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

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF CIVIL AVIATION

AVIATION SAFETY DIGEST

No. 7

SEPTEMBER, 1956

Prepared by the Division of
Accident Investigation and Analysis

Published by Authority
of the Director-General

CONTENTS

PART I

AVIATION NEWS AND VIEWS

Quiz Session

Take a pencil, note the time, turn to page 32 and underneath each dial write the altimeter reading and then note the time you have taken to complete all readings. Check your readings against those given on page 4.

Now, perhaps, you will be interested to read the article which follows.

Misreading the Altimeter

AN accident report in this Digest concludes that a very experienced pilot probably misread the altimeter during an instrument approach. Although most pilots are aware that the conventional sensitive altimeter with three pointers has certain inherent readability limitations, the high probability of misreading it is not generally appreciated. But only careless pilots would misread their altimeter, you think. Tests indicate that careful pilots also misread this instrument.

In 1947, the United States Air Forces Aero Medical Laboratory analysed 270 errors made by pilots in reading and interpreting instruments. This analysis revealed, inter alia, that one of the most common errors was in interpreting multiple revolution instruments such as the sensitive altimeter. The altimeter was misread more frequently than any other instrument and by far the most common error was that of reading the altitude exactly 1,000 feet too high. This analysis also found that instrument reading errors are not confined to any single class or group of pilots. In these tests 97 pilots made 12 readings each from conventional sensitive altimeters and of the total of 1,164 readings 11.7 per cent. were in error by 1,000 feet or more.

In the following year the U.S.A.F. Aero Medical Laboratory examined a number of pilots and non-pilot college students in reading the 3-pointer altimeter. These persons were allowed approximately 7 seconds for each reading. The types of errors, and the frequency of occurrence expressed as a percentage of the total readings, uncovered in this analysis were—

(a) Reading to nearest numeral instead of lower adjacent numeral (reading 13,960 as 14,960 because of failure to consider the more sensitive pointer)—pilots 4.4 per cent, non-pilots 3.7 per cent.

(b) Reading to the lower adjacent numeral when the nearest numeral is correct (reading 28,020 as 27,020 because of failure to consider the more sensitive pointer)—pilots 0.3 per cent, non-pilots 2.3 per cent.

(c) Displacement of digit in number series (reading 16,080 as 10,680 because of interchange of digit with adjacent zero)—pilots 4.0 per cent., non-pilots 5.5 per cent.

(d) Misreading of scale or numeral (reading 34,640 as 34,620) because of erroneous value assigned to scale divisions)—pilots 5.8 per cent., non-pilots 7.1 per cent.

(e) Omission of one pointer (reading 10,700 as 700 because of failure to read 10,000 ft. pointer)—pilots 1.7 per cent., non-pilots 1.3 per cent.

(f) Pointer exchange (reading 25,420 as 52,420 because of interchange of 10,000 ft. and 1,000 ft. pointers)—pilots 0.3 per cent., non-pilots 2.3 per cent.

(g) Repetition of reading on one pointer (reading 28,020 as 28,820 because of repetition of 1,000 ft. pointer reading)—pilots 1.0 per cent., non-pilots 0.8 per cent.

These errors are attributed to the fact that an exact numerical value is obtained from data presented by a combination of pointers on a single dial. That is, the 3-pointer altimeter by virtue of its method of presentation affords opportunities for errors. The most serious (hazardous) of these errors is that referred to at (a), i.e. reading too high by one revolution of the sensitive pointer. This error is demonstrated at Fig. 2, page 32, where the 1,000 ft. pointer is pointing to 4 on the scale, but to read the setting correctly it must be read as 3 or 3,000 feet. The error comes from reading the 1,000 ft. pointer to the nearest numeral, whereas it should be read to the next lowest number.

The majority of cases of misreading of the altimeter have occurred during instrument descents when the pilot has been concentrating on flight attitude instruments, radio conversation and instrument procedures with the result that the altimeter only gets a glance. From studies of pilots' eye movements during instrument flying it is known that pilots spend an average of 4/10ths of a second each time they read the altimeter under these conditions. This is very short by comparison with the average time taken in the above tests, 7 seconds per reading.

As a result of the studies of errors in reading altitude, various aviation authorities and instrument manufacturers throughout the world have been engaged for some time in developing altimeters with improved presentation. Quite a number of different types of altimeters have now been developed and are available for installation.

One type that appears to overcome most of the problems is the counter type. It is comparable in size and weight with the present altimeter and has only one pointer reading in hundreds of feet. The thousands are read in digits through a window in the dial. An improved presentation of the barometric scale is also incorporated which features a four digit type counter. Another type of altimeter which is designed to overcome the most serious error in reading the 3-pointer altimeter, i.e., reading the 1,000 pointer to the nearest numeral, is one in which the 1,000 pointer remains pointing at the numeral indicating the thousands of feet until the altitude changes 1,000 feet when it jumps to the next appropriate numeral. An altimeter with one pointer and a logarithmic scale, which it is claimed will considerably reduce the incidence of reading errors, is currently being evaluated in Canada and present indications are that it would be comparatively cheap to produce.

The Department is currently examining the available improved types of altimeters with a view to their suitability as replacement for the 3-pointer altimeter. REMEMBER, until the present type of altimeter is replaced, the greatest danger is in reading this altimeter too high by 1,000 feet when letting down in instrument conditions.

QUIZ ANSWERS:

1 — 16,080
2 — 13,960
3 — 13,330
4 — 10,700
5 — 34,640
6 — 25,420
7 — 28,020
8 — 1,100
9 — 11,000
10 — 11,100

One mistake is one too many and two mistakes could be fatal.

PART II

OVERSEAS ACCIDENTS

DC.4 Fire in Flight

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (18/27/43)

ON 15th June, 1954, at 0320 hours a DC.4 made an emergency landing off the runway at Gage Airport, Oklahoma. The emergency landing was made because of an uncontrollable fire in the number 3 engine nacelle. There were no injuries to the passengers or crew, but the aircraft was destroyed by fire.

THE FLIGHT

The aircraft was engaged on a flight from Kansas City, Missouri to Burbank, California. The flight was routine until, when in the vicinity of Gage, Oklahoma, the captain was requested to climb and maintain 6,000 feet. Shortly after, the stewardess entered the cockpit and told the pilots that she had observed sparks trailing from number 3 engine. A check by the first officer failed to find anything amiss, and the stewardess returned to the cabin.

Some two or three minutes later, when the aircraft was at an altitude of 5,500 feet and in the vicinity of Gage, the zone 2 fire warning light of the number 3 engine came on. As soon as this was observed the first officer went to the cabin to make a visual check. He returned a few seconds later and reported there was a fire in the number 3 engine. The captain immediately returned the aircraft to level flight and feathered the number 3 propeller. The fire-wall shut-off valve was then pulled, the CO_2 selector set for the number 3 engine and the first bank of CO_2 bottles was discharged. As this application of carbon dioxide did not appear to put the fire out the engine's cowl flaps were closed and the second bank of CO_2 bottles was discharged. Following this action the fire was seen to momentarily die down but almost immediately to flare up again.

At approximately 0312 while the captain was performing these duties the first officer called Gage and advised that the number 3 engine was on fire and that its propeller had been feathered. The Gage communicator immediately turned on the airport runway lights for the north-south runway. There were no other radio contacts with the flight. The captain, unable to extinguish the fire, began a left descending turn toward the airport. During this turn the number 3 engine fell from the aircraft, at which time a complete failure of the electrical system was experienced. The captain testified that throughout the approach he was unable to see the runway lights on the airport, and, not being able to use the aircraft landing lights, he headed in the general direction of the airport beacon. Throughout the latter stages of descent the first officer used a flash light so that he could observe and call out altimeter and airspeed readings. As the aircraft neared the ground the fire illuminated the surface, permitting the captain to see the ground and land the aircraft safely. After rolling a considerable distance the right main landing gear collapsed. When the aircraft came to a stop all passengers were quickly evacuated. Fire eventually destroyed the aircraft.

INVESTIGATION

Investigation conducted at the scene of the accident disclosed that the aircraft first contacted the ground on a heading of 110° about 900 feet to the left of the runway and 1,000 feet inside the airport boundary. After

rolling approximately 1,100 feet the right main landing gear collapsed because of fire damage and the aircraft then skidded sideways to the right, stopping 1,800 feet from the first ground contact point. The captain ordered an immediate evacuation of the aircraft, which was done quickly and in an orderly manner through the main cabin and pilot doors. Evacuation was accomplished in an estimated 1½ minutes without serious injuries to any of the passengers or crew. The intense fire in the number 3 nacelle area continued to burn, spreading progressively throughout the entire aircraft with the exception of the left wing and empennage.

The number 3 engine, which fell from the aircraft, was found 11 miles north-west of the airport. As this engine was the area of origin of the fire, it was given exhaustive examination. The nose case was demolished by impact and cylinders 8, 9, 10, 11 and 12 severely damaged by impact and fire. The diffuser section and accessory case were destroyed. Only portions of the accessories normally installed on the rear case were recovered; all had sustained fire damage. Disassembly of the engine indicated that there was no failure or malfunction prior to impact.

The generator for this engine, a Jack and Heintz Model JH 11300, type R-2, serial number 772, was recovered. It was badly damaged by the intense fire and impact. Disassembly revealed that the inner and outer races of the front bearings were badly galled and distorted. Three accessory case generator mounting studs were recovered. Two were 6½ inches long and were bent about five degrees at the point where they passed through the generator mounting flange. The third stud had failed in tension and bending at approximately the same place where the others were bent. Only the inner race of the rear generator bearing was found. It was still attached to the drive shaft and armature support tube. Approximately ¼ of the circumference of the forward and rear edges of the bearing groove was cut, distorted, and rolled. The generator drive shaft was broken just aft of the clutch assembly. The shear section of the shaft, designed to fail under excessive loads, was intact although bent one degree. The armature and commutator components of the generator were severely scored, distorted and burned. The score marks on the armature matched similar ones on the coils and interpoles and were rotational in direction which indicated they were made while the armature was still turning.

ANALYSIS

Investigation and examination of the wreckage definitely indicated that the failure of a generator bearing was the initial malfunction. This failure resulted in the generation of extreme frictional heat capable of weakening and burning through adjacent fluid lines causing the release of inflammable fluids which were ignited. The fire progressed so rapidly and became so intense that available CO_2 was insufficient to extinguish it.

