COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF CIVIL AVIATION

AVIATION SAFETY DIGEST

No 3

JANUARY, 1954

Prepared by The Accident Investigation and Analysis Branch

Published by Authority of The Director-General

CONTENTS

PART I

AVIATION NEWS AND VIEWS

High Altitude Operations

Introduction

Over a period of years there has been an increasing tendency to fly higher, not only because of technical improvements in the aircraft itself, but also because of the development of direct routes over high terrain and to avoid unfavourable weather. In Australia at the present time, we have only one type of aircraft operating on domestic routes which can be classed as a "high altitude" aircraft, but with the replacement aircraft now on order, high altitude operations will extend considerably in the near future.

The human problems associated with high flying are well known to many pilots, but to others they may present an aspect of flying of new and absorbing interest.

In his book "Human Factors in Air Transport Design," Dr. R. A. McFarland, Harvard University, U.S.A., has dealt at length with these problems, and the following article is a brief summary of the particular chapter.

Physical Characteristics of the Atmosphere

The atmosphere can be separated into two main layers, the troposphere and the stratosphere, with an intermediate boundary known as the tropopause. Storms occur primarily in the lower portions of the troposphere, and if aircraft are to operate above them they must fly in or above the upper troposphere in conditions of low pressure and temperature. Figure 1 shows the variation in temperature, density and pressure in relation to altitude, and also shows the main layers of the atmosphere in relation to the tropopause, the altitude at which temperature becomes constant.

Physiological Effects of High Altitudes

Early experience in air transportation showed that as the cruising altitudes approached 10,000 feet, both crews and passengers were being adversely affected on long flights, making it necessary to carry supplementary oxygen for all on board.

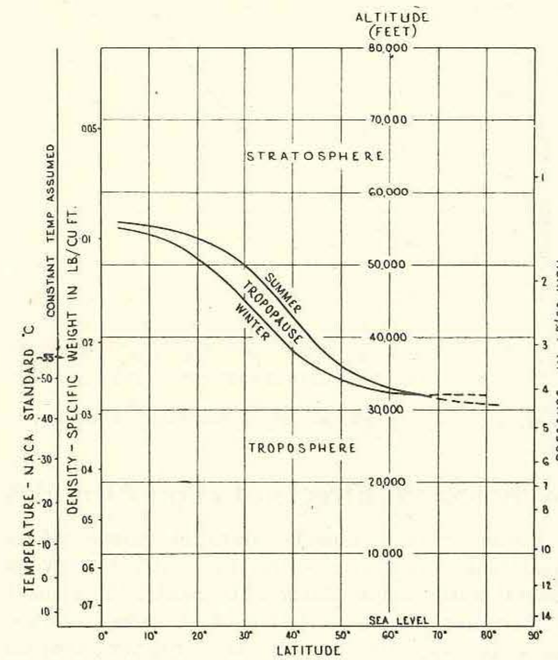


Fig. 1:—Physical Variables of the Atmosphere.

The most important variable, with increasing altitude, is the diminishing amount of oxygen which is available. For example at 18,000 feet, although the composition of air is unaltered, the total atmospheric pressure is reduced by half. Since oxygen is not stored in the blood, marked effects on the nervous system and other parts of the body at this altitude take place within a few minutes of the interruption of the supply.

The effects of lack of oxygen (anoxia) at high altitudes can be counteracted to a height of about 35,000 feet by inhaling oxygen from a cylinder, the percentage of oxygen required in inspired air to maintain altitudes equivalent to sea level being shown in Figure 2.

The ceiling for continued operation can be raised to about 43,000 feet by the use of pressure breathing systems. An alternative system is to maintain the total pressure in the cabin by supercharging (pressurizing), which also lessens or even eliminates effects of rapid pressure changes such as bends and the expansion of gases in parts of the body, e.g., ears, sinuses, etc.

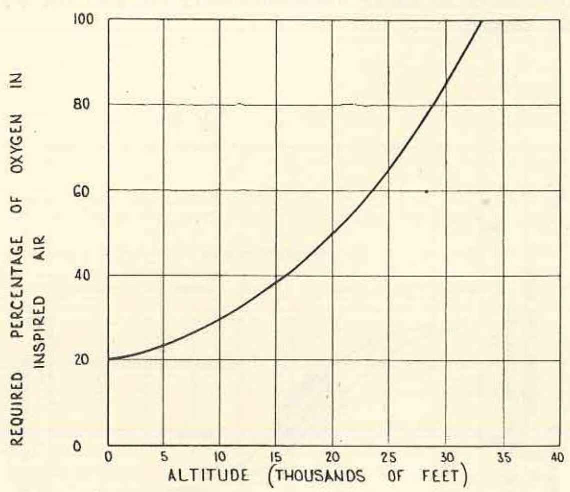


Fig. 2:—Oxygen Requirements for High Altitudes.

Psychological Effects of High Altitudes

These effects closely parallel those of a physiological nature, with the central nervous system being particularly vulnerable. The most outstanding characteristic of anoxia is the insidious way in which the higher mental functions are impaired without the subject being aware of it. Deterioration of psychomotor control has been illustrated on many occasions by a series of handwriting specimens obtained at increasing altitudes, which become more illegible as the effect of anoxia increases.

Studies of sensory functions indicate that the auditory senses are less influenced than visual senses, especially those related to light sensitivity. Light sensitivity begins to become impaired at 6,000-7,000 feet where 26% more light is required to maintain a light sensitivity equivalent to sea level. At 15,000 feet, this figure rises to 150%.

Effects of Rapid Rates of Change in Barometric Pressures

Changes in barometric pressure have no effect on the human body within the limits of altitudes now being generally flown by civil aircraft in Australia. The rate of change, however, as encountered is rapid ascents and descents does cause difficulties, as instanced by the inability of ears to adjust to changes in external pressure during descent. The anatomy of the ear is such that, during ascent, adjustments are made more or less automatically, but during faster descent, conscious efforts must be made to adjust the internal pressure of the inner ear to that of the atmosphere.

The Use of Oxygen

In the early stages of air transportation, considerable diversity of opinion existed as to the altitude at which oxygen should be used. The controversy was not merely a physiological one, but involved questions of weight penalties and a general dislike of masks.

However, once the decision had been made to supply additional oxygen, the difficult question of storage and administration had to be answered. Oral tubes were unsatisfactory, because they were wasteful and necessitated mouth breathing while facial masks were unpopular because they were cumbersome and unpleasant if worn continuously.

The release of free oxygen was impractical because of the large quantities that were required, and the storage of liquid oxygen, while reducing the overall weight, was not viewed with favour because of extreme fire and explosion hazards. The installation of lightweight oxygen cylinders has been accepted as the best method of storing oxygen, but the number of cylinders required for passengers in large air transports is considered to be excessive.

The disadvantages presented by the use of oxygen in high flying aircraft made it necessary to devise other means of ensuring that an adequate supply of oxygen was available at all altitudes at which operations would be carried out. The answer was found in pressurized cabins.

Pressurization

An early argument against pressurized aircraft was that the supercharging system would result in severe weight penalties. An analysis of present day systems, however, shows that they represent between 1% and 2% of the gross weight of a

particular aircraft, this figure being well within that which would be required for oxygen installations on similar aircraft.

However, to offset weight penalties there are the tremendous advantages in crew efficiency and passenger comfort. The operating efficiency of the aircraft is also improved by greater flexibility and greater speed for long flights because of the lower density of the air in which aircraft operate at high altitudes. Furthermore, the reinforcement of the fuselage for pressurization adds protection for aircrew and passengers during ditchings and emergency landings.

One of the most important considerations in aircraft with supercharged cabins is the pressure differential to be used, since it determines the relationship between cabin and atmospheric pressure. The first pressurized aircraft in general use was the Boeing 307 which used a pressure differential of 2.5 lb./sq. inch. This proved to be inadequate in flights above 15,000 feet as the cabin altitude rose to well over 8,000 feet. Later aircraft maintained a cabin altitude of less than 8,000 feet during flight at altitudes up to 20,000 feet.

A second major limitation is some of the earlier pressurized models was the use of pre-set controls which did not permit pressurization to begin at sea level. However, later models have clearly demonstrated that adjustable selective regulators are a great advantage in passenger comfort.

Explosive Decompression

The sudden loss of pressure, which was so greatly feared at first by flight crews and passengers, has proved to be of little significance at altitudes below 20,000 feet, but the problem at greater heights is still the subject of a very careful study.

The first effect from explosive decompression is that of acute anoxia. The useful consciousness above 25,000 feet varies from 1 to 3 minutes, depending on the altitude and physical condition of the subject (Figure 3). A second hazard, particularly above 30,000 feet, arises from the painful effects of nitrogen bubbles forming in the blood, while a third source of difficulty is the expansion of gases trapped in various parts of the body, their increased pressure being painful and even incapacitating. The effect of sudden decompression on normal ears has proved to be suprisingly slight.

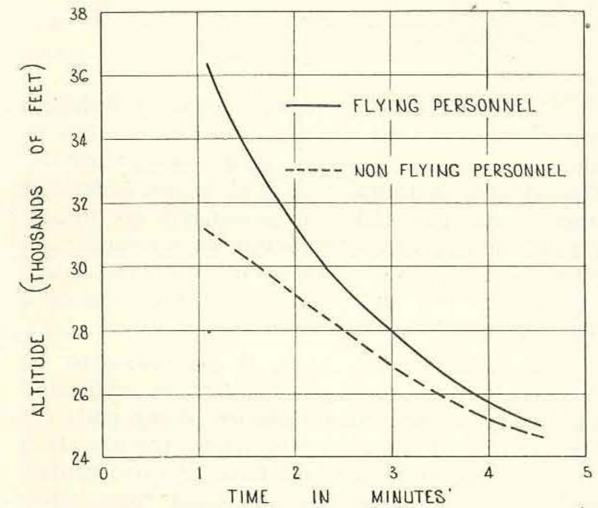


Fig. 3:—Duration of Useful Consciousness at High Altitude after Interruption of Oxygen Supply.

Numerous experiments carried out in flight as well as in the laboratory have repeatedly indicated that no major difficulties will be experienced by the majority of passengers from sudden decompression at altitudes below 20,000-25,000 feet. When operating below these altitudes, descents can be made rapidly enough without the need of oxygen to prevent serious anoxia in the majority of passengers. However, above this altitude, owing to the rapid onset of the effects of a lack of oxygen, the carriage of emergency oxygen equipment for all crew members and passengers may be necessary.

Conclusion

Cabin pressurization is an essential feature in the design of all long-range, high altitude air transports, while even for short range operations requiring frequent stops, a reasonable degree of cabin pressurization is desirable, so that if rapid ascents and descents are necessary they can be made without adverse effects on the passengers.

An Open Letter

Mr. Light-Aircraft Operator,
Anywhere,
Australia.

Dear Sir,

Although the Department of Civil Aviation tries to give you as much latitude as possible in the conduct of your flying, at the same time the Department is morally obliged to act should it appear that you and your passengers are in any possible danger. In other words we are concerned with the safety of aircraft operations, irrespective of whether the aircraft is a Constellation or a Tiger Moth.

For instance, any form of assistance to an aircraft in flight, or in possible distress, invariably involves expensive long distance phone calls for the alerting of rescue organisations, the diversion of civil or military aircraft from planned routes, and the transfer of our personnel from other essential work. The assistance given can therefore be added up in terms of L.S.D.

There are many occasions when this help is instrumental in assisting an aircraft in difficulties, and, at such times, it is impossible to assess the value of the assistance given. However, more often than not, the institution of emergency procedures is later shown to be completely unnecessary. In fact, there have been two recent cases of extensive searches going on while the aircraft concerned were safely bedded down in their hangars.

The majority of occasions on which unnecessary searches are made occur with light aircraft. The most common causes of these occurrences are the failure on the part of the pilot to submit a flight plan or flight details, or his failure to adhere to the stated intention of advising his arrival at the proposed destination.

The problem of flight notification for light aircraft operations was recognised some years ago, and it was realised that many of the standards that had been defined for aircraft operations did not take into account your particular requirements. Accordingly, towards the end of 1949, representatives from amongst the light aircraft operators were invited to a conference to discuss the whole field of orders and instructions so far as they related to light aircraft operations.

Among the conclusions of the conference were several relating to flight notification, as it was considered that the current requirements making the notification of every flight mandatory, were too stringent.

Soon afterwards, we began amending Air Navigation Regulations and writing appropriate Air Navigation Orders, but as it was felt that some immediate relaxation was desirable, an Operations Letter was addressed to all pilots, aero clubs and aircraft owners in March, 1949, setting out in a concise manner the requirements for both radio-equipped and non-radio-equipped aircraft, with reference to pre-flight notification, departure reports, arrival reports and notification of landings at places other than those previously notified. The Operations Letter was later cancelled when the information contained therein was incorporated in Air Navigation Orders, Part 11, Section 11.8.

In setting out our requirements for flight notifications, it was appreciated that a comprehensive communication service should be at your disposal for making such notifications. Accordingly, our normal aeradio service of 57 stations was supplemented with telephone services at 94 additional aerodromes.

At the same time, negotiations were begun with the P.M.G.'s Department to obtain the use of priority telephonic and telegraphic services which were necessary for notification of movements and for obtaining aeronautical information service from our personnel. The outcome of these negotiations was the provision of "Airmove" facilities which ensure a speedy communication link with departmental centres.

With regard to flight notification, etc., we have done our utmost to make the path of the light aircraft operator as smooth as possible. However, the successful operation of any system can only be accomplished by the co-operation of all parties concerned. We feel that we are doing our part and would appreciate your continued co-operation.

While on the subject of light aircraft operations, there are a few other matters which might well receive your attention so that the safety of your operations may be improved.

During recent months there have been occasions where arrival reports have not contained complete information. This invariably leads to trouble, as the inadequate information often means that the significance of the report is not appreciated, resulting in unnecessary emergency action. You will see then, that not only is it necessary to apply the procedures broadly, but they must also be applied in such a way that no doubt will be left in the recipient's mind as to the identity of the sender.

On other occasions, flights over considerable distances have been started with marginal flight time available before the onset of darkness. As always seems to happen, the flight takes longer than intended and the latter part of the flight is conducted under instrument conditions with a night landing at the destination.

As you are aware, flight after dark in most light aircraft is a breach of Air Navigation Regulations and resultant disciplinary action is always possible. However, the Department usually adopts a tolerant attitude on breaches of this nature, and except for flagrant cases, the only action taken is to point out the error of your ways and possibly warn you against similar instances. You will agree that for the most part, such operations are unnecessary, potentially dangerous, and can be avoided by using commonsense in your planning.

It is with some pleasure that we record that the number of cases of unauthorised low flying have decreased considerably. This clearly indicates that light aircraft operators are aware that unauthorised low flying is senseless, and their reaction is heartily endorsed by this Department.

The future of light aircraft operations can only be assured when operations and safety are mated, for this reason, we hope you will accept our remarks in the spirit in which they are given.

Yours faithfully,

D.C.A.

Measurement of Runway Visibility

DURING an instrument approach, the pilot of an aircraft must have advance information on the visual conditions he can expect when he breaks through the cloud base and also the height at which a break-through can be made. At the present time, although he is given this information, it may be obtained at a point some distance from the touchdown point, and may therefore differ considerably from the actual conditions which are experienced. This difference is of importance in marginal weather conditions.

The problem of providing accurate information resolves itself into two sections, firstly the accurate determination of cloud base, and secondly the equally accurate determination of runway visibility. The whole question has been under investigation throughout the world for many years, and from time to time, experimental equipment aimed at bringing the final answer one step closer is produced.

