembered these power lines but had apparently forgotten them.

It was concluded therefore, that the cause of the accident was that the pilot did not inspect the area of intended low level operations to ascertain the nature and location of obstructions and thereby determine a safe height for the operation. It is absolutely essential to the safe conduct of this type of operation that the operating areas should be carefully examined both from the ground and the air and operations based on such inspections.

PART IV

INCIDENT REPORTS

Incorrect Heading

(6/156/265)

A DOVE departed King Island (Bass Strait) for Melbourne via Moorabbin at 1630 hours on the 19th May, 1956, carrying a crew of two and nine passengers. Moorabbin, 18 miles south-east of Melbourne airport, is the normal entry point into the Melbourne Control Zone for aircraft approaching from the south, and the track from King Island to Moorabbin is 016°M and the distance is 128 miles. On this occasion the estimated flight time from King Island to Melbourne was 68 minutes and the fuel endurance on departure was 139 minutes.

On departure from King Island the pilot set course for Moorabbin Aerodrome on a track of 116°M, which was flown by back bearings on the King Island non directional beacon (N.D.B.). There was very little drift and the course flown to make good this track was also 116°M. The weather over Bass Strait at the time was generally 5/8ths to 7/8ths cloud with a base of 500 feet and tops 5,000-8,000 feet. Shortly after reaching cruising altitude, 3,000 feet, at which time the aircraft was in cloud, the pilot endeavoured to tune the radio compass to the Moorabbin and Melbourne N.D.B.'s, but without success. The pilot states that "at approximately 1709 hours (i.e., 39 minutes after departure) I became suspicious of the fact that neither N.D.B.'s (Melbourne or Moorabbin), 3LO (a Melbourne broadcasting station) or the V.A.R. (Melbourne) were being received. I then checked my course against the flight plan and discovered that I had made an error of 100° in my heading (i.e., proper heading 016°M)".

He immediately advised Melbourne Air Traffic Control of the circumstances and requested assistance. At almost the same time he turned onto a course 350°M intending to proceed to Melbourne and on instructions from Air Traffic Control climbed to 5,000 feet. However, after checking his probable position on a map he estimated that there was now insufficient fuel on board to reach Melbourne and at 1714 hours he turned onto a course of 300°M for King Island aerodrome and reduced power to conserve fuel. The pilot then plotted his position on the map by "dead reckoning" using the forecast winds and estimated that his position at 1730 hours was 83 miles, 311°T from Devonport. He calculated that from this position the time interval to reach Devonport would be at the most 30 minutes and that he would have 45 minutes fuel in reserve on arrival at Devonport. At 1730 hours he set course on 120°M for Devonport and shortly afterwards the Devonport N.D.B. was received on the radio compass. A landing was made at Devonport at 1820 hours.

Immediately the aircraft requested assistance, Melbourne Air Traffic Control introduced the alert phase and this activated the Rescue Co-ordination centre and opened the HF/DF station at East Sale. The aircraft was instructed to climb to 5,000 feet to ensure terrain clearance, other aircraft were kept clear of the probable position, all aeradio stations in the vicinity were alerted and a plot was commenced. The information supplied by the pilot concerning changes of courses, times and indicated airspeeds was meagre and resulted in the plot giving a very large area of probable position. Before Air Traffic Control obtained the information necessary to estimate a reasonably accurate position, the pilot reported that he was altering course for Devonport. The aircraft was then provided with the latest weather information, at that aerodrome and advised of its facilities.

The pilot in command of the aircraft held a first class airline transport pilot licence, a first class instrument rating and a flight radio telephony operator licence. At the time of this incident his total aeronautical experience amounted to 2,700 hours, the majority of which had been accumulated as a first officer on DC.3's. His total experience on Doves was approximately 475 hours, all of which had been flown as pilot in command. In the four months preceding the incident he had flown on an average 67 hours a month and in the seven days preceding the incident 7 hours 45 minutes, all on Dove aircraft. However, for some months this pilot had been occupying an administrative position and these duties in addition to his flying duties had imposed an excessive work loading on him. He has stated that at the time of this incident he was in a fatigued condition. The hostess, who held a commercial pilot licence and had a total of 275 hours aeronautical experience, was mainly concerned with radio operator and hostess duties on this flight and was not able to assist to any appreciable extent in the operation or navigation of the aircraft.