The failure of the generator drive shaft to shear at its designed shear section after the bearing failure, permitted the generation of extreme friction heat and the release of inflammable fluids with consequent intense fire.

The loss of all electrical power at the time the engine separated from the aircraft was most probably caused by a ground fault on the power cables during the physical break-up of the nacelle installation.

PROBABLE CAUSE

The Board determined that the probable cause of this accident was a bearing failure of the number 3 engine generator causing extreme frictional heat and the release of inflammable fluid which ignited in flight.

DC-4 Ditching between Honolulu and Wake Island

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (18/27/96)

ON 24th September, 1955, at about 0641, a DC.4 ditched in the Pacific Ocean, approximately 1,000 miles west of Honolulu, after a loss of power in three engines. Two of the crew of five survived, one crew member went down with the sinking aircraft and two others subsequently drowned before the arrival of a rescue vessel the following day.

THE FLIGHT

The aircraft carrying cargo only was on a flight from California, U.S.A. to Tokyo, Japan, with scheduled refuelling stops at Honolulu and Wake Island. The aircraft departed Honolulu on an I.F.R. flight plan to Wake Island, to maintain 8,000 feet.

Approximately six hours later the aircraft was transferred to Wake Island A.R.T.C. and three minutes later an emergency was declared when the captain advised of the loss of power in three engines. The aircraft was ditched during darkness. Neither Wake Island nor Honolulu radio was able to maintain contact with the aircraft and an extensive search was commenced. At 1318 hours on the following day the captain and co-pilot were sighted and picked up by a surface vessel.

INVESTIGATION

On take-off from Honolulu all main fuel tanks were full, and two outboard auxiliary tanks contained 130 gallons each.

When the main tanks were down to 400 gallons, No. 1 and No. 2 engines were transferred to No. 2 auxiliary tank and Nos. 3 and 4 engines to No. 3 auxiliary tank, with the crossfeed control positioned to each pair of engines. When the fuel in the inboard auxiliary tanks (Nos. 2 and 3) was down to 20 gallons in each tank the fuel selectors were positioned to the outboard auxiliary tanks (Nos. 1 and 4). At that time there were 40 gallons in No. 1 auxiliary tank supplying Nos. 1 and 2 engines and 100 gallons in No. 4 auxiliary tank supplying Nos. 3 and 4 engines. Nos. 2 and 3 auxiliary tanks were empty as the selectors had been positioned to transfer the fuel remaining in the inboard auxiliary tanks after switching to use of the outboard auxiliary tanks.

Soon after No. 1 engine stopped and its fuel pressure dropped to zero. The captain then moved the No. 2 and No. 3 fuel selectors from off to the full forward position (No. 1 and No. 4 fuel selectors were already in the forward or auxiliary tank position), mistakenly thinking this was the position for the main tanks. He also shut off the crossfeeds.

The No. 3 engine then stopped and its fuel pressure dropped to zero. The captain realised his error and pulled all four selectors to the centre or main tank position and moved the four mixture controls to the auto-rich position.

During the operation No. 2 engine stopped and its fuel pressure went to zero. Each fuel selector was then checked for main tank position and they were found to be so positioned with crossfeed valves off and main boost pumps on. The captain then moved the crossfeed controls to the "all engines to crossfeed" position, which resulted in the fuel pressure of No. 4 engine fluctuating. The crossfeed valves were then shut off and No. 4 fuel pressure became immediately stabilized. The propellers of Nos. 1, 2 and 3 engines continued to windmill with their respective fuel selectors on main tanks, main boost pumps on, and crossfeeds off for a period he considered sufficient for restarting. The engines did not start and their fuel pressures remained at zero. The captain then feathered Nos. 1, 2 and 3 propellers and used full power on No. 4 engine.

During the descent at an airspeed of 135-140 knots, engines Nos. 1 and 2 were unfeathered in separate attempts to restart; both were unsuccessful. After refeathering and while attempting to restart No. 3 engine, the aircraft struck the water in a slightly nose-high attitude.

ANALYSIS

In order to investigate further the functioning of the fuel system under the conditions reported by the Captain, flight tests were conducted in a DC.4 equipped with the same eight-tank fuel system for the purpose of duplicating the reactions of the equipment to each combination of control positions reported by the Captain.

The flight tests proved conclusively that if the Nos. 1, 2 and 3 propellers had been allowed to windmill with the fuel system and engine controls in the configuration described by the Captain, the engines would have restarted. The conditions described in the Captain's statement were: ignition on; fuel selectors positioned on the main tanks for each respective engine; main tank boosts on; mixture auto-rich; crossfeeds off.

While feathering the three propellers would slow the rate of descent, the action definitely removed any possibility of restarting the engines while in that condition. The separate unfeathering of the propellers and the starting attempts probably consumed more time and altitude than the original feathering may have gained.

The probability of simultaneous failure of three engine-driven fuel pumps is remote.

However, even with the three pumps inoperative, full pressure would have built up immediately, if the fuel selectors had been positioned on the main tanks, each containing approximately 400 gallons, and an electric boost had been used on these tanks.

It is evident that if the remaining fuel (20 gallons each) in Nos. 2 and 3 auxiliary tanks had not been transferred, the loss of power would have not occurred when it did even though the Nos. 2 and 3 fuel selectors were incorrectly positioned for an indefinite period after the loss of power on the three engines.

The flight test also showed that even though the fuel transfer was made and the three engines subsequently stopped, there was more than sufficient time from the altitude of 8,000 feet to restart the engines. The practice employed by the crew in allowing two engines to be operated on one auxiliary tank down to 20 gallons of fuel is considered poor operating practice.

By reason of the positive results obtained in the flight tests, it was concluded that the Captain's and co-pilot's recollection of events occurring after the loss of power, as described in their statements, was incorrect as to action and/or sequence. This absence of accurate recollection is understandable when consideration is given to the stress of the emergency and subsequent events after the ditching and before rescue.

PROBABLE CAUSE

The Board determined that the probable cause of the accident was the loss of power in three engines due to incorrect fuel system management and faulty restarting methods which resulted in the ditching of the aircraft.

Approach Accident DC-6B: San Francisco Bay, California

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (18/27/5)

AT approximately 2308 hours on 20th April, 1953, a DC.6B aircraft crashed into San Francisco Bay, California. The accident occurred whilst the aircraft was descending to enter the traffic pattern for landing. Two of the ten occupants survived. The aircraft was demolished and sank.

THE FLIGHT

The aircraft was on a flight from Los Angeles to Oakland, California with an intermediate stop at San Francisco. The aircraft departed from San Francisco at 2305 and was cleared direct to Oakland Tower to remain clear of clouds at a minimum altitude of 500 feet. Two minutes later the aircraft advised Oakland that it was on a clearance to the Oakland Tower and requested clearance, which was granted, to enter the traffic pattern. At approximately 2302 an orange flash was observed in the direction of the aircraft's flight path and subsequently the wreckage was located in San Francisco Bay.

ANALYSIS

From the testimony of the two survivors, it is apparent that the accident resulted from the pilot's failure to maintain sufficient altitude to avoid contact of the aircraft with the water. The precise reason or reasons for the pilot's action or lack of action in allowing the aircraft to descend into the water is a matter of conjecture. However, there were several pertinent conditions and circumstances that can be considered as contributory factors. These were the type of operation being conducted, the weather conditions that existed over the Bay and the sensory illusions that can occur under certain conditions.

The type of operation being conducted was somewhat of a special nature wherein flights between the Oakland and San Francisco Airports, which are 10 nautical miles apart, are permitted to fly at altitudes below the minima normally prescribed for scheduled airline operations and also below the normal Visual Flight Rule weather minima. This has been authorized to expedite traffic between these two airports in view of the short distance involved and the fact that such flights are made entirely within controlled airspace.

It appears that in proceeding over the Bay, the flight encountered a cloud condition lower than indicated from pre-flight reports and that the pilot, endeavouring to stay clear of clouds as required for this operation, descended below the minimum altitude of

500 feet. In doing so, he may have lost visual reference to the surface both with respect to the lights on shore and to the surface of the water. As the waters of the Bay were reported as smooth, a condition existed that made it extremely difficult if not impossible to judge distance above the water, especially as it was at night and no other means of reference were available for visual orientations.

In this connection, the third condition enters the then existing situation. This is a condition wherein an erroneous belief of an aircraft's altitude can occur when attempting to maintain orientation by means of visual reference to distant lights. In this case the aircraft was approaching the shore some five miles distant where there were numerous lights. But the concentration of the much stronger lights at the airport proper could well cause that cluster of lights to appear as a single foci, and thus cause a sensory illusion, such as described by P. P. Cocquyt in his paper "The Sensory Illusion of Pilots". Under such conditions a pilot believes that he is higher than he really is, and so invites quick disaster if at an extremely low altitude, as was the case in this flight. Briefly, the error in estimate of altitude stems from the fact that a nosed-up attitude of the aircraft causes a distant light or concentration of lights to appear lower and the aircraft thus higher.

Notwithstanding the points mentioned above, there remains the fact that the pilot had two altimeters in the cockpit. It was disclosed that prior to landing at San Francisco the flight received and acknowledged the San Francisco barometric pressure of 29.90 inches. There was no appreciable change in pressure between this time and the time of departure from San Francisco when both airports reported the pressure at 29.89 inches. Therefore, it can be concluded that there was no possibility of erroneous altimeter setting existing as a factor in the accident.

PROBABLE CAUSE

It was considered that the probable cause of the accident was the pilot's action in continuing descent below the 500 feet prescribed minimum altitude until the aircraft struck the water. A possible contributory cause to the aircraft striking the water was the sensory illusion experienced by the pilot.

PART III

AUSTRALIAN ACCIDENTS

Accident to DC-3 at Bourke, N.S.W.

(6/255/466)

ON 15th December, 1955, a DC.3 was involved in an emergency landing following malfunctioning of the starboard engine immediately after take-off from Bourke Aerodrome. The landing was carried out in a clearing in a sparsely timbered area one and a half miles north-east of the aerodrome. The three crew members and ten passengers escaped injury but the aircraft was destroyed by fire.

At the time of the accident the aircraft was being operated on a regular public transport flight which originated at Sydney and subsequently arrived at Bourke at 1321 hours* after an intermediate stop at Nyngan. From Bourke the flight was scheduled to return to Sydney via Nyngan and Warren.