One recent experimental installation for measuring runway visibility is the electronic "eye" which has been installed at Washington National Airport, U.S.A. The "eye" peers down Runway 36, the instrument runway, and reports changes in visibility to control tower operators who relay the information to aircraft.

This is the first of such installations available for operational use, and will be followed by similar installations in the near future at three other major airports.

The new device, known as the Transmissometer, is used by the tower when the visibility along the instrument runway is reduced to $1\frac{1}{2}$ miles. The readings on a dial in the control tower are relayed immediately to pilots on final approach so that they can have the benefit of accurate information on visibility if it lifts for a few moments above the operational minima.

The Transmissometer, which stands at the approach end of Runway 36, is about 15 feet high, and looks down the runway from the touchdown point. The reading at that point registers on the dial in the tower when the visibility reaches one and one-half miles, and continuously indicates any change below that figure. The dial in the tower has separate bands for day and night use.

The Proof of the Pudding

AVIATION magazines have given quite considerable prominence during the last couple of years to the AG-1 agricultural aeroplane which was designed in America specially for agricultural work.

The hours flown by aircraft on various phases of agricultural flying in America amount to approximately 32% of the hours flown by the scheduled airlines, and because of the high accident rate in this type of work the need was felt for an aircraft which would ensure that, even if the number of accidents could not be reduced, at least the number of pilots engaged in crop-dusting work would not be sadly depleted.

The AG-1 aeroplane incorporated most of the design features recommended by the Crash Injury Research Project Committee of the Cornell Medical Centre. The engine bearing structures were designed for approximately 15G loads and the cockpit was, so far as we know, the only cockpit structure specifically designed in any aircraft to protect the pilot under 40G loads.

A 40G seat was used, and the pilot used Navy shoulder harness with a standard military inertia lock of a type developed by Cornell Medical Centre.

As readers have probably guessed from the use of the past tense, the aircraft has now undergone its supreme test, as it struck a power line pole and crashed during a crop-dusting demonstration flight. The plane was totally destroyed except for the cockpit region. The only injury to the pilot was a sprained thumb.

The pilot's account of the accident leaves no question that the crash was extremely violent. When asked whether he felt that the protective design had been effectively demonstrated, the pilot replied, "most excellently."

The investigating officer, who conducts investigations into about 75 crop-dusting accidents per year, was firmly of the opinion that there was no question that the accident would have been fatal in any other type of aeroplane used for crop-dusting.

The results of this crash should stimulate further engineering thought on crash-survival design.

There is no evidence to suggest that the crash was part of the demonstration.

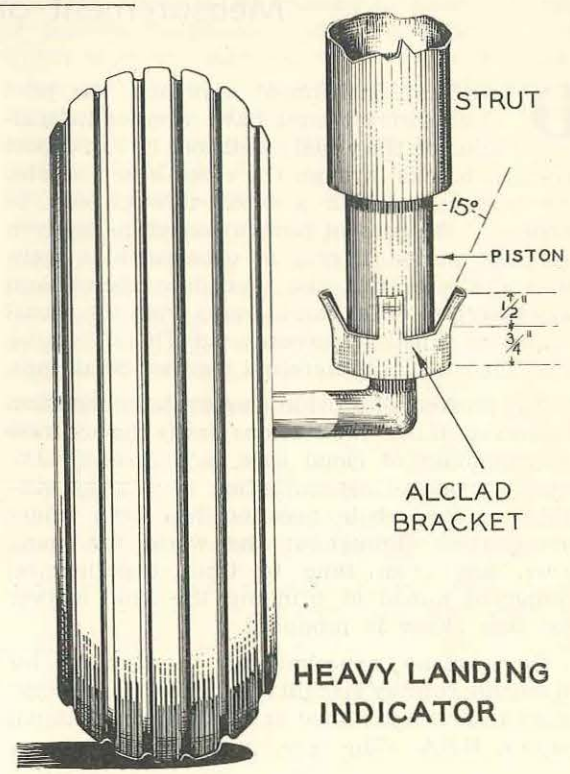
Drop Checks

(By courtesy of the Flight Safety Foundation)

SERIOUS structural failures can occur in routine operations due to hard landings. Pilots have varying opinions as to what may have been a severe jolt when they "drop it in," and a very critical situation might arise if a pilot failed to report a jolt serious enough to start a crack in a spar.

One European airline has devised a "Heavy Landing Indicator," which gives a positive check on hard landings. The indicator consists of a small, light, alloy bracket which is attached to the lower part of the undercarriage leg. Four prongs, pointing upwards, are distorted by impact with the fixed upper portion of the aircraft's leg if the legs are compressed beyond normal limits.

This serves as a visual indication that a certain "G" load has been passed and that an inspection is necessary because of the possibility of structural damage.



HEAVY LANDING INDICATOR

A New Landing Aid

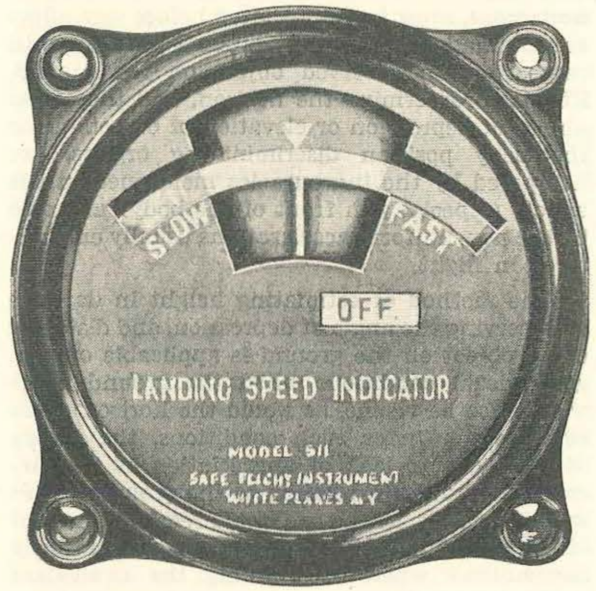
SOME prominence has been given in recent aviation magazines to a new instrument known as the Landing Speed Indicator. The Safe Flight Instrument Corporation of White Plains, New York, claims that this instrument gives a pilot instantaneous indications of safe and critical speeds during take-off, climb, and landing approach.

For those who are not already acquainted with the details, the following condensation of the magazine articles on this indicator may be of interest.

The Landing Speed Indicator consists of a standard instrument fitted on the panel and a sensing unit located near the leading edge of the wing. The panel unit has a single indicating pointer which moves through an arc of 75°, divided into segments coloured red, white and green. A flag alarm, similar to that on the I.L.S. indicator, comes into operation when the Landing Speed Indicator is switched off or becomes inoperative because of some malfunction. The sensing unit consists of a transducer with a small vane which protrudes out and down from the leading edge of the wing. It is located in such a manner that any change in the flow of air at the point where it parts, is sensed by the vane. Any change at this point, known as the stagnation point, has a definite relationship to the lift coefficient and can be indicated on a suitable instrument.

The makers further state, that this unit represents a considerable departure from the stall sensing unit manufactured by them for a stall warning indicator. In the latter unit the vane closes a switch which activates a warning device in the cockpit as the aircraft approaches the stall. In the Landing Speed Indicator, the sensing unit transducer provides an instantaneous indication during the approach and take-off phases directly related to the lift coefficient. The vane is electrically heated to eliminate icing and the entire system weighs less than three pounds.

The makers claim that if the needle on the instrument is centred during the approach, the speed is aerodynamically perfect for a safe approach and flare out and thus the landing run is reduced to a minimum. They also say that the equipment automatically takes into consideration such factors as weight, flap and landing gear configurations, and therefore, because the optimum speed is achieved during the approach, the result is that landings are consistently accurate and uniform.



An example of the critical effect of deviations from the correct approach speeds is evident in the operation of heavy jet aircraft like the B-47. In this particular aircraft, a landing speed of 10 knots in excess of the correct speed means using up an additional 1,700 feet of runway.

Comment:—An instrument such as that described could confer on the pilot many advantages, which would result in a higher degree of safety in the critical phases of aircraft operation.

More About Sensory Illusions

IN the October edition of Aviation Safety Digest, we published an article entitled "Sensory Illusions in Flight." The article was based on theories which had been received with wide acclaim overseas and we invited comments from out readers. One of our own officers has accepted our invitation and his comments which should be of interest to all, are set out below.

"The article 'Sensory Illusions in Flight' contains some statements which are not in accordance with known psychological facts and which could lead to false conclusions as to the source of the illusions and hence to methods of avoiding them. The more important aspects of the problem are discussed briefly in the following —

Ability to estimate height depends basically on the ability to estimate the **apparent size of a known object,** which must have sufficient surface texture for its precise localisation in space. (The difficulty of landing on calm water is due primarily to the lack of texture of the water surface. Katz in "World of Colour," Kegan Paul, discusses this and related problems.) Again, the ground plane, **which is normally assumed to be horizontal,** must be appreciated before any effort can be made to judge the aircraft position with respect to an observed object on the ground. Efforts to determine the horizon, and therefrom angles of depression or elevation of objects using the body position discriminating organs, are hampered by the inaccuracies mentioned in the article (especially in front of the body) and also by the non-uniform accelerations usually encountered in flight.

The method of estimating height in daytime by observing the angle of depression, and distance, of an object on the ground is applicable only in good visual conditions when the ground plane would also be visible, as would the horizon or its equivalent. Under such conditions, the theory of error due to lack of appreciation of the aircraft's attitude (in relation to the ground plane) would not hold, as the eye would receive sufficient visual stimuli or cues to obviate relying on body mechanisms when determining the equivalent of the horizontal plane. It is much more likely that errors arise due to incorrect estimation of distance — in fact the errors are equal, a distance error of 30% resulting in a height error of 30%, etc.

At night-time, optical localisation of lights as a prerequisite to making an estimate of height would be impossible unless the apparent subtended source size of the light was greater than about 5-10 minutes of arc (12-24 inches at a distance of 720 feet). As this condition is never met in practice except for specially designed lights and, in any case, as the light-size is usually unknown, it would be dangerous for a pilot to attempt to make an estimation of height under such conditions.

The explanation given for the illusion due to a sloping runway omits reference to all the other visual stimuli that a pilot would receive by day about the ground plane. At night, where **only the runway lights** were visible, the impression of overshooting or undershooting mentioned in the article would certainly be gained. The use of relative judgments (such as the movement of say the first runway lights with respect to the windshield outline) rather than absolute judgments is required to resolve the illusion.

From the above comments, several conclusions can be drawn regarding height and similar visual judgments:—

(i) The ability to estimate height in daytime is poor, as it depends on the accuracy with which two other judgments are made, i.e., angle and distance. At night, distance cannot be determined, except for specially constructed lights, hence the technique breaks down completely and should never be attempted.

(ii) Non-uniform accelerations affect the body positioning mechanisms to such a degree that, taking account also of the low discriminatory power of these organs, they cannot be used for primary judgment of angles. Where objects are visible on the ground, however, there are usually sufficient visual clues available to enable the pilot to correctly appreciate the ground plane and hence to make a more accurate estimate of angles, etc.

(iii) Visual training of pilots should stress the inaccuracies of 'absolute' visual judgments and emphasise the use of relative judgments which are independent of the body mechanisms. This in turn requires emphasis on the use of aircraft instruments as the primary source of attitude information.

D.B.F. 2.12.53."

We are pleased to print the above comments and thank the person responsible for his interest.

PART II

OVERSEAS ACCIDENTS

Constellation Landing Accident — Chicago

ON the 3rd March, 1953, a Constellation, Model 1049, aircraft was extensively damaged during a scheduled landing at Midway Airport, Chicago. There were 77 passengers and a crew of six. The occupants, with the exception of one passenger, who received a superficial injury, were uninjured.

The following summary is based on the report issued by the Civil Aeronautics Board who investigated the accident.

The Flight

The aircraft was on a regular public transport flight from Miami, Florida, to Chicago, Illinois. As the aircraft neared Chicago, it was passed from Air Route Traffic Control to Approach Control and was subsequently cleared for an I.F.R. descent on the Kedzie A.D.F. The Kedzie beacon is situated 3.8 miles, 132°, from the threshold of Runway 31 left. Shortly after the descent was commenced, radar contact was established and routine vector and descent instructions issued. The aircraft subsequently reported over the Kedzie beacon and was thereupon cleared to land on Runway 31 left; the weather being given as ceiling 700 feet, visibility one mile.

Immediately after passing the Kedzie beacon, the landing gear was selected down. Subsequently, the landing gear warning lights indicated gear fully down and locked, and the hydraulic pressure gauge showed that the pressure was normal. When approximately 1¼ miles from the end of the runway, the aircraft was observed on the radar to be 800 feet to the left of course and was immediately advised accordingly. The aircraft was observed to commence a corrective turn during which it became contact. As the aircraft neared the runway it made a steep left turn followed by a right turn to line up with the runway.

Competent witnesses testify that this latter turn was made at a height about 200 feet above the runway threshold and the airspeed appeared to be in excess of the normal approach speed. The aircraft touched down near the intersection of Runways 31L and 4L, which point is approximately two-thirds of the way down Runway 31L. Immediately after touchdown the aircraft skipped, settled and then veered off the runway to the left and came to rest with the landing gear retracted, just beyond the end of the runway. There was no fire and the passengers were quickly evacuated.

The weather at the time of the accident was — measured ceiling 500 feet, overcast, visibility one mile with light rain, fog and smoke, wind north-east 13 m.p.h.

Investigation

Midway Airport has an elevation of 618 feet. Runway 31L is macadamized and is 175 feet wide and 6,410 feet long. The distance from the threshold of this runway to the far side of its intersection with Runway 4L is 4,000 feet. It was established that the aircraft touched down on the wet runway near this intersection. After travelling approximately 2,000 feet, the aircraft skidded off the left side of the runway and across a broad taxi strip, coming to rest a few feet beyond and to the left of the end of the runway. Many marks made by propeller blades were found on the runway; these were first noticeable at a point 315 feet from the far side of the intersection and extended for some 1,430 feet.

Examination of the aircraft revealed that all propeller blades were bent or broken, Nos. 1 and 4 engines sustaining minor damage and Nos. 2 and 3 engines major damage. A portion of the fuselage belly was badly crushed, the left wing sustained damage on the under side and the right wing, crushing damage to the leading edge.

The main landing gear was found fully retracted, but the hydraulically operated wedges which complete the final locking of the gear were not in place. The nose gear was retracted to within six inches of the full "up" position. Several minor repairs, necessitated by damage on impact, were carried out and the aircraft was then raised by means of airbags and jacks, until the landing gear cleared the ground. As this was accomplished, all three landing gears moved to the fully down and locked position. Auxiliary hydraulic and electrical units were coupled to the landing gear systems and the gear was raised and lowered fourteen times, completely without malfunction, either hydraulically or electrically. The gear electrical system was then adjusted to simulate a condition of aircraft weight on the gear, and tests of the manual override were made without evidence of any malfunctioning. The crew allege that the landing gear was in the "down" position and locked at the time of touch-down, and the gear control lever was not touched after it was placed in the down position. However, as subsequent comprehensive tests of the landing gear system showed it to function in the normal manner, it is difficult to reconcile the crew's statements with what actually occurred. Therefore, it is considered that the landing gear control lever must have been raised by some member of the crew. Also, this action must have been taken before there was sufficient weight on the gear to actuate the safety switch, i.e., during the skip (bounce).