It is apparent that this incident arose through the pilot reading the track of 016°M shown on the flight plan, as 116°M. Shortly after take-off the aircraft entered cloud and the pilot was concentrating on instrument flying and maintaining the heading of the aircraft by reference to back bearings on the King Island N.D.B. The aircraft was fitted with a Pioneer type compass which is read through a small window. This type of compass does not show all the points of the compass at one time and is not fitted with a grid ring. That is, the heading of the aircraft in relation to other points of the compass is not readily noticeable and there is no pre-setting required.

Whilst this incident was caused by the pilot flying the wrong course, it is considered that fatigue was a contributing factor.

Information Breakdown: Communications Breakdown

(6/156/215)

SHORTLY after departure from Melbourne Airport on a regular public transport service, the crew of a DC.3 found that they were unable to establish radio contact with aeradio on the V.H.F. frequencies. Subsequently, contact was established on H.F. and the flight continued.

On the following day the crew of another DC.3, owned by the same company, were also unable to contact aeradio on the V.H.F. frequencies after departing Melbourne Airport. This aircraft was unable to establish radio contact on H.F. and returned.

Investigation revealed that the radio engineer had changed the channel selections on the aircraft's V.H.F. equipment but had omitted to advise the company operations staff that this work had been carried out and consequently both crews were unaware of the changes.

Tractor and Roller Cause Missed Approach

(6/356/186)

A REGULAR public transport DC.3 on a 'straight in" approach to Runway 09 at Longreach aerodrome observed a tractor and roller on the runway and carried out a missed approach.

The driver of the tractor had been notified of the estimated time of arrival of the aircraft. However, the aircraft arrived some seven minutes ahead of its estimated time and for this reason and the fact that a "straight in" approach was made, the driver did not notice the aircraft until it had commenced its missed approach.

Longreach is non-controlled. In order to assess the serviceability of the runways and other factors affecting the safety of the aircraft, a circuit or partial circuit should always be carried out at non-controlled aerodromes.

Auster Aircraft Elevator Trim Tab Cables

(6/256/312)

IN recent years there has been a number of Auster aircraft elevator trim tab cable failures during flight, both in this country and in New Zealand. The following report was submitted by a pilot of an Auster aircraft on the failure of the elevator trim tab cable during a flight from Mt. Margaret Station in South-west Queensland to Bourke, N.S.W. in May this year.

"It was a clear calm day and the aircraft made a normal take-off and climb to 1,000 feet. The passenger sat in the front seat, and about 150 lb. of luggage was in the rear of the cabin; the tanks were full. At the completion of the climb as the elevator trim tab control lever was moved to a more nose-down position the nose-down wire broke near the trim tab itself. The trim control lever, though it could still be used to get nose-up trim by use of the still-intact nose-up wire to the bottom of the trim-tab, was slack and useless in the nose-down half of its travel, owing to the broken nose-down wire, and was left in a position about ¾ way round to fully nose-down, though this position had no effect on the trim tab itself which merely streamlined itself with the elevator. Nose-up trim could, if desired, still be obtained with the lever per medium of the intact nose-up wire.

The nose-down trim could easily be held by a slight hand pressure forward on the control column, and this pressure was reduced to an almost negligible amount by a slight reduction of power to normal cruising r.p.m., and the movement of some of the luggage to a position further forward in the rear compartment.

The flight continued normally for about 10 minutes until the aircraft was turned above a possible landing ground to inspect it. Several steep turns in both directions were made normally until a fairly steep banked turn (about rate 3) was made to the left during which a well-defined, alarming and almost violent buffeting of the whole aircraft was experienced, coupled with a rapid back and forward shaking movement of the control column (covering a distance of about 4-5 inches travel).

Immediately this buffeting and shaking commenced maximum power was applied, the aircraft was returned to a level attitude and within 2 or 3 seconds the untoward manifestations ceased and normal flight was continued in the direction of Bourke; the aircraft climbed satisfactorily to 3,000 feet. However, with 1950 r.p.m. and 80 m.p.h. I.A.S., and the aircraft in a slightly nose-up attitude with the wings level in the rolling plane, the stick was being moved gently forward to round off the climb for level cruising when the same pronounced buffeting and control column fluctuation were evident