THE CIRCUMSTANCES

During the take-off from Sydney the captain noticed some slight surging of the engines and had difficulty synchronizing them during the climb. Surging was again experienced during take-off at Nyngan, the intermediate stop, but this disappeared on the first reduction from take-off power. The flight from Nyngan to Bourke was otherwise uneventful, the aircraft arriving there at 1321 hours; it was then loaded and refuelled for the return flight.

At about 1337 hours the aircraft was taxied to the displaced threshold marks towards the south-west end of Runway 5 and a take-off was immediately commenced into the north-east. The aircraft became airborne after an apparently normal take-off run, but shortly after leaving the ground the starboard engine backfired and the first officer noticed a fluctuation of revolutions and manifold pressure and rough running of this engine. The captain, although not aware of these latter symptoms, heard the backfiring and felt an uneven load on the rudder pedals; from these symptoms he concluded that the engine had failed and as a result feathered the starboard propeller.

A few seconds later the first officer saw the starboard propeller had not stopped but was rotating at an engine speed of some 600 to 700 r.p.m. and he could only distinguish individual blades with difficulty. He concluded that the propeller had not feathered and so informed the captain, who instructed him to press the feather button again. The button was pressed several times but each time immediately returned to the normal position. On the captain's instructions the first officer then held the button in for some two or three seconds but, on releasing it, the button again immediately returned to the normal position. The first officer was unable to detect any change in the propeller's condition and it continued to rotate at a constant speed accompanied by considerable vibration of the engine. At about this time the captain decided to abandon the take-off. Eyewitnesses state that the aircraft did not climb much after take-off before levelling out, and thereafter it flew just above the trees for about a mile before descending from sight. At this time the starboard propeller was rotating slowly, and was seen to stop just before the aircraft descended from their view.

The landing was effected in an area almost clear of trees but near the point of touchdown the starboard wing tip was sheared off on a small tree. The aircraft maintained its direction for 380 feet before colliding with a stump which caused it to slew violently to the right and turn through about 180°. It came to rest 555 feet from the first point of contact. The starboard propeller was torn from the engine just after ground contact and came to rest 60 feet short of the main wreckage.

The wreckage was located 3,200 yards from the end of the runway and 8 degrees to the right of its centreline. The surrounding terrain is flat and sparsely covered with trees of an average height of 30 feet.

* All times, based on the 24-hour clock, are expressed in Eastern Standard Time.

INVESTIGATION

The captain testified that after feathering the starboard propeller the aircraft would not climb but gradually decelerated and lost height, and when the speed had dropped to about 80 knots he decided to abandon the take-off.

The airframe was largely destroyed by fire. The outer wing sections and empennage were substantially intact and showed no evidence of pre-crash deformation or defect which would cause or contribute to a loss of performance. The aircraft's maintenance and overhaul records, and the comments of pilots who had flown the aircraft previously, did not indicate any abnormal characteristics or deterioration in performance. Except for engine surging on take-off at Mascot and Nyngan the crew testified that the aircraft behaved normally prior to the take-off at Bourke, and that the indicated airspeeds for various phases of the flight were normal.

It was established that the port propeller was rotating, but not under any appreciable amount of power, when the aircraft landed. The damage to the starboard propeller showed that it was feathered and not rotating when the aircraft landed. No defects which would affect the aircraft's performance were found in the propellers.

Although both engines were substantially damaged by fire it was found that the power sections had been in good condition with no sign of mechanical failure. The only significant defect was lead fouling of certain spark plugs. Apart from four, which were too damaged to test, all plugs from the port engine had acceptable electrode gaps and these tested satisfactorily, except for one from the rear position of No. 8 cylinder which had extensive deposits of metallic lead on the insulator surfaces. This plug showed almost complete shorting under test as did three from the starboard engine which were also fouled by metallic lead.

From the examination of the wreckage it was not possible to account for poor performance of the aircraft described by the crew.

ANALYSIS

Calculations, and flight tests on a number of airline DC.3's, show that this aircraft should have climbed in the "clean" configuration at 270 feet per minute with take-off power on one engine. Thus, the rate of climb should not have been marginal and any factors affecting performance would need to have been of appreciable magnitude for any one of them alone to have accounted for the loss of performance described. For instance, under the conditions prevailing at the time of take-off, a windmilling propeller would reduce the rate of climb by about 150 feet per minute, or an extended undercarriage by 132 feet per minute; combined, these two factors should result in a rate of descent of 12 feet per minute.

Flight tests were undertaken to see if the behaviour of the starboard engine and propeller, subsequent to the captain's action to stop this engine, could be reproduced, and if so, to observe the effect upon the performance of the aircraft. By leaving the mixture control in automatic rich and the throttle at either take-off or cruise power settings, the behaviour of the propeller, as described by the first officer, could be exactly reproduced by pressing the feathering button only; the propeller feathered normally but continued to rotate at about 500 r.p.m. under power from the engine which vibrated excessively. To achieve any noticeable change in the behaviour of the propeller or engine the feather button had to be held in for at least four seconds when their speed of rotation gradually increased as the propeller unfeathered. If the throttle or mixture control was closed whilst the propeller was rotating in the feathered position, the engine stopped immediately.

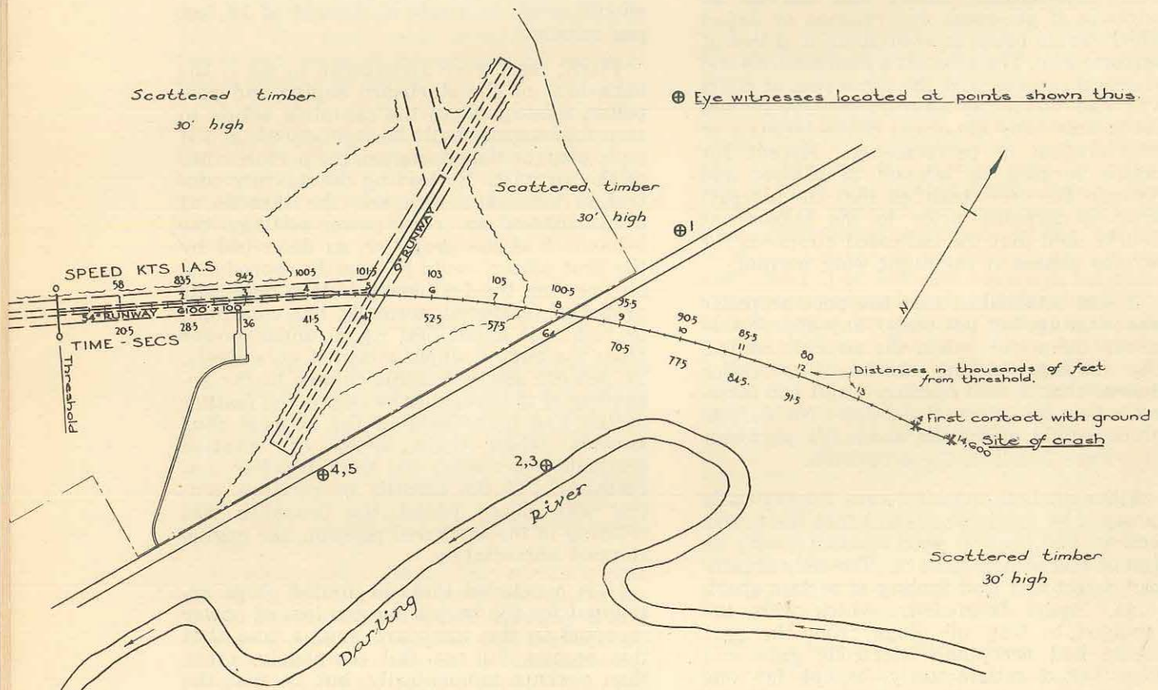
It is concluded that the fouled plugs accounted for the backfiring and loss of power reported in the starboard engine, and that this engine did not fail completely, other than perhaps momentarily, but because the mixture control and throttle were not closed when the propeller was feathered the engine continued to operate with considerable vibration, due to the propeller rotating in the feathered position. It was established that the decrease in climb performance due to

the propeller rotating in the feathered position was about 30 feet per minute; therefore, drag from this propeller was not, of itself, a factor necessitating the emergency landing.

Although both pilots stated that after the starboard engine failed the port engine was delivering full take-off power, this cannot be regarded as conclusive. Prior to this accident, a number of incidents had been reported of backfiring and propeller surging in DC.3 aircraft with Pratt and Whitney R.1830 installations. Almost invariably these symptoms were manifest only at take-off power and were frequently accompanied by high cylinder head temperatures. It is reported that these symptoms which did not always appear together, were nearly always eliminated by reducing to rated power or by placing the mixture control in emergency rich. These symptoms have been attributed in the main to plugs misfiring due to lead fouling. The reduction in cylinder head temperature and pressure on reducing power or using emergency rich accounts for the disappearance of these symptoms.

Of the four plugs from the port engine which could not be tested two were located in the same cylinder—No. 7. The companion plug of the defective one in No. 8 cylinder tested satisfactorily.

If plug malfunctioning alone in the port engine accounted for a marked deterioration in performance it would be necessary for two cylinders at least to be inoperative. There is no evidence of this. The examination of the port engine indicates that its power output may have been reduced about 20 horsepower due to the defective plug in No. 8 cylinder.



LOCALITY PLAN SHOWING LOCATION OF AIRCRAFT, PROBABLE FLIGHT PATH, ESTIMATED SPEEDS AND TIMES, AND LOCATION OF WITNESSES.

1500' 0' 1500' 3000'
Scale of Feet

Although the wreckage examination failed to explain the loss of performance described by the crew, there are a number of defects detectable in a power check which could have accounted for a substantial loss of power. Investigation into this aspect revealed conflicting views as to whether a proper power check was performed prior to this take-off. The captain said that it was made whilst taxying and during the turn from the taxi-taxiing and during the turn from the taxiway onto the runway. In view of the short time it would take to turn through 90° on to the runway it seems that, at the most, only a cursory power check was made. This is contrary to good practice, and particularly so on this occasion in view of the engine surging on previous take-offs, which the captain reports. Although there is no evidence of a substantial loss of power in the port engine a power check performed in the way the captain described would deprive the crew of the opportunity of ensuring, so far as is possible, that this engine was operating normally immediately prior to the take-off.