Throughout the descent the aircraft was flown by the co-pilot from the right hand seat and the descent was monitored by the captain from the left hand seat. The aircraft was 1,500 feet at the Kedzie beacon and the captain told the co-pilot to descend to 400 feet. The aircraft was levelled out at 400 feet, still under I.F.R. conditions, and it was at this stage the radar operator advised the aircraft that it was 800 feet left of course. The aircraft continued at an altitude 400 feet and on the crew's admissions during this period various applications of power were made and the airspeed varied from 100 to 125 knots. During the corrective turn, previously referred to, the aircraft was still under I.F.R. conditions and the captain remarked to the co-pilot that "we might have to go round." However, immediately following this remark, visual contact with the ground was established and a steep left and then right turn was made to align the aircraft with the runway. As previously established the aircraft touched down two-thirds of the way along the runway. On touchdown reverse thrust was applied to all four engines.

It appears that the landing gear was selected down at a distance of 3.8 miles from the runway, which did not allow sufficient time to stabilize airspeeds, power settings, and rate of descent for a smooth co-ordinated approach and resulted in the wide range of airspeeds and throttle adjustments which followed.

The fact that the aircraft was permitted to deviate 800 feet to the left of the course shows lack of alertness on the part of the crew and under the circumstances the captain should have taken over the controls. Furthermore, when visual contact was established at the height of 400 feet and some 2,200 feet from the end of the runway it is apparent that the aircraft was disposed some distance from the centre line of the runway and it would appear that missed approach procedure should have been immediately initiated.

Probable Cause

The Board determined that the probable cause of the accident was an improperly executed approach resulting in excessive speed and a landing too far down the runway to permit normal stopping.

Stratocruiser Crash in Dense Brazilian Jungle

On 29th April, 1952, a U.S.A. airline Boeing 377 (Stratocruiser) aircraft enroute from Buenos Aires, Argentine, to New York, U.S.A., crashed in the dense jungle about 887 nautical miles north-north-west of Rio de Janeiro, Brazil, its last point of departure. All 50 persons aboard, consisting of 41 passengers and a crew of nine, lost their lives and the aircraft was completely demolished.

In accordance with the I.C.A.O. agreement, the investigation was conducted by the Brazilian Government, who invited representatives of the U.S.A. Civil Aeronautics Board to participate.

The U.S.A. Civil Aeronautics Board subsequently held a public hearing at Miami, U.S.A. in November, 1952, and the following is a summary of their report.

The Circumstances

The aircraft was on a regular public transport flight from Buenos Aires to New York with enroute scheduled stops at Montevideo, Uruguay; Rio de Janeiro, Brazil; and Port of Spain, Trinidad. The aircraft departed Buenos Aires at 1826 hours on the 28th April, 1952, and arrived at Rio de Janeiro at about 0105 hours on 29th April, 1952.

At Rio de Janeiro a routine crew change was effected and the aircraft was cleared for an off-airways direct route to Port of Spain. The estimated flight time at standard cruise was 10 hours 30 minutes, with a fuel requirement of 7,296 gallons. On long range cruise the estimated flight time was 11 hours 7 minutes. The actual fuel on board at departure was 7,400 gallons. The take-off weight was approximately 3,550 lb. below the maximum allowable weight and the load distribution was satisfactory.

The aircraft departed Rio de Janeiro at 0306 hours on the 29th April, 1952, and reported on time, at the first three designated reporting points as flying under V.F.R. conditions, off airways, at 12,500 feet. At 0616 hours, some 3 hours 10 minutes after departure, the aircraft reported at the fourth check point, abeam Bameiras, Brazil, flying at 14,500 feet under V.F.R. conditions, with an E.T.A. abeam Carolina, Brazil, at 0745 hours. This was the last known message from the aircraft.

When no further reports were received from the aircraft, missing aircraft procedure was initiated and the wrecked aircraft was subsequently located by a United States Air Force Search and Rescue Unit in a position on course 282 nautical miles north-north-west of the Bameiras abeam check point and 36 miles south-south-east of the Carolina abeam check point.

Investigation

Aerial photographs taken by the Search and Rescue Unit revealed that the wreckage was scattered over approximately a one mile area in dense jungle amid rugged terrain. An aerial survey indicated that there were no survivors and attempts to reach the scene of the accident by parachute teams would be impracticable because of the dense jungle. The route to the scene of the wreckage subsequently taken was by land plane airlift from Belem to an airstrip at Araguacema, 523 miles south of Belem. From this point an amphibian airlift was used to Lago Grange, a point 85 miles south of Araguacema on the Araguia River. A base camp was established at Lago Grange, a village of four mud huts located at a point on the river which was capable of accomodating a large amphibian aircraft. The distance from Lago Grange to the wreckage was 35 miles, 26 miles of which were through dense jungle. The official investigating party finally reached the wreckage on the 16th May, 1952, seventeen days after the accident.

This party began an examination of the wreckage. However it soon became apparent, due to water shortage, difficulties in maintaining supplies and many other problems, that a thorough investigation would require a more carefully organized and much better equipped expedition. The inspection of the wreckage was temporarily abondoned and all persons were evacuated by 20th May, 1952.

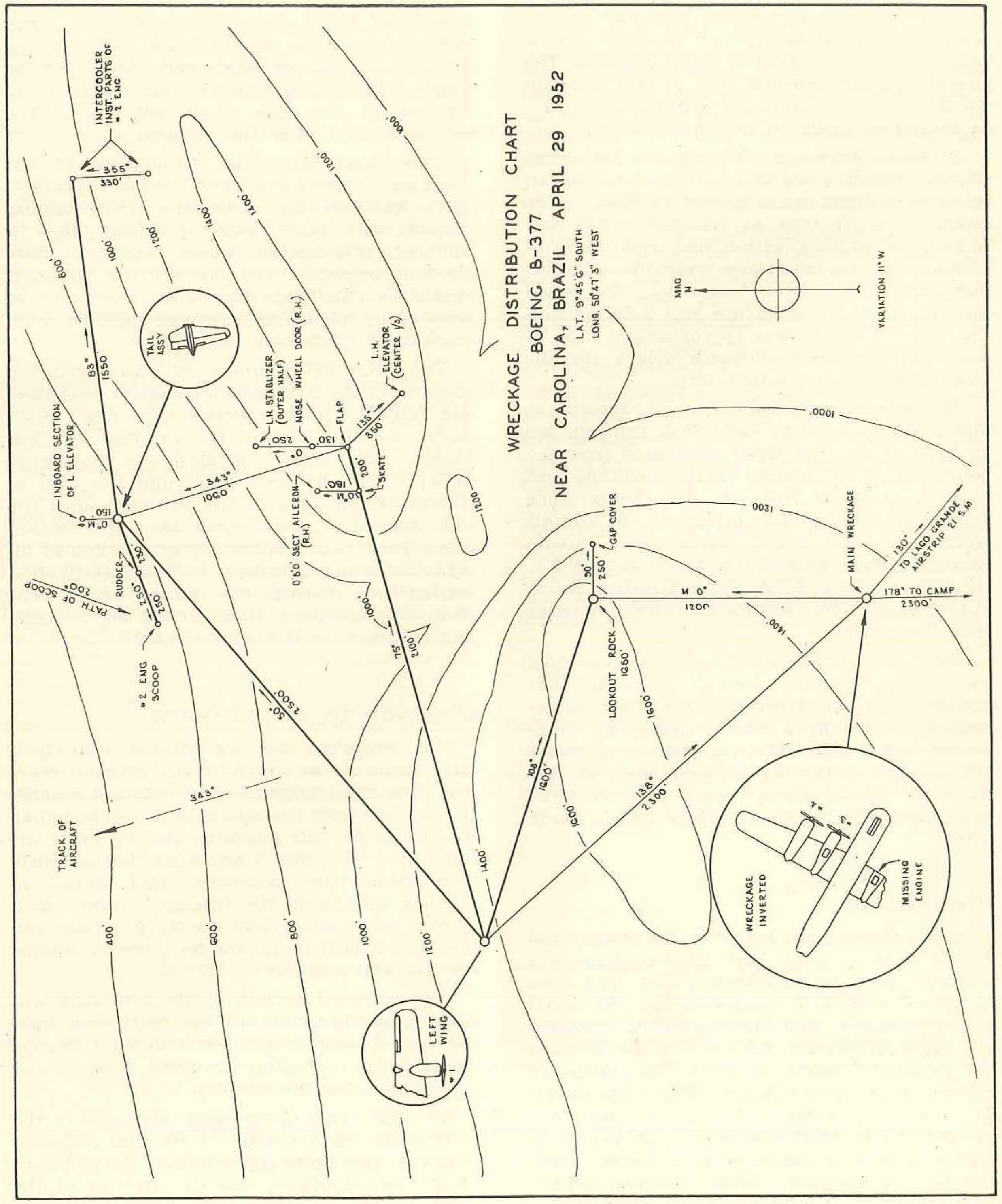
The U.S.A. Civil Aeronautics Board, with the approval of the Brazilian Government, organized and fully equipped a second expedition which moved into the area of the wreckage on 15th August, 1952. This expedition was thoroughly equipped for all eventualities and was able to remain at the scene of the wreckage until the 10th September, 1952, when the rainy season commenced, necessitating the evacuation of all personnel and equipment. The investigation carried out during the above period was reasonably complete, although the No. 2 engine and propeller could not be located.

Observations at the Scene

The wreckage area was divided into three main segments as shown in the diagram overleaf. The main wreckage site contained roughly the fuselage from the nose back to and including the dorsal fin, the complete landing gear, the right wing with Nos. 3 and 4 nacelles complete with engines and propellers; that portion of the left wing from the fuselage outward to a point slightly outboard of the No. 2 nacelle, and the No. 2 nacelle minus the No. 2 engine, engine cowling, and propeller.

The outboard portion of the left wing was found approximately 2,300 feet north-west from the main wreckage, complete with No. 1 nacelle, engine, engine cowling, propeller, aileron, and outer portion of the left flap.

The tail assembly wreckage consisted of the vertical fin, right elevator, horizontal stabiliser from the right tip to approximately the mid span of the left stabiliser, and the aft end of the fuselage. This piece of wreckage was found some



2,500 feet north-east from the left wing wreckage. Numerous other parts were found roughly within a circle formed by the main three segments.

The main wreckage was found lying in an inverted position and it was apparent from the condition of the surrounding trees that this portion of the aircraft had made an almost vertical descent while in a horizonal attitude.

The various portions of the aircraft sustained extreme disintegration on impact and subsequent fire. Also, prior to the examination of the wreckage the Brazilians used flame throwers on the wreckage for sanitary purposes. In addition, a forest fire swept the wreckage before the arrival of the second investigating group.

The heat of the various fires melted away many pieces of the aluminium alloy structure, which resolidified into unrecognisable globules and masses of metal. Many structural parts which retained identifiable state had their fractured edges melted or burned away, making study of them impossible.

Analysis

Despite the extensive damage sustained by the aircraft considerable evidence was obtained in regard to the nature and cause of the failures of the various components. It was possible from this evidence, in conjunction with the evidence of the distribution of the wreckage, to establish with a reasonable degree of certainty the sequence of failures.

From the available evidence it is considered that an emergency occurred in either No. 2 propeller or engine which resulted in these components separating from the aircraft during flight at a relatively high altitude. Very shortly after the loss of No. 2 engine the left wing failed. Almost simultaneously, and as a result of violent pitching of the aircraft during the wing separation, the entire tail section broke from the fuselage in a downward direction at a point just aft of the dorsal fin, probably before the left wing proceeded that far rearward.

Since the No. 2 engine and propeller were not recovered they could not be examined to determine the cause of their separation from the aircraft. However, it was concluded from examination of the No. 2 engine mount, which remained with the aircraft, that separation resulted from the application of forces beyond that for which it was designed. Similar separations of engines from B-377 aircraft in flight, due to excessive loads being applied to the engine mount, are known. In all cases where the engine and propeller were recovered, examination disclosed that the separation resulted from propeller blade failure and the resultant destructive loads due to propeller unbalance.

Probable Cause

The Board determines that the probable cause of this accident was the separation of the No. 2 engine and propeller from the aircraft due to highly unbalanced forces, followed by uncontrollability and disintegration of the aircraft for reasons undetermined.

Landing Accident: Viking: Nutt's Corner — Belfast

On the 5th January, 1953, a Viking aircraft whilst on an approach to land on Runway 28 at Belfast Airport, Nutt's Corner, Northern Ireland, struck the ground some 1,200 feet short of the end of the runway and then crashed through a S.B.A. van and an I.L.S. building, finally coming to rest approximately 750 feet from the runway threshold. The aircraft was destroyed and 27 of the 35 occupants were killed.

The investigation of the accident was conducted by a Court of Investigation convened by the Lord Chancellor of Britain. The following is a summary of the report submitted by the Court to the Minister of Civil Aviation.

Events Preceding the Accident

At the time of the accident the aircraft was on a scheduled flight from Northolt Airport, London, to Nutt's Corner Airport, Belfast. The aircraft was manned by a crew of four and carried 31 passengers and a small quantity of cargo. The all-up weight and centre of gravity were within the allowable limits.

The aircraft departed Northolt at 1929 hours on 5th January, 1953, and crossed the coast of Ireland at 2053 hours flying at an altitude of 5,500 feet. Shortly after, the aircraft came under the control of Nutt's Corner and was advised that Runway 28 was in use and G.C.A. was available. The captain, who was flying the aircraft, elected to carry out a G.C.A. approach. It was a very dark night and the weather at Nutt's Corner at this time was 4/8 cloud at 8,000 feet, 3/8 cloud at 1,800 feet and probably fragments of cloud at a lower level. The wind was from 028°T at 8 knots and the visibility was 3 miles. Continuous slight drizzle was falling.

The aircraft was brought down to a height of 1,195 feet above and 3 miles from the runway on G.C.A. At this point G.C.A. lost radar contact with the aircraft because of interference due to "rain clutter" and the Approach Controller directed the aircraft to overshoot if not visual. About 20 seconds later the aircraft reported "We can see lights now." A few seconds later the aircraft struck No. 6 approach light, touched down 250 feet further on and then bounced and crashed into the S.B.A. van and I.L.S. building.

Investigation

An examination of the wreckage did not reveal any defects or evidence of malfunctioning which may have contributed to the accident.

The weather was substantially the same as reported earlier with a slight increase in cloud amounts; the visibility was 4,400 yards; estimated by an observer and checked by a "Visibility Meter." No low cloud or mist were observed in the vicinity of the aerodrome. Although the "rain clutter" observed on the radar screens is usually associated with large rain drops, only slight rain drizzle was reported at the time of the accident.

Five miles out from the threshold of Runway 28 the elevation of ground is 660 feet above the runway. From there it slopes downwards, till at 3 miles it is 325 feet above the runway and at 4,000 feet where the outer-most approach light is situated 84 feet above the runway. The top of the pole carrying approach light No. 6 is 70 feet above the runway and 113 feet below the glide path; horizontally this pole is some 2,000 feet from the threshold. The S.B.A. van, situated between approach-light poles 3 and 4, was 1,000 feet from the runway and an aerial pole on top of the van, carrying an obstruction light, was 80 feet below the glide path. The I.L.S. building is between poles 2 and 3 and its top is 80 feet below the glide path.

It was revealed that the approach light poles, I.L.S. building, S.B.A. van and various parts of the ground on the approach projected above the "approach surface" as defined by I.C.A.O. Annex 14. However, it has not been possible to find an ideal site in the vicinity of Belfast to meet the approach slope recommendations of Annex 14 for an east-west runway. A runway in this direction is necessary because of the prevailing westerly wind.

In view of the slight projection of obstructions above the desired "approach surface" of Runway 28 the G.C.A. and I.L.S. glide paths have been fixed at 3¾° instead of the usual 3°. After a thorough evaluation of the above obstructions it was concluded that only in the most exceptional circumstances would an aircraft be endangered by these obstructions.