again. The buffeting appeared this time to emanate from the tailplane region. The control column was pushed slightly but firmly forward and again after 2 or 3 seconds the buffeting stopped and the aircraft cruised normally. The pilot realized that the probable cause of the buffeting was that with the trim tab control lever resting in a nose-down position it left the nose-up wire slack allowing the trim tab to move from its streamlined position behind the elevator and flutter or oscillate between almost fully nose-up and nose-down positions, tending to move the elevator in the opposite sense. It seemed that certain attitudes of the tailplane to air flow and/or to the twisting and beating propeller slip stream may have caused the slack trim tab to fluctuate or flutter rapidly up and down, occasioning the alarming buffeting and control column movement aforementioned. Accordingly the trim tab control lever was moved to a position just on the nose-up side of neutral, taking-up the slack in the nose-up wire and putting a slight strain on it, thus preventing the tab from fluttering into the nose-down position. Should it now flutter it must do so only in a restricted way in the nose-up part of its travel and in the airstream only on the underneath side of the elevator (likely to be more constant than the airstreams it experienced alternating from underneath to above the elevator).

The flight to Bourke continued uneventfully with the trim tab control lever in the neutral position and over Bourke aerodrome a series of turns, steep and gentle, and climbs steep and gentle, failed to reproduce any semblance of the buffeting or control column movements experienced earlier when the trim control lever had been in a nose-down position.

The reason for doing the turns and climbs was to establish that the position of the trim control lever was the factor which, coupled with the broken nose-down wire to the trim tab, caused the almost violent buffetings and control column movements experienced earlier.

It is the writer's opinion that these buffetings, if unchecked, might perhaps cause more severe structural damage to elevators or elevator controls, make landing very difficult, or even if experienced for only a short time with no damage, precipitate an easily scared or inexperienced pilot into a forced (or *imagined forced*) landing onto unsuitable or dangerous terrain with resultant danger to aircraft and occupants."

The opinion expressed in the last paragraph is endorsed.

Investigation by the Department of this and other similar incidents resulted in the following letter being forwarded to all Auster aircraft owners in July this year.

AUSTER ELEVATOR TRIM TAB CABLE: INSPECTION

Dear Sir,

Recently two Auster accidents have occurred because of elevator trim tab cable failures. One happened in Queensland, the other in New Zealand.

In the first case a successful landing was made with great difficulty but in the New Zealand case, control was lost and the aircraft crashed with the loss of the life of the pilot and his two passengers.

An investigation into the circumstances of the Australian accident revealed that due to the unavailability of correct cable, the heart strand of 5 cwt. flexible cable had been used for both top and bottom trim cables. Diameter of the substitute cable was approximately .035 in. as compared with .048 in. in the case of the original cable. The substitute cables had been in operation for 560 hours since installation and had last been inspected 67 hours prior to the failure. Excessive wear and corrosion reduced the strength of the cables to such an extent that they both failed. This caused the aircraft to shudder violently and made it exceedingly difficult to control even with reduced power. The pilot made an emergency landing.

In the case of the New Zealand accident, the aircraft had flown 362 hours 25 minutes since overhaul (1,257 hours total time). The accident followed failure of the upper trim tab cable about 4½ in. from the trim tab attachment. The break occurred at the point where the cable is subjected to heavy friction where it passes into the fairlead. Examination of the broken cable showed that excessive wear had obviously taken place prior to the accident.

Would you please ensure that no 'improvised' trim tab cables are fitted to your aircraft. Any such cables should be replaced by solid piano wire or correct cables.

Our records indicate that solid piano wire used as trim tab cables on a large number of Austers appeared to have a very much better service life than stranded counterparts. We are informed however, both solid and stranded trim tab cables need to be replaced periodically. In order that we can make a proper assessment of the problem we would like to have full case histories of trim tab cable replacements and would therefore appreciate if you would kindly advise us of the exact type of cables fitted to your aircraft at present, the hours they have been in service and the details of all previous replacements, i.e., size, construction and hours at replacement.

It is strongly recommended that you have the elevator trim tab cables of your aircraft inspected as soon as possible and periodically at intervals of not more than 25 flying hours until further notice.

Your attention is also drawn to the fact that last year another Auster accident occurred because of a trim tab cable failure brought about by sticking of the trim tab arm pivot. This caused excessive bending of the cable and resultant failure.

In performing the inspection we recommend that the cables be inspected at full trim tab movement in both directions and cables showing any signs of wear, flat spots or broken strands be replaced before further flight. It is also essential to ensure complete freedom of the pivot pin referred to above".

You will be notified further of any other information of interest which we obtain.