Since this accident some automatic mixture controls have gone out of adjustment in service in several DC.3's of the same company. The defect involved stretching of the automatic mixture control capsule thus altering the setting of the metering needle to which it is attached, causing a leaning of the mixture in the take-off power range. As the carburettors are set on the rich side of best power at take-off this leaning of the mixture tends to increase power in the take-off range. Nevertheless, at high ambient temperatures this mixture leaning would be conducive to detonation resulting in a nett loss of power.

If detonation, such as would reduce the power output of the port engine to an extent that the aircraft would not climb, had been occurring regularly there would have been evidence of it in the strip examination. The engine, which had operated for some 600 hours since overhaul, was in good condition when stripped. Furthermore, a company engineer who was travelling as a passenger in this aircraft and was seated on the port side of the cabin, noticed no malfunctioning of the port engine, as would be apparent with severe detonation, during this take-off.

After reviewing all the evidence it is considered that this accident could have occurred in one of three ways—

(a) Through a substantial loss of power on the port engine, probably resulting from severe detonation, necessitating an emergency landing.

(b) A partial loss of power on the port engine due to moderate detonation resulting in a marginal climb performance which through the captain's lack of experience and knowledge of single-engine operation and performance led him to abandon the take-off.

(c) The pilot abandoned the take-off in the belief that it could not be continued safely after being informed that the starboard propeller was windmilling and could not be feathered.

If the aircraft would not accelerate or climb, as the crew claim, then it is clearly evident that there must have been a very substantial loss of power in the port engine, of the order of 25 per cent. In these circumstances it would not be possible to continue the take-off. However, no evidence of such a power loss could be found from any source; detonation of the necessary severity would have been accompanied by obvious symptoms, such as rough running and backfiring, which even if not observed by the pre-occupied crew, should have been noticed by the engineer in the cabin.

On the other hand the possibility of the port engine being affected to some lesser extent by detonation is not so remote and if the effect of this, together with that due to the behaviour of the starboard propeller, was such that the rate of climb was reduced by 150 to 180 feet per minute, then the climb performance of the aircraft would have been distinctly marginal and it would have been necessary to fly it very carefully to gain height. Unless this was done the aircraft would lose height. It is significant that the captain did not check the airspeed when the engine failed and he had no particular speed in mind at which to fly the aircraft; therefore, he was unable to make an appraisal of the aircraft's performance. In these circumstances, with his limited experience and knowledge of flying the DC.3 type on one engine, his inclination might well have been to abandon the take-off. Although this explanation of the accident is considered to be more probable than that outlined previously, there is no clear evidence of detonation to support it.

The possibility that the captain abandoned the take-off when he was informed that the starboard propeller was continuing to windmill is considered to be the most reasonable

explanation for this accident. It is based on the evidence of the first officer and two ground eyewitnesses and is not in conflict with the known facts, but the captain, naturally enough, disputes it. However, in contrast to the captain's account of the circumstances, the important detail in the original statement of the first officer substantiates this explanation except only for the first officer's belief that the starboard propeller did not feather. This belief was based on the appearance of the blades, which he could only distinguish individually with difficulty. As his observations accurately describe a propeller turning in the feathered position it is apparent that he misinterpreted what he saw.

According to the first officer the take-off was abandoned some twenty seconds after action had been taken to feather the starboard propeller. In this time with an otherwise normal aircraft, assuming feathering started at 105 knots and that the optimum speed of 90 knots was achieved and thereafter maintained, the maximum height reached would have been approximately 250 feet. At the optimum speed the nose-up attitude would be quite pronounced. Eyewitnesses' evidence indicates that there was nothing unusual in the attitude of the aircraft and that there was no marked change in direction. It is apparent that the aircraft was not flown at optimum speed and thus the height reached at the end of the 20 second period would have been substantially less than the maximum of 250 feet. In this regard the evidence of an eyewitness located a short distance from the aerodrome is significant. He stated that—

> "My attention was drawn to the aircraft by the spluttering of one of the engines. I then observed the aircraft about three-quarters of the way down the strip at a height of approximately 50 feet but I did not notice the airscrew. The aircraft was lost to sight behind the trees and when next it came into view it was just over the end of the strip just above tree-top level which would mean the aircraft was about 100 feet above the ground. At this time the starboard airscrew was rotating extremely slowly and the other engine appeared to be at full power. The aircraft was then observed to flatten off and maintain altitude for about one mile, but as from my position the aircraft was just above the tree-tops considerable anxiety was felt for the aircraft. The aircraft suddenly disappeared behind the trees."

The observations of this witness were confirmed by a companion who was with him at the time. The area in which they saw the aircraft level out is about 8,000 feet from the start of the take-off. Although the captain denies abandoning the take-off shortly after the failure to stop the starboard propeller, the evidence of the first officer strongly suggests that he may have done this. Had he done so at the time indicated by the first officer then the aircraft was in the area where it was seen to flatten out and fly for about a mile before descending from their view.

The captain's experience of flying the DC.3 on one engine was confined to conditions under which the aircraft had a positive and clearly perceptible rate of climb. His limited knowledge of the performance of this type with a windmilling propeller placed him in an awkward situation when he was informed that the starboard propeller had not feathered. To continue, as he himself pointed out in discussion, would necessitate running the port engine for an extended time at take-off power. He indicated that if under these circumstances it subsequently failed he might then be committed to a landing in unsuitable terrain with disastrous results. Without a full knowledge of the behaviour of a DC.3 on one engine, and if, as there is good reason to believe, the captain was not confident that the aircraft would maintain height with the propeller windmilling, then there was no alternative open to him but to abandon the take-off.

Air Navigation Regulation 214 requires that an airline provides a training and checking organization to ensure that its operating crews maintain their competency. Having regard to this pilot's shortcomings it would appear that this company might not have fully observed its obligations under this Regulation and that this factor may have contributed to the accident.

CONCLUSIONS

1. On 15th December, 1955, at about 1340 hours a DC.3 was involved in an emergency landing following malfunctioning of the starboard engine immediately after take-off from Bourke Aerodrome, N.S.W. The aircraft was landed in a small clearing 1½ miles north-east of the aerodrome. The ten passengers and crew of three escaped from the aircraft without injury; the aircraft was destroyed by fire.

2. The aircraft was operating under valid certificates of airworthiness and registration, and a valid maintenance release. The two pilots were properly licensed for the duties they were performing.

3. The all-up-weight on departure, approximately 24,092 lb., was within the maximum imposed by the conditions obtaining at the time, and the centre-of-gravity was within the prescribed limits.

4. The malfunctioning of the starboard engine was caused by the breakdown of a number of spark plugs at take-off power apparently because of the "build up" of metallic lead on the plug insulator surfaces.

5. Despite statements to the contrary by the pilot in command and the first officer, it is considered that the starboard propeller feathered normally, but the propeller continued to rotate under power because the pilot in command failed to take proper feathering action in that he omitted to close the throttle and mixture control.

6. There is no evidence of any defect in the airframe or the port engine, except for one spark plug from No. 8 cylinder which broke down during bench tests.

7. The pilot in command decided to carry out an emergency landing shortly after initiating action to stop the starboard engine and feather the propeller, because he believed that the aircraft was not performing adequately on one engine for the take-off to be continued safely.

8. Flight tests of a number of airline aircraft show that, under the conditions obtaining at the time of this take-off the average DC.3 should have a climb performance of 270 feet per minute with the starboard engine inoperative, the propeller feathered, the undercarriage and flaps retracted and the port engine at take-off power. This rate of climb is reduced by approximately 30 feet per minute when a propeller rotates under power in the feathered position.

9. Although the pilot in command claims that he decided to abandon the take-off because, after his attempt to feather the starboard propeller, the aircraft decelerated and lost height, it is considered that the behaviour of the aircraft as described could not be attributed solely to mechanical malfunctioning, including detonation.

10. Although no evidence of detonation in the port engine could be obtained, it has not been possible to dismiss conclusively this possibility. The deterioration in the performance of the aircraft that would have resulted from this condition could have been aggravated, if the aircraft was not handled so as to produce its optimum performance, to an extent that would make an emergency landing inevitable.

11. At the time of the accident the pilot-in-command possessed an inadequate knowledge of the performance of and the technique for flying the DC.3 type with one engine inoperative.

12. *CAUSE*: The probable cause of the accident was that the pilot, having failed to adopt the correct technique for asymmetric flight following failure of the starboard engine on take-off, abandoned the take-off in the belief that it was not possible to remain airborne.

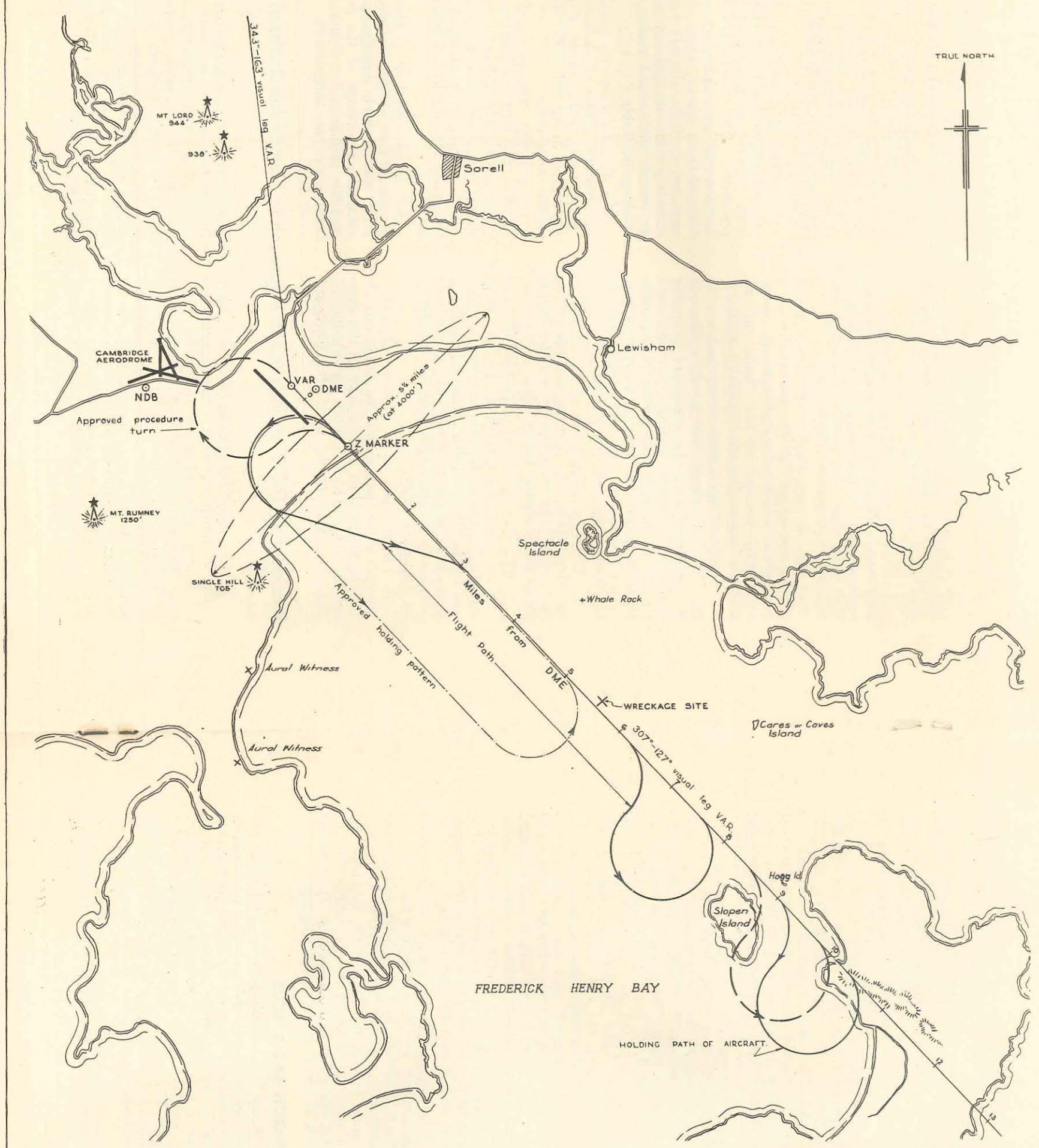
13. In his handling of the situation following failure of the starboard engine the pilot was severely handicapped by his inadequate knowledge of the performance of and the technique for flying the DC.3 type with one engine inoperative.