Runway 28 has two rows of white runway lights 150 feet apart. In each row the lights are set at 50 feet intervals. The threshold lights are 13 green lights at 12½ foot intervals across the threshold. The approach lights are 10 sodium lights set at a hundred-yard intervals mounted on poles. These lights are set at 45 degrees to right and left. Expert evidence in relation to the runway and approach lighting was given by Mr. E. S. Calvert, B.Sc., Head of the Illuminations Section of the Royal Aircraft Establishment, Farnborough, who was responsible for the design of the internationally approved lighting system which bears his name. Mr. Calvert pointed out how, under certain circumstances, the approach lighting to Runway 28 could lead to errors of judgment by a pilot. However, on this occasion the weather was not close to the minimum and all the indications from witnesses on the ground tend to show that there should have been no very exceptional difficulty in judging position and angle of descent.

Five persons, who were familiar with aircraft operations, observed the aircraft lights from when the aircraft broke cloud until it crashed. Their evidence generally agrees that the aircraft broke cloud above 1,000 feet and slightly less than 3 miles from the runway. This would be consistent with the point at which the aircraft reported "We can see lights now." When first observed the eye-witnesses considered the aircraft to be slightly higher than usual for an aircraft on an approach and then a steeper than normal descent was made and maintained until the aircraft struck the ground.

Analysis

From the available evidence it appears that the aircraft continued for some 40 seconds on the descent after radar contact was lost before becoming visual. At this stage the captain considered he was exceptionally high and steepened his descent. In doing so he made an over correction and descended more steeply than was necessary, failing to check the descent in time to clear the ground. It is probable that the weather conditions were such that the aerodrome lights were somewhat blurred, but not to the extent of being seriously misleading to a pilot with normal eyesight, visual judgment and experience in flying various weathers. The evidence shows that he should have been able to adjust his descent so as to be able to land on the runway. Even after he had started to descend too steeply, he should have realised when he was still several hundred feet from the ground, that he was on a path which would bring him down short of the runway and should have levelled out earlier than he did. In these respects he made errors of judgment which indicate a falling short in the degree of perception and ability to act correctly in an unusual situation which are to be expected of an experienced pilot.

The relevant conclusions of a British Court of Investigation are given as answers to questions submitted to the Court by the Attorney-General.

The significant questions and answers were:—

Question: Were the Approach and Runway Lights satisfactory during the aircraft's approach?
Answer: Yes.

Question: Did the G.C.A. equipment function correctly?
Answer: Yes, subject to its inherent limitations.

Question: Was all possible assistance given to the Captain of the aircraft by the G.C.A. operating crew?
Answer: Yes.

Question: Did the prevailing weather conditions at Nutt's Corner cause or contribute to the accident?
Answer: They contributed to the accident in the sense that the accident would in all probability not have happened if the weather conditions had been different but they did not cause or contribute to the accident in the sense that the weather conditions made the accident unavoidable.

Question: Was the Captain's decision to make a visual approach to land a correct one?
Answer: Yes.

Question: Did the S.B.A. van and the I.L.S. building endanger aircraft landing at night on Runway 28?
Answer: Not aircraft landing in anything like a normal manner.

Question: What was the cause of the accident?
Answer: Error of judgment on the part of the Captain in (a) starting his final approach to land at too steep an angle and (b) failing to appreciate, until it was too late to make an effective correction, that the angle of his descent would bring him to the ground far short of the runway.

DC-3 Approach Accident — St. Louis, Missouri

At about 0418 hours on the 24th May, 1953, a DC-3 aircraft crashed on the east side of Lambert Field, St. Louis, Missouri, approximately 1,950 feet east of the north-south runway. The accident occurred while the aircraft was being manoeuvred beneath a 400 feet ceiling preparatory to landing. Six out of the seven persons on board were killed and the aircraft was demolished.

The Flight

The aircraft was en-route from Telerboro, New Jersey to Oklahama City, Oklahama, with a P & W R-2800 engine to be installed in a company C46 aircraft.

Initial contact was made with St. Louis Tower at 0357 hours, the aircraft then approaching Alton intersection, some few miles west-north-west of St. Louis, at 3,000 feet. In reply to a question, the tower was advised that the aircraft carried ILS equipment, and it was then cleared to the ILS Outer Marker, to maintain 3,000 feet, and to report when over the Alton intersection. Shortly after, the present St. Louis weather, indicating ceiling 400 feet, overcast, visibility 3 miles, wind south and variable 5 m.p.h., fog and smoke, altimeter 29.93 was passed to the aircraft, along with a clearance for an ILS approach to Runway 24 or 12, to report when leaving 3,000 feet, when passing Alton and when over the Outer Marker.

The captain reported leaving 3,000 feet at 0408, passing the Alton intersection at 0410½ and inbound over the Outer Marker at 0414. While the airport controller was watching the approach end of Runway 24, expecting the aircraft to come into view at any moment, a surging of engines was heard and almost simultaneously a message was received from the aircraft that it was over the field with one engine out.

All runway and approach lights were turned up to full intensity and the pilot was advised that the surface winds were calm and to use any runway he could make.

Shortly after, the airport controller, for the first and only time, sighted the DC-3 south of the field on a south-easterly heading. The altitude was estimated to be 300 feet and the aircraft appeared to be descending with the landing gear down. Upon reaching an altitude of about 200 feet, a left climbing turn was started and the aircraft disappeared into the overcast.

Repeated efforts were made to contact the aircraft, and it was learned later that the aircraft had crashed. There was no fire.

Investigation and Analysis

An inspection of the wreckage area showed that initial contact with the ground was made by the right wing tip, and after going straight ahead on a northerly heading for about 65 feet, with the right wing making a deep gouge in the earth, the aircraft cartwheeled to the right, coming to rest right side up after sliding rearwards for about 10 feet. The forward section of the fuselage was severely crushed, both engines were torn out, and the R-2800 engine was thrown through the cabin roof and was lying about 40 feet away. The landing gear was fully extended and latched, the wing flaps were fully retracted, the elevator trim was slightly nose high, and the rudder trim was neutral. The cockpit damage was so extensive that the instrument readings were meaningless. Both altimeters were found on the ground away from the wreckage, and although extensively damaged, the barometer settings were found to be 29.90 and 29.96 inches respectively. Nothing was found that would indicate that the aircraft was not airworthy prior to the accident.

The fact that the aircraft acknowledged that it was equipped to make an ILS approach does not definitely mean that this type of approach was attempted. Actually, subsequent events would appear to indicate that such an approach was either not made, or if started, was abandoned.

The aircraft was observed by competent witnesses at the north-west corner of the field to twice approach the airport from the north below the overcast and disappear in a southerly direction. This direction was approximately at right angles to Runway 24 — the ILS runway. These witnesses all stated that the engines appeared to be operating normally. Other witnesses at the south side of the airport who got one fleeting glimpse of the aircraft as it passed overhead, stated that the left engine was either windmilling or feathered. However, the survivor stated that he believed that both engines functioned normally throughout the circuit of the field, and that the only change of power he recognized was when the aircraft climbed slightly after crossing the field the first time. It was considered that the witnesses at the south side of the field were in error in that, due to an optical illusion when the aircraft passed overhead, they thought the left propeller was only turning slowly. The survivor's testimony seems far more credible as he was in a position to hear the sound of the engine.

It appears then that the pilot did not experience any difficulty with the engines prior to the accident. More probably, he elected to remain visually contact with the airport rather than execute a missed approach and since the ceiling was below the authorized minimum of 500 feet prescribed for a circling approach he reported an engine out to justify his actions in circling below this height.

The four fuel tanks were undamaged in the crash and when dipped shortly afterwards were found to have approximately the following amounts of fuel in each:

Left main tank	80 gallons
Right main tank	70 gallons
Left auxiliary tank	40 gallons
Right auxiliary tank	10 gallons

The investigation of the fuel system disclosed that the left main tank was selected to the left engine, while the right auxiliary tank was connected to the right engine. The left engine carburettor, main fuel supply line, fuel regulator and fuel transfer line were full of fuel, but the right engine carburettor and fuel lines were empty, while there was only a very small quantity of fuel in the regulator. There was no reason why the right engine fuel supply should have been taken from the right auxiliary tank when the right main tank contained about 70 gallons.

From the testimony of the survivor, it appears that four crew members took turns at the controls in various seating arrangements during the flight from Telerboro. The only conclusion that can be reached for the fuel mis-management is that during the times the pilots were changing positions in the cockpit prior to arrival at St. Louis, the change-over from the auxiliary to the main tank was overlooked.

During the course of his evidence, the survivor also stated that shortly before the crash, the aircraft "trembled" twice in rapid succession, but there was no recognizable change in power, and the aircraft continued in level flight. A few seconds later, the aircraft again "trembled" and the right wing dropped. The crash followed immediately.

Conclusions

Because the right engine carburettor and related fuel lines contained little or no fuel, and as there was only about 10 gallons of fuel in the tank being used, the Civil Aeronautics Board, who investigated the accident and from whose report this summary is taken, concluded that during the final left turn the outlet of the fuel tank became unported, allowing air to enter the line and that, immediately following this turn, the engine suffered a critical loss of power due to fuel starvation.

It was further concluded that the loss of power, together with the reduced airspeed at the time, caused the right wing to drop and the aircraft to settle from an altitude too low to effect a recovery.

Probable Cause

The Board determined that the probable cause of the accident was mismanagement of fuel resulting in loss of power and control while circling the field preparatory to an approach for landing.

PART III

AUSTRALIAN ACCIDENTS

A Flat Spin — DH-82 — Near Liverpool, N.S.W.

At 0800 hours on the 31st August, 1952, a Tiger Moth failed to recover from an intentional spin which was entered at an altitude of approximately 3,200 feet and crashed 12 miles east of Liverpool, New South Wales. Both occupants of the aircraft were seriously injured, while the aircraft was substantially damaged.

The aircraft departed from Bankstown at about 0730 hours for an instrument flying practice flight for a private pilot who was in the rear cockpit under the blind flying hood. At an altitude of about 4,000 feet, the pilot-under-instruction carried out two or three spins to the left, the recovery in each case being normal. He was then requested to put the aircraft into another spin which was commenced at about 3,200 feet and was made to the right.

After approximately two turns, the pilot-under-instruction attempted to recover from the spin but his efforts were ineffective, and when he felt the instructor's hands on the controls, he handed over completely to him.

The instructor took-over at about 2,000 feet, and although the aircraft had entered the spin in a normal manner, it was by this stage in a "very flat spin." Immediately on taking over the instructor moved the control column fully forward, applied full left rudder, and opened and closed the throttle. However, this failed to arrest the spin and the instructor moved the controls to various positions in an endeavour to get them to take effect, but without result. Despite all efforts to recover, the aircraft continued in a "flat spin" and struck the ground still rotating to the right and in a relatively flat attitude.

It was considered that the cause of the accident was that the aircraft, on being intentionally spun, developed a flat spin from which neither pilot was able to recover.

An inspection of the wreckage at the scene of the accident did not reveal any abnormality in the airframe or the controls, while a subsequent examination at Bankstown did not indicate any pre-crash defects or malfunctioning that may have contributed to the crash. Due to the extensive damage, no check of the rigging was possible.

The unusual behaviour of the aircraft was discussed with the Professor of Aeronautical Engineering, Sydney University, as a result of which, it was suggested that DH-82 aircraft have doubtful spinning characteristics and can enter flat spins from which recoverey is always slow and difficult and frequently impossible. This implication is at variance with the usually accepted opinion that DH-82 aircraft have excellent spinning characteristics.

The original civilian DH-82 was modified for R.A.F. training by fitting aileron and rudder mass balances, slot locking gear, strengthened wings and undercarriage, night flying equipment, and by changes in aileron differential and improved protective treatment of the wing structure. The modified aircraft was designated the DH-82, Mark II. After this mark of DH-82 had been in service for some time, several instances occurred in England where dangerous spins developed during spinning practice.

As a result of these reports, the spinning characteristics of Tiger Moths were investigated by the Royal Aircraft Establishment at Farnborough, England, the most significant finding being that the aircraft were very sensitive to aileron setting during spins. Any application of opposite aileron would tend to flatten the spin, with the result that recovery would take longer than usual from a normal spin. It was established that the rolling moment of inertia of the original DH-82 had been increased in the Mark II by the

fitment of aileron mass balance weights, and that this was the main cause of the deterioration in the spinning characteristics. To counteract this it was recommended that the mass balances be removed, or preferably that anti-spinning strakes should be fitted along the rear of the fuselage. However, although some overseas users fitted anti-spinning strakes, all operators in this country elected to remove the aileron mass balance weights.

DH-82 aircraft have been used extensively as training aircraft for some 15 years during which time many thousands of spins have been carried out and, with the exception of the few instances referred to in the R.A.E. Report, and this case, there are no recorded reports of any previous incidents which suggested that the spinning characteristics of this aircraft are other than excellent. The subject of flat spins in DH-82 aircraft has been discussed with several highly qualified and experienced flying instructors. They do not recall any instances in this country that have raised any doubt about the spinning characteristics of DH-82 aircraft. It is their opinion that a correctly rigged and loaded DH-82 aircraft would not inadvertently develop a flat spin. Further it is contended that a particular technique would be required to get a normal DH-82 aircraft into a flat spin and it is the concensus of opinion that it would be almost impossible to maintain this type of spin. Therefore, from the available evidence it is considered most unlikely that standard DH-82 aircraft (without aileron mass balance weights) possess any dangerous spinning characteristics, although there is a possibility that under certain conditions such as faulty rigging or incorrect loading an abnormal spin could develop.

From the R.A.E. Report it appears that for a DH-82 aircraft to develop a flat spin it must have a relatively high rolling moment of inertia and that there must be some misuse of the ailerons. However, once a flat spin is entered the aircraft will tend to remain in this spin and recovery cannot be effected unless the ailerons are centralised. It is suggested that the tailplane is completely stalled in a flat spin, that the elevators are totally ineffective until the rotation is slowed down, and that, due to the direction of the airflow over the empennage, the horizontal stabiliser and elevator have a greater blanketing effect on the rudder that in a normal spin, particularly if the elevators are depressed. The effect of engine power on this type of spin is not known but if, as in this accident, the spin is to the right, engine torque and propeller slipstream may tend to keep the aircraft in the spin. That a flat spin has dangerous characteristics is evidenced by the fact that the recovery technique used on this occasion, although not strictly correct, would have been quite effective in a normal spin. Therefore although very little evidence is available it is considered that a flat spin in a DH-82 is potentially dangerous as recovery is slow and requires a particular technique.

Some two months prior to the accident, the aircraft sustained damage to the undercarriage, starboard wing and engine mountings. Subsequently, the instructor involved in the subject accident reported that he was unable to get the tail down when landing. An examination of the control system was carried out but this was found to be satisfactory and no adjustments were made. No check was made on the rigging at this time. Both before and after this inspection, the aircraft had been flown by another instructor on instructional flights which included spinning but nothing abnormal was noticed about the handling characteristics of the aircraft. However, in view of the nature of the accident, it is possible that some defect was present in the rigging at the time.

The instructor did not know that full rudder in the opposite direction of rotation must be applied before the control column is moved forward when recovering from a spin. This technique is essential on aircraft with marginal spinning characteristics, but is not normally necessary on DH-82's unless in a flat spin. On this occasion, the instructor's technique in depressing the elevators at the same time as full opposite rudder rendered the rudder ineffective. Although the instructor's technique was not strictly correct, it would have been quite effective in recovering from a normal DH-82 spin. However, there is a distinct possibility that even the correct technique would have been ineffective in this particular case.

DH-82 Accident — Near Keglsugl, New Guinea

At approximately 0715 hours on the 21st April, 1953, a DH-82 crashed on a mountain spur at an altitude of 9,600 feet, two miles north of Keglsugl Airstrip, Central Highlands, New Guinea. At the time of the accident, the aircraft was on a private flight from Korigu in the Central Highlands to Madang. Neither of the occupants was injured.