Accident to DC-3 on Instrument Approach to Cambridge (Hobart) Aerodrome

(6/156/2).

A DC.3 freighter arrived over the Hobart "Z" marker at 0322 hours on 12th January, 1956, after an uneventful flight from Melbourne. After holding in cloud at 4,000 feet for 11 minutes, the aircraft was cleared for an instrument descent into Cambridge (Hobart) Aerodrome. Approximately 5 minutes later the aircraft advised Hobart Air Traffic Control that the aerodrome lights were in sight and it was then cleared to land. The aircraft acknowledged, but thereafter no further communications were received from it. At 0548 hours aircraft wreckage and one survivor, the captain, were sighted in Frederick Henry Bay, seven miles south-east of Cambridge Aerodrome. The captain was picked up approximately 25 minutes later and the body of the first officer was recovered later in the day. There were no other occupants in the aircraft.

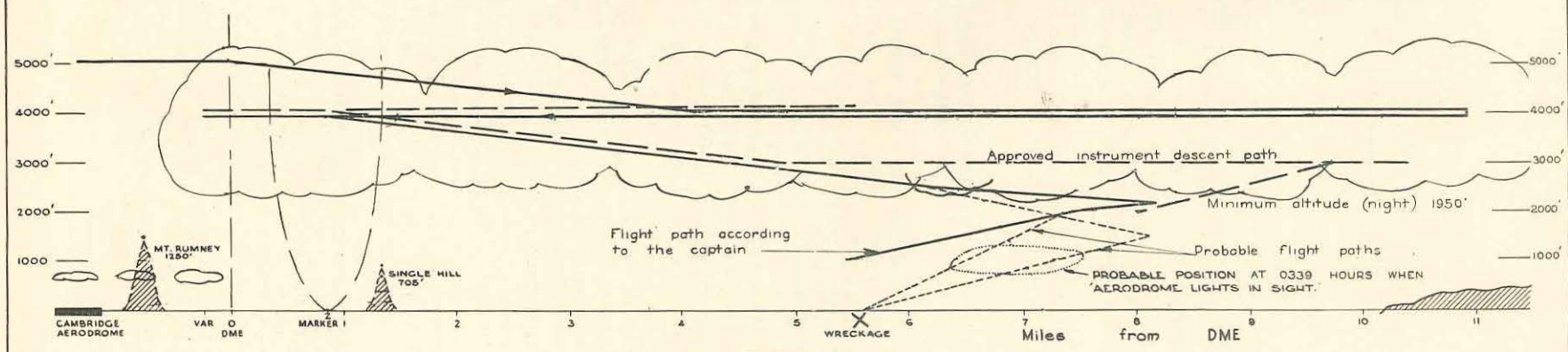
ACCIDENT TO DC3 AIRCRAFT
NEAR CAMBRIDGE AERODROME, TASMANIA
ON 12TH JANUARY, 1956



APPROVED HOLDING PATTERN ——— — ——— — ———

STANDARD DESCENT FROM 4000 FEET —— — —— — ——

DESCENT ACCORDING TO CAPTAIN OF AIRCRAFT ————————



PROFILE ON SOUTH EAST LEG V.A.R.

Note:- Vertical scale twice horizontal scale

THE CIRCUMSTANCES

The aircraft departed Melbourne Airport at 0109 hours on 12th January, 1956, for Cambridge Aerodrome on a special freight (charter) flight with a crew of two. The all-up-weight on departure was 26,200 lb. and the freight comprised 12 refrigerators and 61 cases of tomatoes. The weather forecast for Cambridge Aerodrome at the estimated time of arrival, 0333 hours, was 8/8ths strato cumulus cloud base 2,000 feet, 2/8ths stratus cloud base 1,000 feet, drizzle, visibility 4 miles and wind light and variable. This weather necessitated provision being made for an alternate and on departure from Melbourne Airport the aircraft carried sufficient fuel for the flight to Cambridge Aerodrome, holding for 26 minutes near Cambridge and then diverting to Launceston, to arrive at Launceston with a reserve of 52 minutes.

En-route to Cambridge Aerodrome the aircraft reported at the designated reporting points on schedule, and arrived over the Hobart "Z" marker at 0322 hours at an altitude of 5,000 feet. The Cambridge weather at this time was 5/8ths cloud at 1,200-1,300 feet, 8/8ths cloud at 2,000-2,200 feet and visibility 3-4 miles. Under these conditions the aerodrome was closed, the night cloud ceiling minima being 1,950 feet, and the aircraft was instructed to hold on the holding pattern at 4,000 feet on a QNH* of 1002 millibars*. Just after 0330 hours the weather improved to 8/8ths nimbo stratus cloud with a base of 2,200 to 2,400 feet and 2/8ths fracto stratus cloud in two layers between 700 and 1,400 feet and at 0333 hours the aircraft was cleared to carry out an instrument descent on the Visual Aural Range (V.A.R.), commencing from the "Z" marker. The aircraft, which was not fitted with Distance Measuring Equipment, arrived over the "Z" marker at 0334 hours and a left turn through 210° was carried out back through the marker, intercepting the south-east leg of the V.A.R. at an angle of about 30° (see plan on page 16). On passing the "Z" marker outbound the descent was commenced at 500-600 feet per minute at 115 knots with the undercarriage up. At an altitude of 2,500 feet a procedure turn to the right was commenced and the undercarriage lowered. A rate of descent of 200-300 feet per minute at 115 knots was maintained during this turn, which was completed at an altitude of 2,000 feet, at which stage the aircraft was again on the south-east leg of the V.A.R. and heading for the "Z" marker. The captain states that during the turn he "could clearly see large areas of water but no lights" and as the turn was completed "could see Seven Mile Beach but could not see the aerodrome or aerodrome lights" nor was there "any cloud between my position and Seven Mile Beach, but to remain visual I continued to descend at 1,000 feet per minute". Shortly afterwards the aerodrome lights were sighted and at an altitude of 1,000 feet he "trimmed the aircraft and adjusted power to maintain a rate of descent from 200-300 feet per minute direct towards the end of the runway". At this time, 0339 hours, the captain, who was flying the aircraft and also operating the radio, called Hobart Air Traffic Control and gave his position and height and reported that the aerodrome lights were in sight. Hobart acknowledged and advised that the rotating beacon would be switched on. The captain replied "thanks" and a few seconds later found himself underwater.

The captain surfaced some distance from the aircraft and on swimming back to it he found it floating in a nose down attitude but comparatively high in the water. There was a large hole in the nose of the fuselage and he swam in through this to search for the first officer but without success. The aircraft sank as he came out of the fuselage.

SEARCH AND RESCUE

When the aircraft had not arrived at the aerodrome by 0344 hours, i.e., approximately five minutes after the aircraft had reported having the aerodrome lights in sight, Hobart Air Traffic Control commenced calling the aircraft. No reply was received and at 0350 hours, Hobart advised Launceston Air Traffic Control Centre‡ of the circumstances and emergency procedures were introduced.

* The QNH is, briefly, the altimeter setting which if set on the sub-scale of the altimeter ensures that the instrument indicates height above mean sea level. Thus with this setting when the aircraft lands the altimeter should indicate the approximate height of the aerodrome above sea level.

* Although the instrument approach chart, current at this time, specified the minimum holding altitude as 5,000 feet the Victoria-Tasmania Region Airways Operations Instructions, Volume 2, Part 8, Section 8.4.3.1 authorized Air Traffic Control to permit holding at 4,000 feet.

‡ Launceston is the alerting centre for the Launceston Flight Information Region, which includes Hobart.

An aerial search was commenced shortly after first light and a survivor, subsequently found to be the captain, was sighted at 0548 hours and was picked up by boat at approximately 0620 hours, i.e., 2 hours 40 minutes after the accident. In the vicinity of the position in which the captain had been located, the body of the first officer was found at approximately 1000 hours

SALVAGE OPERATIONS

The wreckage was located in a position 5½ miles from the Hobart D.M.E. on the south-east leg of the V.A.R. and approximately in the centre of Frederick Henry Bay. The depth of water at this point was 50 feet.

Salvage operations were commenced on 13th January, 1956, the day after the accident, with equipment and personnel provided by the Hobart Marine Board. All the major components were recovered and these operations were completed on 18th January, 1956.