The direct route to Madang through the Bundi Gap as closed by low cloud, and the aircraft was headed towards a slightly higher gap a few miles to the west. However, when near the entrance, the approach to which was made at 10,500 feet, the aircraft encountered a strong down draft and rapidly lost altitude despite the application of full power. An attempt was made to turn away from the gap, but was unsuccessful and the aircraft crashed on a spur protruding from the side of the valley.

The pressure altitude of 10,500 feet corrected for density altitude shows that the aircraft was operating at a density altitude of 12,500 to 13,000 feet. This is about the ceiling of a normal DH-82 when operating near its maximum all-up weight as was the case on this occasion. Thus, even a moderate downdraft could result in a loss of altitude. Similarly, in view of the deterioration of handling qualities at this altitude, only gentle manoeuvres whilst maintaining, or attempting to maintain altitude, could be successfully executed. Therefore, it is extremely doubtful if the aircraft could have been manoeuvred away from this spur.

It was therefore concluded that the accident was due to the aircraft suddenly and unexpectedly encountering, in the vicinity of rugged mountainous terrain, a strong downdraft which forced the aircraft into a position where it could not be manoeuvred clear of the terrain.

A contributory cause was the operation of the aircraft near its ceiling in relatively close proximity to high rugged mountainous terrain.

Missed Approach Accident, DH-84 — Chimbu, New Guinea

On the 23rd September, 1952, a DH-84, while engaged on a charter flight from Madang to Chimbu, New Guinea, stalled and crashed on the side of a hill 300 yards north-west of Chimbu airstrip when the pilot attempted to carry out a missed approach. The pilot, who was the sole occupant, was seriously injured.

The Flight Path

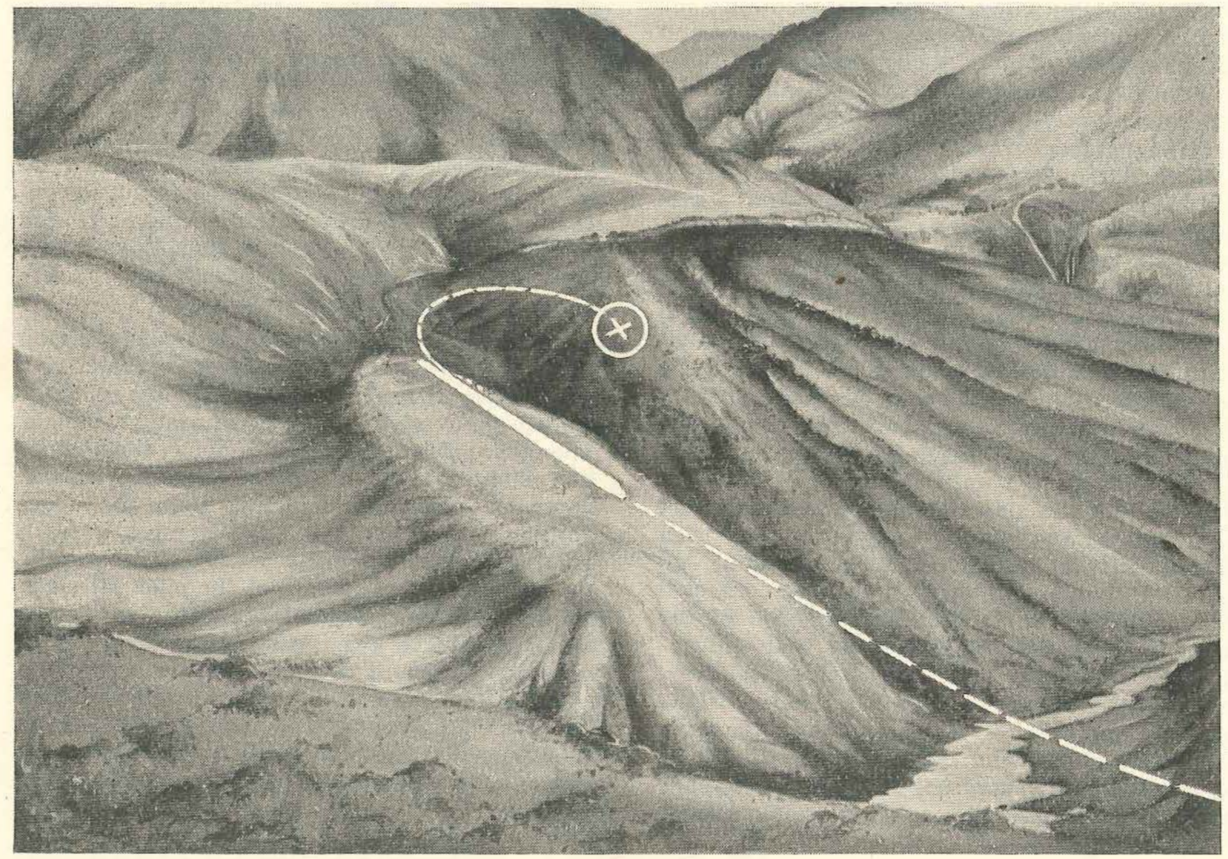
After an uneventful trip from Madang the aircraft arrived over Chimbu airstrip at approximately 1540 hours and an approach to land into the north was commenced. According to the pilot the approach was normal up to the threshold of the airstrip where a severe up-draft lifted the aircraft to a height of some 50-70 feet above the airstrip, whereupon he immediately commenced missed approach procedure.

The aircraft was observed to fly along and just above the airstrip until approximately 150 feet from the northern end of the airstrip when a turn to the right was commenced. Immediately after leaving the airstrip, the pilot commenced a steep 180° turn to the right in an effort to avoid rising high ground. This turn was almost completed when the aircraft stalled and crashed on to the side of a hill approximately 600 feet north-east of the northern end of the strip. After the initial impact the aircraft slid down the side of the hill for about 20 feet before coming to rest.

Chimbu Airstrip, Wahgi Valley

Chimbu airstrip, which is 1,730 feet long, 215 feet wide with a grassed surface, lies in a north-south direction with a down slope of 1 in 25 from the north to the south. The geographical altitude is 4,900 feet, and for aircraft operational purposes, the New Guinea density altitude factor of 2,800 feet is added, giving a density altitude of 7,700 feet.

On the western side of the strip — which is situated on the crown of a hill — and extending around the northern end towards the eastern



An Artist's Impression of the Chimbu Airstrip, Wahgi Valley, New Guinea, showing Flight Path and Point of Impact of DH-84.

side, is a gully some 200 to 400 feet below the level of the airstrip, and 300 to 600 feet in width at the level of the strip. On the other side of this gully from the airstrip, the ground rises steeply to the mountain ranges, whilst on the eastern and southern sides of the airstrip, the ground falls away to the Chimbu River.

In view of the physical characteristics of this airstrip, landings can only be made into the north and take-offs into the south. Further, the NOTAM governing aircraft operations at Chimbu airstrip, in addition to certain weight and cross-wind limitations, prohibits all operations in downwind conditions.

Analysis

At the stage when the missed approach was commenced the airspeed was relatively low and the acceleration, in view of the poor performance of DH-84 aircraft at altitude, was undoubtedly slow. It is apparent from the evidence that as the aircraft neared the northern end of the airstrip very little, if any, altitude had been gained and the airspeed was still relatively low. At this point the pilot was forced to attempt a turn through 180° in an endeavour to avoid the high terrain around the northern end of the airstrip. It is evident that this turn, which the pilot was forced to steepen progressively because of the close proximity of the high terrain was entered at a relatively low speed and resulted in the aircraft stalling.

The meteorological situation over the New Guinea Central Highlands at the time of the accident reveals that the wind in the vicinity of Chimbu airstrip was not being influenced by any air mass movement but was dependent solely on local effects. Surrounding the Wahgi Valley are steep high mountain ranges which give rise to diurnal anabatic winds. Because of the nature of the terrain in the immediate vicinity of Chimbu airstrip this wind is variable and gusty. It usually commences about 10 a.m., reaches its maximum about mid-afternoon and dies away by evening. The wind strength is generally light to moderate, and providing it does not present a tailwind component, landings can be safely effected throughout the day. The pilot alleges that he checked the wind velocity prior to landing and considered it was such that a safe landing could be effected. However, the European residents of Chimbu estimate that the wind velocity at the time of the accident was generally from the south-south-east at 10 m.p.h. Such a wind would give rise to a tailwind component during the landing and also would cause up-drafts at the approach or southern end of the airstrip. Although the aircraft undoubtedly encountered some up-draft as it reached the southern end of the airstrip, it is unlikely that if was of such severity that the aircraft was lifted some 50 feet as alleged by the pilot. In any case it has been calculated that a safe landing, assuming nil tailwind component, could have been effected from a height of 50 feet over the end of the airstrip. Therefore, it is unlikely that the up-draft encountered at the approach or southern end of the airstrip was the sole reason for the missed approach. The ground observers estimation of the wind velocity at the time of the accident suggests that the approach was made with a tailwind component and calculations show that even with a relatively light tailwind component it is extremely doubtful if a DH-84 aircraft could be landed and brought to rest on Chimbu airstrip (hence the Notam on Chimbu airstrip prohibiting operations under tailwind conditions). It is considered, in view of the available evidence, that the aircraft approached to land with a tailwind component and encountered an up-draft at the approach end of the strip with the result that the aircraft was placed in such a position that a safe landing could not be effected.

It is apparent from the nature of Chimbu airstrip, that a successful missed approach in a DH-84 aircraft from a position near the southern end of the airstrip would be almost impossible. The concensus of opinion among experienced New Guinea pilots is that a successful missed approach could not be made from the above position and under the circumstances a crash landing would have to be made on the airstrip. In this regard it appears that the pilot, although he had carried out some fifty landings on Chimbu airstrip had not given the matter of a missed approach sufficient consideration. Although no criticism is made of the pilot's technique during the missed approach it is considered that he should not have attempted such a procedure but should have attemtped to stop the aircraft on the airstrip.

DC-4 Taxying Accident — Sydney

AFTER normal starting procedure had been carried out, the captain of a DC-4, believing that the "all clear" signal had been given by the despatch engineer, released the brakes and started to taxy. However, almost immediately, the propeller of No. 2 engine hit the Auxiliary Power Unit (A.P.U.) the fuel tank of which exploded. The resultant fire was extinguished by tarmac personnel and the Aerodrome Fire Unit.

An investigation of the events preceding the accident showed that after the four engines had been started, the despatch engineer moved from his position in front of the aircraft to tow the A.P.U. clear. He was just starting the tug when the aircraft moved forward and No. 2 propeller struck the A.P.U.

A freight porter saw the aircraft move while the despatch engineer was attempting to start the tug and made frantic signals to the captain. Although the captain did not fully understand these signals, he gathered that something was amiss and applied the brakes, but too late.

In his evidence, the captain stated that when he saw the despatch engineer walk away, he thought the "thumbs up" signal had been given and that he was clear to proceed. However, all tarmac personnel were definite that the "all clear" signal had not been given.

The cause of the accident was an error on the part of the pilot in that he commenced taxying before he had been cleared by the despatch engineer.

Points of possible significance arising out of the accident are —

(i) Prior to the accident, the captain's attention had been diverted to the operation of the engines. Under these circumstances, it would have been wise to double-check for the "all clear" signal.

(ii) The flight was half an hour late and the captain was in a hurry to depart. A clear case of more hurry less speed.

(iii) The captain had only been in-command of DC-4 aircraft for a short time, and in his hurry, may have possibly overlooked the fact that the location of the A.P.U. in front of the propellers during DC-4 starting is different from the smaller DC-3 unit placed aft of the propellers.

(iv) The captain in his period as DC-4 captain had not previously seen the despatch engineer leave his position prior to giving the "all clear" signal. Any final removal of obstructing objects, e.g., tow unit and A.P.U., was normally done by another man. The circumstances of this accident could well be brought to the attention of personnel who may at one time or another be employed as despatch engineers.

Anson Forced Landing Accident — Embessa, New Guinea

AN Anson aircraft departed from Port Moresby at 0656 hours on the 4th February, 1953, on a charter flight to Poppendetta and return. On the return trip, which was begun at 0850 hours on the same day, the pilot flew into clouds over the Owen Stanley Ranges and became lost. When almost out of fuel, a forced landing was made near Embessa. The aircraft was seriously damaged, but none of the eleven passengers or the pilot was injured.

Events Preceding the Flight

The purpose of the flight was to take passengers and freight to Poppendetta and return with a similar load. Although it had no bearing on the accident, subsequent investigations revealed that the aircraft was overloaded by 946 pounds on departure from Port Moresby and by 335 pounds for the return flight. Also, prior to departure from Port Moresby, the load C. of G. was not checked, nor was the load properly secured.

A captain from another company had been engaged for the flight with the pilot who was actually involved in the accident as second officer. However, certain unsatisfactory aspects caused his to withdraw. The first officer, without reference to the operator, then decided to take the aircraft on what would be his first flight in-command of charter aircraft. He had about 140 hours flying in New Guinea and 33 in Ansons, mostly as co-pilot. He could, therefore, be considered as inexperienced both with the type of aircraft and with flying conditions in New Guinea. In addition he had not been to Poppendetta before, and was therefore not qualified for the route as required by Part 28 of Air Navigation Orders.

The Flight

The take-off and climb from Port Moresby was watched with some concern as the behaviour of the aircraft indicated a heavy load and an aft C. of G. The climb took longer than usual and it took 59 minutes to reach Poppendetta.

The take-off from Poppendetta was made up a slight slope in fine weather and no-wind conditions contrary to a NOTAM which specified take-off down the slope under such conditions. When half-way back to Port Moresby, and over the Owen Stanleys, the pilot flew into cloud. His navigation failed and he became lost. Aeradio was informed of the predicament, but the pilot could not give an accurate position, and it subsequently transpired that there were no maps on board.

He was then advised to return to Kokoda which was on the way back to Poppendetta and in an area where the weather was known to be good. During the next three-quarters of an hour, the aircraft was flown on various courses in a general north-easterly direction, in and out of clouds, and from one valley to another. The pilot finally reached the northern side of the mountains, but was unable to position himself. However, from the terrain description given to Aeradio, the aircraft was placed somewhere in the Embessa area.

After sighting the northern coast in the distance, the fuel was so low that the pilot attempted a forced landing on a kunai grass flat near the Embessa village. The approach was made under power with the undercarriage down. The aircraft settled in the tall grass, and soon after the undercarriage touched the rough ground, it collapsed, causing damage to the mainplane and fuselage.

Cause

The forced-landing was necessitated by a shortage of fuel which resulted from the pilot becoming lost due to poor navigational technique, and his failure to comply with the requirements for V.F.R. flight as specified in Air Navigation Regulation 153.

Violations

In addition to the violations of the Air Navigation Regulations and Orders already mentioned, the investigation revealed that the pilot also contravened the following Regulations:—

Air Navigation Regulation 155 — he committed the aircraft to I.F.R. flight without being the holder of the necessary instrument rating.

Air Navigation Regulation 158 (1) — he filed a flight plan which did not show the correct amount of fuel on board.

Air Navigation Regulation 220A — he permitted a passenger to occupy a dual control fitted seat in the pilot compartment.

Air Navigation Regulation 225 — he failed to —

(a) carry the necessary maps for the flight.

(b) ensure that the aircraft was not overloaded.

(c) adequately secure the load.

Resultant Action

The Pilot

His Commercial Pilot Licence was suspended for eight weeks during the investigation of the accident, during which time it came up for renewal. Renewal was then refused for a period of six months from the date of the accident.

The Operator

His Commercial Pilot Licence was suspended for a total of ten weeks during the investigation.