INVESTIGATION

The fuselage, with the port wing and empennage attached, was found supported on the sea bed by the undercarriage, which was extended. The starboard wing, which had broken off just inboard of the wing attachments, was found underneath the aircraft The nose section of the fuselage had broken at the rear of the forward door, across the top of the pilot's emergency exit and down the starboard side at the rear of the pilot's window. This section, attached to the fuselage by the control cables and about 2 feet of skin on the underneath side, was severely crushed and distorted and was inverted and twisted to the port side of the aircraft. Both propellers had broken from their respective engines and both engines were broken off the aircraft at their mountings.

There was no evidence of any pre-crash structural failures. Because of the circumstances surrounding the accident the wreckage was specifically examined for indications of any type of explosion. There were no signs of fire marks, flash burns, embedded or fused metal, blast tracks or bulged panels. In addition, the possibility of a refrigerator having exploded or the cockpit having become contaminated from a leak of the refrigerant was thoroughly examined. It was concluded that the design of the unit is such that it could not explode and even if the total quantity of refrigerant carried in all refrigerators had been released into the cockpit at the one time it would not have had any serious effects on the crew.

No evidence was found to suggest that the flying controls were other than serviceable at the moment of impact. It was established that the undercarriage was down and locked on impact and that the flaps were up. The instrument panel was crushed and distorted and a number of instruments was missing, in particular the mechanism of the captain's altimeter. The barometric scale of the first officer's altimeter was set to 1002 millibars. An examination of the gyroscopic instruments established that they were spinning at the time of impact and as far as it was possible to tell, there were no pre-crash defects in the pitot static system, the vacuum system or any of the instruments available for examination. It was established from an examination of the components of the automatic pilot that it was not in use at the time of the accident.

There was no evidence of any pre-crash defects in the engines. The propeller blade tips of both propellers were bent backwards and it was established from the damage to the blade gear segment teeth that the pitch settings of both propellers on impact was 24°. These settings are consistent with the engines operating at low power and the aircraft flying at a relatively slow speed.

The nature of the damage indicates that the aircraft struck the water in an almost level attitude with the wheels down and flaps up whilst flying at a relatively slow speed under low power. This configuration is substantially the same as that described by the captain as being flown immediately before finding himself in the water.

The captain, who was 32 years of age, held a first class airline transport pilot licence endorsed for a number of aircraft including DC.3 aircraft, together with a first class instrument rating for A.D.F., V.A.R. and Localiser equipment. At the time of the accident his total flying experience amounted to approximately 8,100 hours, of which over 5,000 hours had been flown as a pilot in command of DC.3 aircraft, and this total includes some 1,250 hours as pilot in command on night flying. During the five years preceding the accident he had made some 120 night landings at Cambridge Aerodrome. In the 90 days preceding the accident he had flown a

total of 200 hours all on DC.3's and had made 25 night landings. His last night landing at Cambridge Aerodrome was 26 days before the accident. Throughout his career he had satisfactorily passed each periodic flight check.

The first officer held a commercial pilot licence endorsed as a "DC.3 trainee", which permitted him to carry out the duties of a first officer on DC.3 freighter aircraft. His total aeronautical experience at the time of the accident was 360 hours, of which his experience on DC.3's amounted to 42 hours as a supernumerary pilot, 14 hours 30 minutes on dual instruction and 17 hours as a first officer.

The weather in the vicinity of Cambridge Aerodrome at the material time was—

> Visibility 3 to 4 miles; no wind; no turbulence; Cloud — 8/8ths strato-cumulus, tops 5,000 feet, base 2,500 feet with nimbo-stratus at the base of the strato-cumulus reducing the effective base to 2,200-2,400 feet; also two layers each 2/8ths to 3/8ths fracto-stratus between 700-800 feet and 1,200-1,400 feet; this low cloud was mainly over the land; drizzle and light rain around Frederick Henry Bay but no rain on south-east leg of the V.A.R. or over the aerodrome at the time of the accident.

ANALYSIS

The plan on page 16 shows the path for the references available were the coastline, the approved V.A.R. instrument approach and the path flown by the aircraft on this flight. As can be seen from this plan the approach adopted on this occasion differed from the approved procedure in certain important aspects. Notably, the inbound procedure turn was completed at an altitude 1,000 feet below the altitude specified in the approved approach procedure for the completion of that turn.

An analysis of the approach path adopted on this occasion, indicates that, although non-standard, under the circumstances it was not inherently unsafe, but there were several undesirable features in it. The more serious were that the minimum altitude was not observed during the inbound procedure turn, and, as is discussed later, the rates of descent varied and a high rate of descent was adopted when the aircraft was at a relatively low altitude.

The captain's last recollection before the impact was that the aircraft was "performing normally" and was descending at about 200-300 feet per minute at an airspeed of 100 knots and was at an altitude of 800-1,000 feet. No evidence was found to suggest that the captain could have been rendered unconscious before impact and consequently it appears that the captain's last recollection of the aircraft flying normally was immediately prior to the impact. A reconstruction of the descent described by the captain places the aircraft at approximately 1,000 feet when directly over the point of impact, yet all the evidence contradicts the possibility of any sudden loss of height. Thus, it is concluded that just before impact the aircraft was being flown approximately 1,000 feet lower than the captain believed it to be and was inadvertently flown into the water.

Particular attention was paid to the altimeters and the static system but after an exhaustive examination it was concluded that both altimeters were functioning properly and the proper barometric settings were being used at the time of the accident.

The captain stated that as the inbound procedure turn was completed, the aircraft was clear of cloud and he could clearly see the beaches (around Frederick Henry Bay) and shortly afterwards some lights on the aerodrome and the obstruction lights on Single Hill and Mt. Rumney became visible. During this stage of the flight the captain says that he was flying partly by reference to the instruments and partly by reference to external objects and that "first light had appeared to an extent which could have just permitted me to land without reference to any lights but with reference to the ground alone." He states further that he estimated his altitude visually with reference to the "beaches and Single Hill" (obstruction light). It appears from the captain's statement that, although he checked occasionally with the altimeter, he used the external references to estimate his height and was confident that his estimation was accurate, and not in disagreement with his altimeter observations.

Following this accident a flight simulating that on which the accident occurred was carried out for the purpose of examining the external visual references available to the pilots under the conditions at the time. This flight established that the only external reference available were the coastline, the

aerodrome lights and the obstruction lights. Despite the onset of first light, it was quite dark below the aircraft. It was concluded that "there was no external reference or combination of references by which the height of the aircraft could have been estimated with any degree of accuracy during the approach and any attempt to do so could have led to serious errors in the estimation of heights."

The captain states that he increased the rate of descent to approximately 1,000 feet per minute immediately on completion of the inbound procedure turn, in an endeavour to get to a height below all cloud on the remainder of the approach. During this stage of the approach he was discussing various features of the descent with the first officer and operating the radio in addition to looking outside the aircraft and reading the instruments. In these circumstances he would be able to devote limited attention to the instruments.

Tests carried out in the United States of America indicate that U.S.A.F. pilots flying solely on instruments spend an average of about 4/10ths of a second on reading the altimeter and rate of descent indicator at a time, and that this time is insufficient to ensure accurate altimeter readings, on all occasions. In these tests 11.7 per cent. of all altimeter readings were in error by 1,000 feet or more. However, on this occasion the captain was not concentrating solely on instrument flying, and between his comparatively infrequent glances at the altimeter its readings were changing at irregular rates due to the varying rates of descent; it is considered that all these factors, together with the absence of external indications of altitude, increase the possibility of error in reading the altimeter, which the U.S.A.F. tests have shown to be high under normal conditions of instrument flying.

The various tests conducted in the United States have shown that the altimeter is the instrument most frequently misread. The most common error is to read 1,000 feet too high and this occurs mostly when the sensitive hand is near zero or just below it. For example, when the altimeter is indicating 1,900 feet, the thousands hand is pointing almost directly at 2 whilst the sensitive hand is at 9. It is easy to misread this altitude as 2,900 feet, exactly 1,000 feet too high. In this accident it is significant that the captain believed he was flying at 800-1,000 feet just before impact and at approximately 2,000 feet at the conclusion of the procedure turn.

The likelihood of erroneous altimeter reading is least when the pilot is concentrating on instruments solely, i.e. in this accident up to the commencement of the inbound turn at which time the aircraft first broke through cloud. During the procedure turn, the captain's attention would have been first distracted by the lowering of the undercarriage and then by checking the increasing rate of descent and adjusting power and trim. The captain is most likely to have "lost" 1,000 feet during this turn or else during the more rapid descent following it, and it is not difficult to imagine how he could continue to misread the altimeter after making an initial error.

The pilot in command had experienced an active day prior to the accident. He was for several hours driving a tractor on farming work and was able to retire to bed for only a little more than two hours before driving 35 miles to the Melbourne Airport to undertake this flight. The possible influence of fatigue as a factor contributing to the accident cannot be overlooked.

Taking all things into account it is considered that the probable cause of the accident was the reliance the pilot in command placed on inadequate external references for his estimation of altitude and his failure to give enough attention to the flight instruments. The unorthodox approach carried out, whilst not directly unsafe in itself, lacked steadiness and precision in a way that afforded the opportunity for errors, and thereby possibly contributed to the accident.

CONCLUSIONS

1. At approximately 0340 hours on the 12th January, 1956, a DC.3 aircraft crashed into Frederick Henry Bay, 6½ miles south-east of Cambridge (Hobart) Aerodrome, Tasmania. The wreckage was located at this position in 50 feet of water.

2. At the time of the accident the aircraft was flying in darkness clear of cloud and with the aerodrome lights in sight, having just carried out an instrument approach through low cloud. It struck the water in a normal flying attitude.

3. The weather, at Cambridge Aerodrome was 8/8ths nimbo-stratus cloud with a base of 2,200 to 2,400 feet and 2/8ths fracto-stratus cloud, in each of two layers, between

700 to 1,400 feet. There was no wind, no turbulence, the visibility was 3-4 miles and it was dark; first light had started to appear behind the aircraft on its final course.

4. The aircraft was engaged on a special flight and the only occupants were the captain and the first officer.

5. The captain, who was thrown clear of the aircraft on impact and was rescued from the water some 2½ hours later, received serious injuries. Despite his injuries he swam into the sinking aircraft in search of the first officer. The first officer, who was probably rendered unconscious through injuries received on impact, was drowned.

6. The aircraft sustained major damage by impact and submersion in the salt water. Damage to other property was confined to the freight, which was also virtually a total loss.

7. The aircraft was operating under current certificates of registration, airworthiness and safety (in lieu of a maintenance release) and all maintenance records were in order.