His Aircraft Maintenance Engineer Licence was suspended for a period of six months from the date of the accident.

Auster Take-Off Accident — Ardrossan, South Australia

DURING the afternoon of 3rd July, 1953, an Auster J1/B crashed and burnt after striking high tension wires when taking-off from a paddock two miles south of Ardrossan, South Australia. The passenger, who received fatal injuries, was incinerated, while the pilot received minor injuries and severe burns.

The Take-Off Area

The paddock which was being used is situated on the coast, lies in an east-west direction and is 2,190 feet in length and 270 feet wide, with roads on the western and southern sides. The surface was stubble and very hard. High tension wires on poles 42 feet in height run along a road at the western end. Air Navigation Orders, Section 91.3, which sets out the physical requirements for authorized landing areas, stipulates that for Auster aircraft the landing area shall consist of at least one run and the approach angle to each end shall be at least 1 in 30 and the minimum length of run, at sea level, shall be 1,500 feet. When this approach angle is applied over the high tension wire poles the available length of run becomes approximately 1,000 feet which is far below the above minimum requirements. Furthermore, this paddock has an up-slope of 1 in 15 from the eastern end for a distance of approximately 500 feet and then 1 in 22 for the remainder of the length. This gradient is more than twice the maximum allowable longitudinal grade specified by the above Order for authorized landing areas.

The Take-Off

The pilot elected to take-off uphill into the west-north-west because of a relatively strong and gusty wind of 20-25 knots from that direction. The first 500 feet of the paddock was not used, undoubtedly because the 1 in 15 slope would have made manoeuvring in this area very difficult. The take-off was commenced some 1,590 feet from the high tension wires. One-third flap was used, and the initial climb was made at about 60 m.p.h. to a height considered to be above the high tension wires. The pilot then raised the flaps and selected climbing power.

The pilot states that it was "very bumpy" during the initial climb and a few seconds after climbing power had been selected the aircraft suddenly lost height to below the wires. Full power was immediately re-applied and flaps were lowered, but the aircraft failed to respond sufficiently to clear the wires.

The aircraft struck the wires and fell onto the road, bursting into flames.

The Take-Off Technique

Calculations show that with one-third flap, full power, correct take-off technique and under the load and wind conditions existing at the time, the aircraft should have become airborne and reached the height of the obstructing wires after travelling about 1,000 feet. The pilot's description of the take-off, up to the time of raising the flaps, indicated that is was consistent with these calculations.

From this and other evidence, it would appear that the take-off was normal and that the aircraft reached a height above the wires when a short distance from them. However, there is a distinct possibility, in view of the subsequent loss of height, that the aircraft was at minimum climbing speed at this time.

Therefore, while it is usual procedure to raise the flaps and select climbing power shortly after becoming airborne, in this instance because of the relatively low airspeed and under the existing wind conditions with moderate turbulence, the pilot's action in raising the flaps and reducing power before crossing the wires was premature and was the cause of the accident.

Although the pilot applied full power and lowered some flap immediately he realized the aircraft was sinking towards the wires, it is apparent that there was insufficient time for these actions to take effect before the aircraft struck the wires.

The Cause

It is considered that the accident was due to an error of judgment on the part of the pilot in raising take-off flap and selecting climbing power under turbulent wind conditions and whilst in close proximity to high tension wires.

Violations

The take-off was attempted from a paddock which did not comply with the physical requirements for authorized landing areas for Auster aircraft as specified by Air Navigation Orders, Section 91.3, and indicates an apparent disregard by the pilot of Air Navigation Regulation 89.

Auster Fires

Ten of the thirteen Auster types operating in this country have the main fuel tanks positioned immediately behind the engine. During the past two years Auster aircraft with fuel tanks so positioned have been involved in five serious accidents involving impact with the ground, and and in four of these accidents fire has occurred following the crash. In the same period, Auster aircraft with the fuel tank in the mainplane have been involved in three serious accidents, but in no case did fire occur.

It is considered that the positioning of the main fuel tank in close proximity to the engine is conducive to fire occurring after the crash and seriously reduces the possibility of crash survival, particularly if only lap strap safety belts are worn with the consequent possibility of the front seat occupants striking their heads against the instrument panel and being rendered unconscious.

Two alternatives present themselves, one is to move all engine mounted fuel tanks to another position, for example, the mainplane, while the other is to use a safety harness which will prevent an occupant being thrown violently forward on impact, thus rendering him unconscious and incapable of extricating himself from the aircraft.

The question of fuel tank location in Auster aircraft is at present under discussion in this Department, and all Auster operators will be advised of any decisions on this matter.

With regard to safety harness, recent publicity has been given to the desirability of the fitment of full harness in light aircraft. This accident supports the recommendation made by the Department that all light aircraft owners should fit full harness to their aircraft.

Landing Accident, DC-3 — Madang, New Guinea

On the morning of the 10th February, 1953, a DC-3 aircraft, VH-MAE, was landing on the Madang single-strip aerodrome, when its landing path was obstructed by another DC-3, VH-EAQ, which taxied onto the airstrip in front of it. In order to avoid a collision the captain of VH-MAE braked fiercely and attempted to turn into a taxiway, but the aircraft skidded on the wet grass at the side of the airstrip and slid into a drainage ditch.

The starboard undercarriage of VH-MAE was broken and the nacelle and starboard outer wing flaps were damaged. VH-EAQ was not damaged. None of the occupants of either aircraft was injured.

Events Preceding the Accident

On the day of the accident, the weather at Madang was fine and the airstrip serviceable, excepting that a NOTAM was in force warning of slippery areas at the sides of the runway.

VH-MAE, which was landing into the west, had been correctly cleared to land and was on a low approach from over the sea. At the same time VH-EAQ had started its engines and was taxying out preparatory to taking-off into the west. As VH-MAE touched down, VH-EAQ entered the airstrip and began taxying slowly towards the eastern end, obstructing the relatively narrow dry centre part of the strip. At this stage, VH-MAE was committed too far with the landing to enable a "missed approach" procedure to be adopted.

By the time the separating distance was reduced to the point where VH-MAE had to take avoiding action, VH-EAQ had received an urgent R/T warning to "pull to the left." It did so, but too late for VH-MAE to change its tactics. The captain of VH-MAE applied severe braking and tried to turn into the nearest tarmac entrance. The wheels did not hold on the wet surface as the turn was being made at too high a speed. The collision was avoided, but the ensuing skid carried VH-MAE into a drainage ditch at the left side of the airstrip.

Discussion of the Evidence

The accompanying diagram shows the relative positions of the aircraft from the time VH-EAQ taxied until VH-MAE finished its landing run in the ditch.

VH-EAQ commenced to taxy from the tarmac to the airstrip entrance before obtaining taxying instructions. However, as the aircraft neared the airstrip entrance a taxy clearance was requested and obtained. The evidence as to whether this clearance was to the airstrip entrance or eastern end of the airstrip is conflicting, although all the witnesses agree that the phraseology was consistent with a clearance to the airstrip entrance only. However, when issuing the clearance the airport controller omitted to advise VH-EAQ that VH-MAE was about to land. It is considered that had this information been passed to VH-EAQ there would have been no misunderstanding of the terms of the clearance and the accident would have been avoided.

The lack of prior warning to VH-EAQ in time to prevent the accident was due to the first officer of VH-EAQ carrying out a lengthy R/T transmission to the Control Tower whilst EAQ was taxying, thus preventing the airport controller from transmitting to the aircraft. This long transmission was a radio test and should have been carried out prior to commencing taxying. Aldis lamp warnings were tried without success, as VH-EAQ was heading almost directly away from the Tower. When the airport controller eventually contacted VH-EAQ, is was well onto the airstrip and obstructing VH-MAE.

It is apparent that the crew of VH-EAQ did not take the normal precautions, prior to entering the airstrip, of carrying out a visual check of the airstrip and circuit area. Had they done so there is no doubt that VH-MAE, which was about to touchdown at this stage, would have been sighted. Therefore, despite the misunderstandings and discrepancies discussed above, the pilot-in-command of VH-EAQ failed to take adequate precautions in moving onto the airstrip and must be held primarily responsible for this accident.

Cause

The accident was caused by the negligence of the captain of VH-EAQ in entering the airstrip without observing other aerodrome traffic, for the purposes of avoiding collosions, as required by Air Navigation Regulation 143.

Contributory causes were:—

(a) A misunderstanding by the pilot-in-command of VH-EAQ of the airport controller's taxying instructions in which VH-EAQ was required to hold before entering the runway.

(b) The inability of the airport controller to contact VH-EAQ by radio as it was entering the runway, owing to the unnecessarily prolonged transmission by VH-EAQ of a report on the reception of taxying instructions from the control tower.

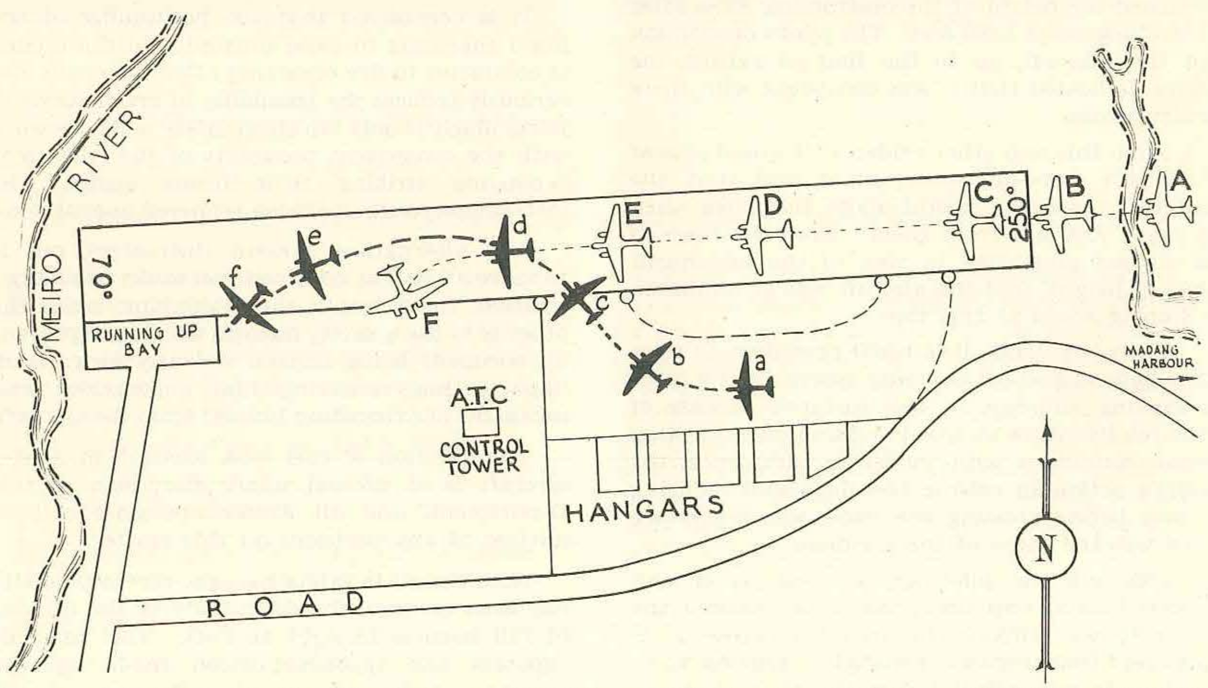


Diagram of Accident at Madang, New Guinea on 10th February, 1953, involving DC-3 Aircraft VH-MAE and VH-EAQ. (Aa, Bb, etc., indicate relative positions of both aircraft during successive intervals of time.).

Stall Accident, B.A. Swallow — Near Tamworth, N.S.W.

A B.A. Swallow aircraft sustained substantial damage when it crashed about 2 miles north of Tamworth Aerodrome, N.S.W., at about 1640 hours on the 21st June, 1953. Neither the pilot nor his passenger was injured.

The Operation of the Aircraft

The take-off and climb from Tamworth were normal and the aircraft levelled out at about 800 feet. Shortly after levelling out, the aircraft passed over a small settlement $2\frac{1}{2}$ miles north of Tamworth and the passenger pointed out his home to the pilot. The pilot was unable to pick out the particular house, so turned and flew back over the settlement at a height of about 300 feet.

The aircraft was observed to fly over the settlement at a very low altitude and make several turns at a height between 40 and 150 feet around the residence of the passenger. The aircraft then climbed to about 400 feet and began a turn to the right. While in this turn, and with right wing down, the aircraft began to "sink." The pilot immediately applied full power and moved the control stick to the left and back in attempt to effect recovery. However, the aircraft continued to lose height rapidly and after passing through some telephone wires, crashed in a field.

The Aircraft

The B.A. Swallow is a low winged two place tandem seat, single-engined light aircraft having excellent handling and aerodynamic characteristics. The makers claim that the aircraft is non-spinnable, while an evaluation by an independent authority indicates that short of suicide tactics near the ground, it is practically impossible to get into trouble. In addition, it appears that the aircraft "sinks" when stalled, rather than falling away in the conventional manner.

Pilot Technique

It is apparent, in view of the excellent aerodynamic characteristics of the aircraft, that the pilot's technique in the execution of a medium climbing turn was extremely poor. Certainly, his action in using full back stick and opposite aileron in an attempt to recover from stall shows incorrect technique and a lack of knowledge of the theory of flight, and resulted in the aircraft remaining in the stalled condition. An altitude of 300 feet should have been ample to enable recovery to be effected in an aircraft with such gentle stalling characteristics.

Early in the investigation it became apparent that the pilot's flying ability and aeronautical knowledge was lacking and his licence was therefore suspended under Air Navigation Regulation 264, pending a practical flying test and a theoretical examination. About one month after the accident the pilot was found to be incompetent on both these aspects and his Private Pilot Licence was cancelled for a period of 3 months as from the 1st August, 1953.

Cause

The cause of the accident was the pilot's failure to employ correct technique when attempting to recover from an inadvertent stall which resulted from a lack of care in the execution of a turn at a low altitude.

Violations

Air Navigation Regulation 38.

The aircraft was not operated under a valid Certificate of Safety, this having expired some 2 months prior to the accident. A Certificate of Safety for private operation is valid for 120 hours or six months, whichever time expires first.

Air Navigation Regulation 124 (1).

The pilot flew the aircraft in a reckless manner likely to endanger the life or the property of others.

Air Navigation Regulation 133 (2).

By engaging in unauthorized flight below 500 feet, the pilot failed to observe the requirements of this Regulation.

Air Navigation Regulation 275.

The pilot dismantled parts of the wreckage before the wreckage was released by the Department.

Prosecution

Summary proceedings were taken against the pilot for breaches of Air Navigation Regulations 38, 124 (1) and 133 (2) (b). These proceedings resulted in the pilot being fined £70 plus costs for offences against Regulations 124 and 133.

Auster Take-Off Accident — Taree, N.S.W.

At about 0600 hours on the 16th January, 1953, an Auster J1/B crashed and burnt shortly after take-off from Taree Racecourse, N.S.W. The three occupants received minor injuries and the aircraft was totally destroyed by impact and fire.

On the previous afternoon, the aircraft was enroute from Evan's Head to Bankstown when bad weather in the vicinity of the Myall Lakes forced the aircraft to turn back. The pilot flew the aircraft over Forster and Nabiac aerodromes, but was unable to land because of squally weather conditions. The aircraft was then flown to Taree where a successful landing was made on the racecourse.