8. All major components of the aircraft were recovered and an examination revealed no indication of malfunctioning controls, structural failure, fire or explosion.

9. On departure from Melbourne Airport the all-up-weight was less than the maximum permissible and the load was distributed so that the centre-of-gravity was well within the prescribed limits. However the pilot in command did not take reasonable steps to ensure that the load carried was, in fact, so distributed as to be safe for flight.

10. Contrary to the requirements of Regulation 159, the pilot in command failed to comply with the approved instrument approach procedure for Cambridge, as prescribed in Aeronautical Information Publication R.A.C.-2.

11. *CAUSE*: The probable cause of the accident was that the pilot in command relied on inadequate external visual references for determining the altitude and paid insufficient attention to the instruments, particularly the altimeter.

12. The irregular approach procedure carried out by the pilot in command deprived him of the opportunity to monitor the safe approach to the aerodrome through the correlation of time, height and position. This probably contributed to the accident.

Take-off Accident near Stannum, N.S.W.

(6/255/131)

SHORTLY after taking-off from an airstrip 4 miles north-west of Stannum, New South Wales, a DH.82 engaged in aerial agricultural operations crashed into rising ground.

The aircraft was one of a number of DH.82 spreading fertilizer in the area. After experiencing some difficulty with take-offs into the north-west, it took-off into the south-east, and after holding the aircraft down until the airspeed was "in excess of 65 m.p.h." the pilot commenced to climb straight ahead. At a height of about 80 feet, he completed a climbing turn to the left with full power applied and then levelled out and reduced power. At this moment a severe upward jolt was experienced as the aircraft commenced to lose height. Full power was applied and an endeavour was made to operate the dump valve release lever. As this was inoperative the normal dropping valve was opened.

By this time it was impossible to clear the rising ground and the aircraft struck a tree with the starboard mainplane and crashed into the ground.

The pilot was the holder of a commercial pilot licence with a total aeronautical experience of 2,306 hours. His total aerial agricultural experience amounted to 50 hours.

There was no evidence of pre-crash defects or malfunctioning that may have contributed to the accident.

The aircraft took-off on this flight with 448 lb. of super-phosphate in the hopper, although the maximum weight authorised was 350 lb. The all-up-weight of the aircraft was 1,945 lb., 120 lb. in excess of the maximum permissible weight as specified in its certificate of airworthiness.

The weather conditions at the time were warm and humid and there was undoubtedly some turbulence near the ground. The circumstances of the loss of height suggested that the aircraft was being operated below a safe airspeed when it encountered a downdraft which, in view of the low airspeed was of sufficient strength to cause the aircraft to lose height. As the aircraft "dropped" the pilot pulled back on the control column and in doing so placed the aircraft in a nose high attitude at such low airspeed and altitude that, despite the application of full power, the aircraft steadily lost height.

It was concluded that the probable cause of the accident was the failure of the pilot to maintain a safe airspeed under the conditions of load and turbulence.

Legal proceedings, taken against the owner for removing the wreckage without permission, resulted in a fine of £30 with costs for contravention of Air Navigation Regulation 275.

Helicopter Accident near Morehead, New Guinea

(6/455/27)

DURING an approach to land at the heliport near Morehead, New Guinea, a Bell 47D1 helicopter crashed among logs adjacent to the landing platform and sustained substantial damage. The pilot was uninjured.

The helicopter, which was engaged in supply work, departed from a dynamite supply base for Heliport F21, a distance of approximately 7 miles. The pilot, who held a commercial helicopter pilot licence, reported that the descent into the heliport was normal until, at a height of about 10 feet above the ground and just short of the landing platform, the collective pitch was raised and power applied preparatory to lowering the helicopter onto the landing platform. At this moment the helicopter fuselage turned rapidly through 90° despite the application of full left rudder. The pilot was unable to turn the helicopter fuselage back towards the landing platform and commenced to move it sideways, but almost immediately the fuselage began to rotate rapidly and he had no alternative but to lower it to the ground. The helicopter still turning touched down in a clear area 45 feet from the landing platform but bounced slightly to the right and the port pontoon struck a tree stump. The helicopter came to rest in an inverted position.

Examination of the wreckage revealed that the tail rotor gear box ball race had failed. The ball race cage on the inboard side was broken into a number of pieces, all of which were considerably distorted. In addition to being a radial bearing, the ball race holds the rotor shaft in position, i.e. acts as a thrust bearing. Failure of this race will allow the tail rotor shaft bevel gear to move out of mesh with the drive shaft pinion gear. Thus the tail rotor would be disconnected from the main rotor and directional control lost.

It was concluded that the cause of the accident was loss of directional control at a very low height when the tail rotor drive became disconnected as a result of the disintegration of a ball race in the tail rotor gear box.

The ball race and other relevant components were forwarded to the helicopter manufacturers for investigation and it was determined that the breakdown of the ball bearing assembly was due to either—

(a) the failure of the bearing cage which released the bearing balls and allowed pieces of the cage to find their way between the mating gear teeth,

or

(b) a piece of foreign metal worked its way between the mating gear teeth and produced an impact thrust which failed the bearing and its cage.

Collision with High Tension Wires

(6/156/46)

AT Thorpdale South, Victoria, a DH.82 flown by a licensed commercial pilot was engaged in spraying parathoin over a potato crop. The weather was fine and calm with unrestricted visibility when the aircraft prepared for another run across the field. However, during this run, and when in a shallow dive, the aircraft struck

high tension wires, completed a back somersault and struck the ground at an angle of about 40°. The pilot, who was the sole occupant, received serious injuries to both legs and the aircraft was rendered a total loss by impact damage.

The potato field was approximately 130 feet in length and separated from the landing field to the north by a gully. A high tension power line runs alongside the landing field and continues across the gully and passes approximately 600 feet to the west of the potato field. The height of the wires above the ground was approximately 130 feet decreasing to approximately 50 feet at a point in line with the southern boundary of the potato field. The spraying runs were made at about 5 feet above the crop and the pilot was required to continue beyond the wires before making a turn back towards the field. During these turns some 50 to 100 feet of height was gained and then a shallow dive to the required height was made. As the spraying runs continued towards the south, and the height of the wires above the ground decreased, the aircraft became closer to the wires, until they were struck at a point 75 feet above the ground.

The pilot stated that he was not aware of the existence of the high tension wires and at no stage of the flight did he see them. The power line was erected approximately two weeks prior to the accident and as the pilot had operated in the area on a number of occasions, he apparently considered that he was sufficiently familiar with the area.

It was concluded that—

(a) the cause of the accident was that the pilot, whilst engaged in authorised low level aerial agricultural operations, inadvertently flew the aircraft into high tension wires; and

(b) the presence of the wires in the area of operation was not known to the pilot because he failed to adequately familiarize himself with the area before commencing operations.

DH-82 Mid-Air Collision near Werribee, Victoria

(6/155/13)

TWO civil DH.82's, VH-RVA and VH-RVE, being used under contract to give flying training to R.A.A.F. National Service trainees, collided at a height of about 1,000 feet and crashed into a field near Werribee, Victoria. The pilots of both aircraft had been authorised to carry out periods of solo flying including side-slipping, steep turns, spins and forced landings. The pilot of VH-RVA was killed on impact with the ground and the pilot of VH-RVE received minor injuries. Both aircraft were destroyed.

The attention of a group of people was attracted by a noise above them and on looking up they saw an aircraft, with the mainplanes missing from one side, almost vertically in a tight spiral to the right. It crashed in the field shortly afterwards. The other aircraft was observed to descend, turning to the left, and crash in the same field.

The surviving pilot stated that, at the time of the collision, he was making his second consecutive practice forced landing approach from a height of 3,000 feet. At about 1,200 feet, as the aircraft came out of a steep turn preparatory to turning into wind toward the forced landing field, the pilot, "felt a bump and the aircraft yawed to the left". Immediately he found difficulty in controlling the aircraft which commenced to lose height and turn to the left. Whilst attempting to control the aircraft he noticed another aircraft crashed in a field almost below him. He attempted to carry out a forced landing in the same field but just before touching down, lost control completely, and crashed about 600 yards from the other aircraft.

Inspection of the aircraft wreckage revealed, in the case of VH-RVA a mark on the top of the leading edge of the starboard upper mainplane two feet from the wing root, consistent with its having been struck by an aircraft tyre, and a severe impact mark smeared with aircraft dope on the starboard tyre of VH-RVE. Marks on the starboard upper wing slat of the former aircraft were consistent with its having been struck by an aircraft undercarriage; there were fractures in both spars of the respective upper mainplane in line with the inboard end of the slat. It was also apparent that subsequently both starboard mainplanes failed at the wing root and folded rearwards. A further tyre mark was found diagonally across the top of the fuselage behind the

rear cockpit. It was concluded that either one or both of the aircraft had some left bank applied at the moment of impact, that the starboard tyre of one aircraft was on top of and near the wing root of the starboard mainplane of the other and the port tyre below the starboard mainplane at the inboard end of the slat, and that the "turtleback" of the lower aircraft was struck by a tyre as both aircraft momentarily maintained their line of flight after impact.

Impact damage to VH-RVE included tearing away of the lower eye end of the port radius rod and breaking of the upper fork end of the undercarriage. This allowed the port undercarriage leg to swing back after being broken and damage the port aileron cable balance and lower control lay shaft bracket. It is considered that the probabie consequent restriction on aileron movement resulted in the loss of control by the pilot. No other defects or evidence of malfunctioning which might have contributed to the loss of control were found.

Evidence suggested that the pilot of VH-RVE was making his forced landing approach into a field similar, but adjacent, to the approved forced landing ground. In view of the relatively low altitude at which the collision occurred, it is probable that the pilot of VH-RVA was also engaged on forced landing practice, possibly climbing away from an approach, and turning to the left, across wind, at the time of impact. As noted above VH-RVA had just completed a steep turn. In view of the probable flight paths both pilots were considered to have ample opportunity to see the other aircraft and take avoiding action long before the aircraft were in dangerously close proximity.

Both pilots had approximately 21 hours flying experience under instruction and 12 hours solo flying at the time of the accident, all on DH.82 aircraft. The weather was fine with unlimited visibility and a wind of 6-8 knots from the south. There were no other aircraft in the area at the time.

The cause of the accident was considered to be the failure of both pilots to maintain a proper watch for other aircraft.

Fatal Stall in DH-82

(6/355/1).