The following morning the weather was fine with no wind and after inspecting the field, the pilot decided to take-off using the longest available run. One quarter flap was selected for take-off and full power was applied before the brakes were released. According to the pilot the aircraft became airborne at about 45 m.p.h. and a climb was commenced. As the aircraft crossed the fence, the underneath side of the empennage struck the top rail, There was no great deviation from the flight path and the aircraft continued to climb. However, at a height of about 50 feet the aircraft fell away to the right. The pilot was unable to effect a recovery and the aircraft finally crashed about 250 yards from the fence. There was no evidence of any malfunctioning or pre-crash defects which may have contributed to the failure of the aircraft to clear the fence, while it appears that the loss of control was not the result of a normal Auster J1/B stall, but was rather the result of damage sustained by the aircraft on impact with the fence.

The distance between the fences at either end of the selected take-off run was 858 feet, which is just over half the minimum length of run specified in Air Navigation Orders Section 91.3 for the operation of Auster aircraft. An inspection of the field showed that the tailwheel did not leave the ground till the aircraft was about 44 feet from the fence. This suggests that the distance the aircraft took to become airborne was greater than the distance of about 600 feet estimated by the pilot, and it is possible that the aircraft was placed in a climbing attitude immediately the pilot felt that it was about to become airborne and before adequate take-off speed had been reached, so lengthening the take-off run.

It was calculated that the aircraft could, under the load and wind conditions existing at the time, and by using the correct take-off technique, become airborne in about 650 feet, and could have cleared the fence by a few feet. However, the theoretical clearance over the fence revealed by these calculations is too marginal to be certain that a successful take-off could have been effected.

Cause

It was considered that the cause of the accident was an error of judgment on the part of the pilot in attempting to take-off from a field when the available length was inadequate.

Violations

In attempting to take-off from a field that did not meet the requirements for authorized landing grounds for Auster aircraft as specified by Air Navigation Orders, Section 91.3, the pilot apparently disregarded Air Navigation Regulation 89.

The length of the available run was so short that the pilot flew the aircraft in circumstances likely to cause avoidable danger to the passengers and aircraft in apparent contravention of Air Navigation Regualtion 124 (2).

Court action taken against the pilot for contravening these Regulations resulted in him being fined £15 with costs on each account.

Auster Take-Off Accident — Kalumburra Mission, W.A.

During an attempted take-off from Kalumburra Mission Aerodrome at about 0515 hours on the 10th June, 1953, an Auster Autocar collided with a truck parked on the side of the airstrip. The two passengers and the pilot of the aircraft escaped injury, but a native who was standing on the back of the truck was killed. A European seated in the truck was seriously injured, but the other occupant was uninjured.

Kalumburra Mission Aerodrome consists of two strips 4,752 feet and 4,136 feet long located on bearings 285°/105° and 048°/228° respectively intersecting at about the midpoints. The width of the strip, as indicated by drum type markers, was approximately 250 feet.

Events Preceding the Accident

After the arrival of the passengers at about 0500 hours, the pilot requested that the truck be placed on the south side of the 285° strip and near the intersection in order to mark a rough patch. The truck was parked 100 feet from the centreline of the strip, some 19 feet inside the strip markers, and facing about 45° to the aircraft. The one serviceable headlight was on.

The aircraft which had been parked at the end of the 285° strip, commenced to take-off on that strip at 0515 hours, some 19 minutes before official daylight. The weather was fine with no wind, and according to the witnesses the ground visibility was slightly in excess of 3 miles.

The pilot states that shortly after full power had been applied, and as the aircraft approached flying speed, the windscreen fogged on the inside. Before he had time to open the side panels, or clean the windscreen, the aircraft became airborne and he elected to continue to take-off. However, almost immediately the headlight of the truck became visible directly in front of the aircraft. Attempts to climb over the truck were unsuccessful and the prepeller and starboard undercarriage leg struck the truck. The aircraft was thrown out of control and crashed straight ahead on the strip.

Fogging of the Windscreen

The morning of the 10th June, 1953, was comparatively cool with a high relative humidity. The Autocar has an almost draft-proof cabin, with ventilation being obtained by the use of side panels. The pilot closed the side panels shortly before take off, and the warmth and moisture introduced in the cabin by the occupants increased the temperature and moisture content of the cabin. As the take-off was commenced, the slipstream would cause rapid cooling of the windscreen and a corresponding decrease in the temperature of the air inside the cabin and adjacent to the windscreen. Under such conditions the relative humidity of the air adjacent to the windscreen could rapidly increase and condensation would take place on the windscreen.

Windscreen

An examination of an Auster Autocar which had flown about half the number of hours as that involved in the accident showed that the windscreen was covered with a maze of tiny scratches. This scoring reduced the light intensity in the cockpit, under dull conditions, by about 50%. If condensation occurred on such a scratched windscreen the total effect on the pilot's vision would be very considerable. The importance of adequate ventilation of the cockpit, by opening windows, during take-off with low outside air temperatures is clearly apparent. Furthermore, it is important to replace extensively scratched windscreens. Therefore, it is considered that the visibility through the windscreen of the aircraft in the accident would probably have been such that the truck, except for the headlight, would be hardly visible against a background of bushes.

Cause

The cause of the accident was the pilot's loss of visual reference to the ground when taking-off under conditions of poor cockpit visibility, with the result that the aircraft deviated from the intended take-off path.

A contributory cause was the presence of a motor truck on the side of and half-way along the strip.

Violations

By taking-off with the truck parked in close proximity to the intended take-off path where it could become a potential hazard in the event of any foreseeable emergency condition arising during the take-off, the pilot operated the aircraft in a manner likely to cause avoidable damage to persons and property, contrary to Air Navigation Regulation 124.

By taking-off on a VFR flight some 19 minutes before the commencement of official day as defined by this Department, the pilot apparently disregarded Air Navigation Regulation 154.

PART IV

INCIDENT REPORTS

DC-4 Feathering Difficulties

DURING recent months, several cases of difficulty in feathering propellers on DC-4 aircraft have been reported. A brief summary of three cases is given below:—

Case 1: Soon after a descent was commenced into Canberra, No. 1 Zone, No. 2 engine, fire warning light came on. No. 2 propeller was feathered and the firewall shut off valve pulled. An inspection did not show any sign of fire. A little later, a slow thumping indicated that No. 2 propeller was again turning. The feathering button was again pressed, but when it came out, the propeller seemed to be turning faster. The wing inspection light was turned on to enable a closer check to be made, but before any further action could be taken, the propeller had gone into full fine and was rotating at 3,300 r.p.m. The feathering button was held in and the blades turned to the feathered position. On the ground, No. 2 engine was found to have seized.

Case 2: The oil level in No. 2 nacelle tank was noticed to be falling fairly quickly and, on inspection, the engine was found to be losing oil from the vicinity of No. 7 cylinder. The motor was then closed down. However, the engine could not be completely stopped with the feathering button.

Case 3: When Zones 2 and 3, No. 4 engine, fire warning lights came on, the captain immediately closed down the engine, feathered the propeller and then pulled the firewall shut-off valve. The captain was about to fire No. 1 extinguisher, when the firewarning lights went out, so the extinguisher was not used. During the return to the departure aerodrome, a constant watch had to be kept on No. 4 engine, as the propeller would start to turn and the feather button would have to be re-engaged every few minutes.

The investigation of each case of feathering difficulty showed that the trouble was caused by the blade packing seals gripping the blade shank and bunching as the blades turned to the feather angle.

After the blades reach the feathered position, the pressure cut-out switches open the circuit to the feathering pump, causing a drop in oil pressure. The bunched seal then springs the blades back off the feather stop and the propeller begins to windmill. If the firewall shut off valve has already been closed, oil to the governor is cut off and the windmilling propeller scavenges oil from the propeller dome. There is then every possibility that, due to centrifugal force, the propeller blades will turn quickly to full fine pitch and the propeller speed build up to a high r.p.m. with the associated danger of engine seizure.

Considerable work and experimentation was carried out with various types of rubber and rubber hardnesses in an effort to overcome this difficulty, but a solution was not found. Finally, a set of seals was modified by grinding a 25° chamfer on both sides of the inside and outside diameters of the seal. This resulted in the bearing area between the seal and the blade shank being reduced to 7/32 inch and was effective in eliminating the bunching of the seals.

A period of testing showed that the incorporation of the modification to the seals would eliminate feathering difficulties due to this cause, and an Air Navigation Order was issued making the modification mandatory for all DC-4 aircraft.

Spar Boom Corrosion — De Havilland Dove (DH-104)

During routine inspection, corrosion of the intercrystalline type was found in the main spar booms in the region of ribs 4, 5 and 6 in two DH-104's. Both aircraft were temporarily grounded.

Aircraft A

The corrosion on this aircraft had advanced considerably in a very short time. It was found in the upper boom of the starboard wing and the upper and lower booms of the port wing. The corrosion on the starboard wing consisted of a general attack along the whole area, the major trouble occurring along the bottom of the top flange and rivets attaching the web to the boom. The latter was in isolated patches of some depth, whereas the former was of a general nature of not great visible depth. On the port wing, general corrosion of the top boom had occurred on the bottom edge and on the bottom boom several patches had occurred around rivet holes.

The corrosion in all cases was, from visual inspection, of the intercrystalline type in various stages of progress. The exact amount of progress could not be established, the worst patches being those on the upper starboard boom and the lower port boom. The aircraft was withdrawn from service and flown to Sydney for overhaul.

Aircraft B

The corrosion of this aircraft was in the preliminary stages only on the bottom edge of the starboard upper boom. It had only affected the corner for a distance of about one inch. No further corrosion existed in the areas inspected.

The corrosion was removed and the affected area treated. The whole accessible area aft of the engine nacelles on both wings was covered with clear lacquer, and the affected area is to be inspected monthly until the next C. of A. overhaul.

Intercrystalline Corrosion in Light Alloys

Intercrystalline corrosion differs from general or pitting type corrosion in its mode of attack on the structure of the metal. The attack occurs only in areas surrounding the edges of the grains, and the final result is a complete loss of cohesion throughout the metal. It is consequently far more dangerous than general corrosion, in which the reduction in strength is proportional to the amount of metal removed. Corrosion at the grain boundaries destroys only a small percentage of the total volume of the affected metal, consequently it is very difficult to detect in the early stages of its development.

The corrosion penetrates through the metal as fine channels which sometimes inter-connect below the surface, and it may travel a considerable distance from the starting point without reappearing at the surface. Consequently, it is not always possible to determine its full extent by visual surface inspection. Fortunately, in extrusions the corrosion tends to spread more rapidly in planes parallel with the extruded surface than in the transverse direction; this effect is due no doubt to the elongation of the grain boundaries during extrusion. As a result of this horizontal distribution at a number of different levels below the surface, the corrosion frequently gives rise to flaking or rippling at the surface.

On end sections a number of well-defined layers can frequently be observed. The layers can sometimes be separated by means of a pocket knife or similar implement. The development of flaking or rippling on a rolled or extruded surface is a clear indication that intercrystalline corrosion is taking place, and a complete investigation should always be made to determine its full extent. In the very early stages the corrosion is most readily identified by the presence of numerous small elongated blisters on the face of the extrusion. The blisters can be extremely small — often they are about pinhead size — and when broken a small amount of corrosion product can usually be detected at the base of the remaining cavity.

DC-3 Battery Fire

While loading a DC-3 at Charters Towers, a person assisting the captain with the loading reported that the aircraft was on fire. An immediate inspection showed smoke belching from the radio compartment.

The aircraft CO2 extinguishers were used on the suspected seat of the fire, and the battery "No Smoking" sign, which was the only electrical equipment on, were switched off. The passengers were ordered off and away from the aircraft.

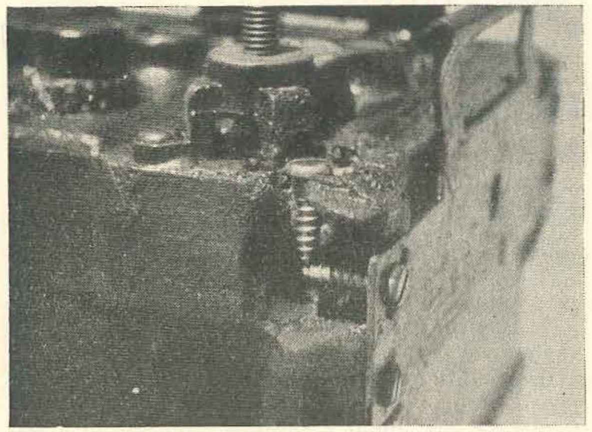


Fig. A:—Burnt Battery fitted with new handle and new ¾" screws to show origin of short circuit between terminal post and handle.

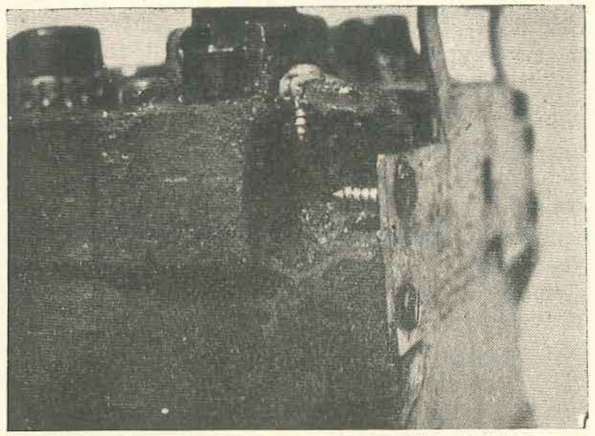


Fig. B:—Burnt Battery fitted with new handle and new ½" screws to show clearance existing with correct screws.

Further inspection resulted in the starboard battery being released and lowered, and it was found that the fire had originated at this point, being caused by the positive pole of the battery arcing across to the battery housing.

Fortunately, the fire commenced when the aircraft was on the ground and it was possible to lower the battery, but the fire could have easily occurred in flight when it would have been impossible to get at the battery. To use the captain's own words, "the starboard battery is most inaccessible from the inside of a DC-3."

A later examination showed that the earth fault actually occurred between the positive terminal post outer holding down screw and the adjacent upper handle securing screw. The screws in use were ¾" self-tapping screws. When these are in the above positions, their tips are so close together that any build up of corrosion products in the screw holes results in the possibility of the tips coming into contact thus providing a short circuit path to earth with the associated fire danger. The close proximity of the tips when ¾" screws are used is shown in Fig. A.

New batteries of the type in use at the time of the fire use ½" self-tapping screws for securing the terminal posts and the handles, and these provide adequate clearance, as shown in Fig. B, to ensure that there is no danger of a short to earth occurring through the handle.

However, in some old batteries and replated batteries, the ½" screws have been replaced by ¾" screws. Action was taken soon after the incident to ensure that all ¾" screws were removed, and it is now unlikely that battery fires will result from the causes set out here.

Some People Won't Be Told

An Auster aircraft was being used for joy flights from a paddock in the outback of Western Australia. Prior to starting the flights, the pilot had obtained the assistance of one of the locals to act as groundsman and he had been impressed that it was necessary to keep would-be customers to one side of, and well clear of, the aircraft.

One passenger was so thrilled with his first flight that on its completion he dashed off to town and returned with his two daughters whom he wished also to enjoy the thrill. In his enthusiasm, he came around the prohibited side of the aircraft and spoke to the pilot who asked him to return to the "safe" area, which he did. However, shortly after, his enthusiasm must have got the upper hand again and the next thing the pilot knew, his erstwhile passenger had been struck by the propeller which severely gashed his shoulder.

It is apparent from the available evidence that the person injured disregarded instructions to keep clear of the aircraft and is thus primarily responsible for his own injuries. At the same time, however, it is considered that insufficient precautions were taken to ensure that persons did not approach the aircraft, and therefore a portion of the responsibility must be accepted by the pilot.

At present, there are several operators engaged in joy flight operations and this incident should serve to emphasize the operator's responsibility in providing some effective means of controlling bystanders. Furthermore if casual local help is employed, the employee must be thoroughly briefed in his duties.

Aural Signals — Sydney 'Z' Marker

DURING July, 1953, the captain of a Convair aircraft reported on three separate occasions that aural signals from the Sydney 'Z' Marker were received at distances up to 30 miles from Sydney when operating on the Sydney-Melbourne route. The same aircraft was involved on each occasion.

Immediately these reports were received, the Marker Beacon was checked, but could not be faulted, while requests to other aircraft in the area indicated that marker reception was quite normal. In addition later tests and a careful watch on the marker beacon operation have failed to find anything which would cause these incidents.

Since only one aircraft was involved, the marker receiver installation was subject to careful checking on each occasion that the aural signals were received so far from Sydney, but nothing to which these incidents could be attributed was found.

Apart from the three occasions mentioned above, there have been no further reports of a similar nature.

The nett result is that we have a serious incident to which, at present at any rate, no answer has been found. The operation of the Sydney marker beacon is being kept under observation, and aircraft captains can help by immediately reporting by radio and later submitting detailed incident reports of their observations on any occasion where aural signals are received at abnormal distances from marker sites.

Essendon Localizer Procedures

AIRCRAFT on holding patterns on the Essendon Localizer during the last couple of months have been flying a racecourse pattern from the holding marker on a time beam of 2 minutes. Many captains may have wondered why the limit marker which once formed the outbound turning point on the holding path was removed. Here is the story.

In February of last year, a DC-3 arrived over Melbourne Airport at 5,000 feet and was cleared to descend to 4,000 feet on the Essendon Localizer. The aircraft reported at the holding marker outbound and about a minute later began a left procedure turn during which a clearance to 3,000 feet was received. On the completion of the turn, the limit marker was received inbound and shortly after a clearance to 2,000 feet was approved.

On receipt of the holding marker signal the holding pattern was commenced and on completion of the turn, the time passing abeam of Eltham NDB was noted. The outbound track was continued for a time estimated to be about 1½ minutes. A final approach clearance was then received and a rate 1 turn was immediately commenced to intercept the Localizer track inbound.

Because of the absence of any signal when outbound to indicate that the aircraft had passed the limit marker, the captain was surprised when about one minute after completing his turn, the limit marker was received both visually and aurally, when, from previous observation, he was expecting to hear the holding marker. The approach was continued to the holding marker and the final approach and landing completed.

Although the safety of the aircraft was not a factor in this incident, the captain contended that should a pilot's attention be diverted, to other operational matters, and he is depending solely on the receipt of a limit marker signal to denote his turning point, without any regard to the time factor, it is conceivable that he could, in the absence of any signal, get so far away from the limit marker when outbound that a risk would be created.

As a result of his experience, the captain suggested that at altitudes below 3,000 feet, all holding procedures should be carried out strictly

on a time basis of two minutes in conjunction with either or both the Eltham NDB and Holding Marker, using the limit marker as a guide only, or alternatively, a second NDB be installed at the limit marker as a secondary aid for the turning point.

The present procedures are a direct result of this suggestion, but we have gone one further and removed the limit marker altogether, so that all holding on the localizer is carried out on a time basis from the holding marker. It is considered that this procedure eliminates the necessity for a second NDB at the former position of the limit marker.

Tiger Moth Taxying Mishap

WHILE taxying at Benalla, the pilot of a Tiger Moth commenced a turn to the left, but the aircraft did not fully respond. As there was a downward slope, and the aircraft was rolling towards a telegraph post, the pilot applied throttle to assist the turning. However, this was ineffective and the port wing struck the post.

This accident was caused by the negligence of the pilot in taxying too close to an obstruction without the assistance of personnel at the wing tip.

The damage was extensive and was assessed as about £300. The owners of the aircraft, a flying school, suspended the pilot from flying for a period of three months and made him contribute £25 towards the cost of repairs to the aircraft.

About 25% of all accidents and mishaps involving flying school aircraft occur during taxying, and the cost of repairs to these aircraft, coupled with the total time that the aircraft are unusable must mean considerable loss of revenue to the aircraft owners. For the most part taxying accidents are avoidable, and if "fines" help to impress on the pilots the need for extreme care during this phase of operations, then the resultant decrease in this type of occurrence should prove the action to be warranted.

Auster Tail Wheel Spring Attachment

TOWARDS the end of a landing run in a paddock near Dalwallinu, W.A., the tail-wheel spring assembly became detached from an Auster aircraft which was being used for joy flights. The defect was caused by the failure of the tailwheel spring anchor bolt which allowed the whole tailwheel assembly to collapse, causing minor damage to the rudder and stern post spring attachment bracket.

The anchor bolt had broken through the threaded portion 1½ threads from the end of the threaded portion. Other Auster aircraft were inspected and in two cases the anchor bolt was found to be bent.

Although there was no evidence of the spring working on the bolt due to lack of tension, there were definite lines on the bolt which coincides with the spring laminations.

As a precautionary measure, it is suggested that owners arrange for an examination to be made of all Auster tail-wheel anchor bolts at the next scheduled service.

Action in the Event of Engine Failure

SOME time ago a DC-3 aircraft experienced an engine failure in the vicinity of Mangalore when southbound to Melbourne. On arrival over Mangalore the pilot requested and received permission from Air Traffic Control to proceed to Melbourne.

At first glance the incident appears to be of a routine nature, however, there is one important aspect which may not be generally appreciated. The approval to proceed granted by Air Traffic Control relates only to an air traffic clearance, i.e., the aircraft is cleared for a particular course of action in relation to other aircraft operating in the controlled air space in the particular area. Such a clearance is not intended, nor should it be construed, as meaning that the aircraft has permission to continue to Melbourne when in the opinion of the pilot-in-command the aircraft should proceed to a more suitable aerodrome. In this regard, the attention of all pilots is directed to Air Navigation Orders, Section 20.6 which clearly defines the responsibilities of pilots when operating a multi-engined aircraft with one or more engines inoperative.

Keep Drains and Vents Outlets Open

RECENTLY, a Douglas DC-4 aircraft sustained extensive damage to the integral fuel tank area of the wing structure while in flight. This could have resulted in either total failure of the wing structure had the aircraft been subjected to abnormal turbulence, or an uncontrollable fire as the result of fuel leakage in the exhaust track.

The damage to the wing structure resulted from the insertion of a cork in the fuel tank vent line outlet. The vent outlet had probably been "plugged" to prevent spillage of fuel on the tarmac due to thermal expansion of the fuel.

The aircraft took-off on a flight of approximately 2,000 miles with the tank vent "plugged" and as the engine fuel pumps drew fuel from the "sealed" tank the air pressure within the tank was reduced below that of the outside atmosphere. As the pressure differential increased, the resultant external effective pressure was sufficient to collapse the tank and wing structure until the seal was broken by cracks in the structure.

It is fortunate that only minor cracking did occur for it permitted breathing of the tank and continued operation of the engines, without total failure of the wing structure. Had cracking of the tank structure occurred below the fuel level, fuel may well have spilt into the exhaust track with possible disastrous results.

It needs a second thought to appreciate the high loads, other than those catered for in the original design, which would have been imposed on the wing skin and spar webs of the aircraft if the pressure in the tanks had been reduced to say 3 pounds per square inch below that of the outside air. Such a pressure differential would result in an effective total force of 4,320 lb., or nearly 2 tons, over a surface area measuring 5 feet by 2 feet.

In addition to the need for unrestricted fuel tank vents, it is equally important that drain lines from fuel, hydraulic and other engine driven accessories should be kept unrestricted at all times. These drains are provided to warn of leakage, a job they cannot do if restricted. If leakage of the pump shaft seal occurs, the fuel or hydraulic oil can flow practically unrestricted into the engine rear case with ultimate damage to the engine because of pollution of the engine lubricating system and possible flooding or foaming of the oil tanks. On the majority of engines, the engine drive shafts are fitted with seals designed to prevent flow from the engine only.

The moral of this story is therefore: "Keep your vents and drains open, and under no circumstances plug or restrict a vent or drain line." Even if an aircraft is not operating, a restriction in a vent or drain can have serious consequences due to the thermal expansion of liquids or gases, or in the case of pump drains, prevent detection of the failure of a seal that is essential to the safe operation of an aircraft.

Operating crews should familiarize themselves with the location of drains and vents on their aircraft and the leakage limitations of various components. These should be checked regularly for blockages at outlets and excessive leakage.

Covering of Freight

THE captain of a DC-3 reported that a particular flight usually carried freight in some of the passenger seats. This freight was generally covered with large sheets of brown paper. In the pilot's opinion, this created an unnecessary fire hazard, as should a careless smoker set alight to such a large sheet of paper, extinguishing would be difficult. The fire would isolate the cockpit from the cabin and the pilots may be unaware of the blaze until too late.

We are in agreement with the views expressed by the captain in that, whilst newspaper and other materials in passenger compartments are acceptable risks, sheets of brown paper wrapped loosely over freight in passenger compartments are unnecessary and their use should be avoided.

However, it would be extremely difficult to legislate for the coverage of cargo in passenger compartments, without embracing paper wrappings on parcels, hats, etc., and we are therefore of the opinion that this is a domestic matter for operating companies who should ensure that large expanses of inflammable covering should not be used where there is any possible danger of ignition through careless handling of matches by the passengers.

Unauthorized Ascent

A DC-3 departed from Hobart for Launceston at 2108Z, cruising in the free air space. However at 2133Z, the aircraft reported at Ross on top of cloud at 4,500 feet and climbing to 5,000 feet. No clearance to enter the controlled area had been issued by either Hobart or Launceston.

A southbound DC-3 passed Ross at 2123Z and was making a VFR approach into Hobart, and standard separation did not exist at the time the aircraft passed each other, although both aircraft were aware of each others position.

In his report on the incident, the captain of the northbound DC-3 stated, that in the Ross area it became apparent that it would not be possible to maintain ground contact and efforts were made to contact Hobart to obtain permission to ascend to 5,000 feet. However, this could not be done, probably due to the lack of altitude, and as he had heard the southbound DC-3 report over Ross and knew the aircraft had passed, he decided to climb so as to remain in the clear above cloud, the tops of which were about 4,300 feet.

Contact was established with Launceston Control at Ross, and the aircraft was then cleared to proceed I.F.R.

On this occasion, the pilot of the northbound DC-3 erred in ascending into the controlled airspace without a A.T.C. clearance. The procedure to be adopted is such a case is set out in Air Navigation Orders, Part 11, Section 11.6.7. The flight should not have been pursued to a point where it was no longer possible to maintain V.F.R. flight.

One other aspect of the incident is the failure to establish radio contact with Hobart when it first decided to ascend. In his report, the captain stated that this was because of lack of altitude. The inference is, then, that these efforts were made on the V.H.F. channels only, with no attempt being made to use the H.F. frequencies.

There have been a number of occasions of late where aircraft have been out of communication on V.H.F. frequencies and the alternate H.F. channels have not been used to restore contact. One of the purposes of the alternate H.F. channels is to provide backing for V.H.F. channels and aircraft captains would do well to keep this in mind when V.H.F. contact is not possible.

Diversion Procedures — Adelaide

ON reporting abeam of Tailem Bend, S.A., on course for Adelaide on the V.A.R. contact at 9,000 feet, a Convair was granted permission to descend to 3,400 feet on the V.A.R. At the same time the Convair was warned that a DC-3 was climbing to 8,000 feet direct to the Tailem Bend NDB from Parafield.

The Convair commenced to descend, and when at approximately 7,000 feet and abeam of Murray Bridge it sighted the DC-3 directly ahead at the same altitude and on a reciprocal track. By increasing the rate of descent, the Convair passed beneath the DC-3.

The Convair captain reported the incident to Adelaide Aeradio. This message was intercepted by the DC-3 captain who stated that he understood that he had been cleared on the V.A.R.

An investigation of the incident showed that the Area Controller had advised the Airport Controller to clear the DC-3 direct to the Tailem Bend NDB, and the Airport Controller cleared the aircraft accordingly.

However, the DC-3 should have been cleared by the diversion which provides for departing aircraft to proceed on a track parallel to the V.A.R. until abeam of Tailem Bend. This ensures that lateral separation exists between inbound and outbound aircraft.

The flight plan prepared for the DC-3 aircraft provided for a direct Adelaide—Tailem Bend flight, and if this plan had been followed, the DC-3 aircraft would not have been on the V.A.R. route in the vicinity of Murray Bridge. However, with a direct route authorized in his final clearance, the pilot would naturally gain the impression that no lateral separation problems existed, and would therefore tend to ease across on to a positive track guide. It is thus easy to understand his statement that he understood the flight was cleared on the V.A.R.

The cause of the incident was considered to be due to the failure of Air Traffic Control to apply the correct diversion procedure, thereby causing a track to be used which did not provide adequate lateral separation between the two aircraft. Immediate corrective action was taken.

Rudder Stop Cables

DURING a pre-start check prior to departure from Launceston, a DC-3 captain noticed a restriction in the movement of the rudder controls. An inspection by a ground engineer showed that the rudder stop cable was broken.

The pilot reported that a moderately severe swing of the rudder occurred while taxying downwind at Essendon and it is assumed that the stop cable broke at this time. The aircraft behaved normally on the flight from Melbourne to Launceston.

Failure of rudder stop cables is always a possibility when taxying in high wind conditions if snatching of the rudder is permitted.

VHF Communication — Port Moresby

ALMOST immediately after being cleared from Aeradio Control to Tower Control, a DC-4 was heard calling Port Moresby Tower on VHF. The Tower answered with landing instructions and the DC-4 asked for a repeat because of fade out. The Tower repeated the instructions, but no further contact was made. Further calls were made, but with no avail, until aircraft was in sight rounding a hill to the north-west of the strip. Normal VHF contact was then established.

Information indicates that difficulty in establishing VHF contact is often experienced when aircraft are flying under 3,000 feet in the vicinity of Port Moresby.

This trouble is due to the present siting of the Tower VHF aerials and action has been taken to purchase a site on Burns Peak near Konedobu so that the aerials may be located in a more suitable spot. This site will also be the location of the DME installation and it will be necessary to provide access roads and power lines before the aerials can be re-located.

It is estimated that the new facilities will be ready for use in about twelve months, and the present VHF communication difficulties will continue until that time.

In the meantime it has been recommended to Air Traffic Controllers that aircraft approaching from directions from which VHF difficulties have been experienced previously be instructed to call on the appropriate HF channels.

Aircraft captains can also help in this matter by immediately transferring to HF frequencies when any VHF communications difficulties with Port Moresby Tower are experienced.

Costly Low Flying

ON the 11th April, 1953, it was reported that a light aircraft flew at a very low altitude over a public gathering of about 15,000 people at Baulkhain Hills, N.S.W. The person reporting the incident stated that the aircraft flew over the gathering several times at very low level and this was corroborated by excellent low level photographs which appeared in a leading newspaper the following day.

From the evidence available it was considered that the pilot of the aircraft contravened Air Navigation Regulations 124, 132 (1) and 133 (2) (b) which relate to negligent operation and low flying, and Air Navigation Orders, Section 11.8.1.1.1 by failing to submit a flight plan or obtain a clearance for the flight. Had he done so, the flight would have been queried.

The owner of the aircraft had not approached the Department for approval for the flight, which was undertaken at the request of a newspaper company, but in the pre-flight briefing he gave the pilot to understand that official approval had been obtained for the flight. It was therefore recommended that the owner be joined with the pilot in any prosecution action, as provided for by Air Navigation Regulation 312 (2).

Legal proceedings were taken against the pilot and the owner and these resulted in the pilot being fined £10 with costs on each of two charges, while the owner of the aircraft was fined a total of £40 plus costs in respect to charges preferred for contravention of Air Navigation Regulations 132 and 133.