ELEVEN light aircraft taking part in a field day at Coolangatta departed from Archerfield aerodrome at 1245. The departure had been delayed due to forecasted storms in the area. Soon after their arrival at Coolangatta, a distance of 46 miles from Archerfield, the aircraft were instructed to return as storms were forecast for the area by 1600 hours.

A DH.82 carrying a pilot and a passenger departed from Coolangatta on the return flight to Archerfield. A second aircraft which departed six minutes later, flew north to Southport because of a storm on the direct route, and observed the DH.82 flying at a height of 1,500 feet. The DH.82 was seen to descend and fly at a very low height above the beach on South Stradbroke Island. The weather at the time was 5/8ths cloud with a base of 2,000 feet, but visibility was unrestricted; there was a storm situated 10 miles west of the island. After flying alongside the DH.82 and endeavouring to "wave him up and in the direction of Archerfield", because of forecasted weather deterioration, the aircraft flew off.

The pilot of the DH.82 stated that he failed to understand the signalling of the other aircraft and continued along the beach. The DH.82 then commenced a climbing left turn towards Archerfield; the pilot stated that in this turn the aircraft slipped to the left and lost height. The aircraft then stalled and crashed onto the beach. Several fishermen removed the pilot and passenger from the wreckage. The passenger received extensive head injuries and died a few minutes later; the pilot was seriously injured.

Examination of the engine and airframe disclosed no defects, maladjustments or evidence of malfunctioning.

The pilot held a current private pilot licence. His total flying experience amounted to 121 hours of which 101 hours had been flown on DH.82's.

The wind was from the north at the time of the accident and as the aircraft, which had been flying towards the north entered a climbing turn to the left it would commence to drift to the left. It is possible that the pilot was misled by the drift into believing

that the aircraft was "slipping" during the turn and that he attempted to correct this "slip". It is apparent that the pilot misused the flight controls during the turn and this resulted in the aircraft stalling.

The cause of the accident was misuse of the flight controls by the pilot during the climbing turn, possibly arising from a mistaken impression on his part that the aircraft was "slipping" during the turn.

Nose Heavy Norseman, New Guinea

(6/455/22)

THE difficulty of assessing the bearing strength of every part of the surface of a newly-constructed natural surface airstrip in the highlands of New Guinea, particularly after rain, contributed to an accident in which a Noorduyn Norseman aircraft overturned while landing at the licensed aerodrome at Ialibu.

On the day before the accident, the strip had been inspected by Departmental officers and a Class 1 Notam issued opening the strip for operations by Norseman aircraft, subject to a rainfall restriction of not more than 100 points in 24 hours. The accident occurred during the first landing after the airstrip was opened, 55 points of rain having fallen in the previous 24 hours.

The strip is orientated on a bearing of 115°T with a 2 per cent upslope to the east. Weather at the time of the accident was fine with the wind from 100°T at 16 knots. The pilot made a normal approach to land into the east and touched down slightly to one side of the centreline of the strip and some 600 feet from the western end. It has been calculated that under these conditions and assuming the surface to be "wet grass" a landing run of some 800 to 1,000 feet would have been required. However, the aircraft travelled for approximately 1,150 feet from the point of touchdown, following an oblique path toward the side of the strip when the wheels sank into soft ground and the aircraft tipped onto its back.

The pilot had omitted to compile a load-sheet for the flight on which no freight or ballast was being carried. Even with the fuel quantity giving the best weight distribution the centre-of-gravity would have been at least 7 inches in front of the permissible forward limit throughout the flight. This would make the aircraft dangerously nose-heavy in flight and on the ground. Despite the unserviceability of part of the airstrip there is a possibility that the aircraft would not have overturned had the centre-of-gravity been within the allowable limits.

The pilot had accumulated 1,785 hours up to the time of the accident, including 897 hours on Norseman aircraft in New Guinea.

The cause of the accident was that the aircraft, loaded dangerously nose heavy, encountered a soft patch on the airstrip during the landing run.

Proctor Lost in Cloud

(16/2/26)

DURING an early morning flight from Moorabbin, Victoria, to Canberra, a Percival Proctor carrying a pilot and two passengers crashed on the side of a steep, heavily timbered ridge at the head of the Dixon's Creek valley, 4½ miles E.S.E. of Kinglake, Victoria. The occupants were killed and the aircraft disintegrated on impact.

The aircraft was engaged on a private flight and prior to departure the pilot received a route forecast which indicated that the weather over the route was influenced by a south-west stream, and 7/8ths cloud, base 3,500 feet, could be expected until north of the Victorian ranges. The pilot submitted flight details for a V.F.R. flight below the controlled airspace. The aircraft was cleared to fly below 1,500 feet above the terrain. The clearance was acknowledged and no further communications were received from the aircraft.

Witnesses in the Kinglake area reported having seen the aircraft "appear out of cloud in a steeply banked attitude descending rapidly in a vertical dive". Another witness reported having heard the aircraft circling over Mt. Slide a few minutes prior to its appearance through the cloud.

An examination of the impact marks and lack of damage to surrounding trees revealed that the aircraft was in an almost vertical

dive when it struck the ground. There was no indication of engine malfunctioning that may have contributed to the accident.

The south-west stream which existed gave rise to considerable cloud on and south of the ranges and the weather in the vicinity of the scene of the accident at the material time was 7/8-8/8ths strato-cumulus base 1,500 feet, with good visibility below cloud.

It is probable that the flight was made below cloud until nearing the ranges, the highest of which is Mt. Slide, 1,600 feet above M.S.L. and 1½ miles W.N.W. of the wreckage site. The pilot was then forced to climb to clear the ranges and probably commenced flying between breaks in the clouds. However, within a few miles the breaks became smaller until finally he lost visual contact with the ground.

The pilot held a private pilot licence and had a total aeronautical experience of 138 hours of which 12 hours had been flown in command of Proctor aircraft. The aircraft was equipped with a full instrument panel but the pilot was relatively inexperienced and had had no training in instrument flying. His only course of action was to find a break in the cloud and descend as soon as possible.

It was concluded that:—

(a) The probable cause of the accident was loss of control by the pilot whilst flying in cloud resulting from his inexperience of instrument flying;

(b) A contributory cause was an error of judgment on the part of the pilot in attempting to continue the flight in conditions in which continuous visual flight became impossible.

DH-82 Take-off Accident

(6/255/81)

WHILST engaged on aerial agricultural operations a DH.82 took off and after successfully negotiating a hill immediately off the end of the strip, lost height and struck the ground. The pilot, the sole occupant, received minor injuries and the aircraft was substantially damaged.

The pilot who had limited experience on aerial agricultural operations, proceeded to "Booraig" Station aerodrome near Talbingo, N.S.W., and carried out a successful fertilizer operating flight. On the second flight, the aircraft took off into the south and after becoming airborne the pilot climbed it over a 400 feet hill immediately off the southern end of the strip. The pilot reported that as the aircraft passed over the hill with about 50-60 feet clearance, he "experienced a sudden jolt and the aircraft seemed to fall rapidly". The pilot released the fertilizer and took corrective action but was unable to prevent the aircraft losing height and it struck the ground.

"Booraig" Station aerodrome consists of two grassed runways 40 feet wide, one 1,200 feet in length running north-south and the other 1,350 feet running east-west. The terrain rises steeply within half a mile of each end of the north-south runway and within a few miles on all sides the ground rises steeply to some 3,000 feet above the aerodrome. This aerodrome does not meet the minimum requirements in respect of length, width and longitudinal grade between runway ends or approach angles as specified in the Aeronautical Information Publication.

The weather was fine with unrestricted visibility and the wind on the ground was light and variable. The all-up-weight of the aircraft on take-off was 37 lbs. in excess of the maximum permissible all-up-weight specified in its certificate of airworthiness.

The evidence revealed that after take-off the pilot attempted to climb over high terrain requiring a gradient of climb beyond the performance of the aircraft. It is considered that the accident was caused by the pilot's inexperience and lack of appreciation of the hazards which must be expected when operating amongst hills.

Mid-Air Collision at Narromine, N.S.W.

(6/255/159)

WHEN two DH.82s, VH-AVX and VH-BKO, collided almost head-on at a height of about 1,000 feet over Narromine, New South Wales, during the late afternoon, the two occupants of each aircraft were killed instantly. Immediately following the collision the aircraft crashed, about a half mile apart, into the Narromine

township. Both aircraft disintegrated on impact with the ground. No other persons were injured and the damage was confined to a small outbuilding and the roof of an hotel.

THE CIRCUMSTANCES

Aircraft VH-AVX was being flown (from Narromine aerodrome) by the chief flying instructor of the local Aero Club with a student pilot on a dual flight. Aircraft VH-BKO departed from Narromine aerodrome approximately 10 minutes later on a local private flight carrying one passenger.

Witnesses reported having observed the aircraft when they were about a half mile apart. Aircraft VH-AVX was on an easterly heading while aircraft VH-BKO was on a westerly heading with both aircraft flying straight and level at a height of about 1,000 feet. There was no apparent deviation in their flight paths and the starboard upper mainplane of VH-AVX passed between the starboard mainplanes of VH-BKO. The leading edge of the starboard upper mainplane of VH-AVX struck and dislodged the starboard interplane struts of VH-BKO and the then unsupported starboard upper mainplane of VH-BKO failed at the wing root and parted from the aircraft. Almost simultaneously the starboard lower mainplane of VH-BKO struck and dislodged the starboard interplane struts of VH-AVX.

The collision occurred over the Narromine township at a point approximately 1½ miles south-east of the aerodrome. In the impact, portions of each aircraft were torn away. Aircraft VH-BKO entered an almost vertical spiral dive, crashed onto a small outbuilding in the back yard of a house and burnt on impact with the ground. Aircraft VH-AVX entered a steep spiral dive and crashed into a minor street. A slat which became detached from the starboard wing landed on the roof of an hotel.

ANALYSIS

At the time of the collision, aircraft VH-AVX flying in an easterly direction, was probably on the downwind leg of a left-hand circuit with the intention of landing into the west-south-west. It is also probable that at the time, the instructor was giving the pupil some verbal instruction and both were concentrating on positioning the aircraft in relation to the landing path, which was on the left and consequently neither was maintaining a regular watch to the right of their aircraft. The visibility at the time was good and as the aircraft was on an easterly heading, the pilots' visibility would not have been disturbed by glare. At the angle at which the aircraft converged, the other aircraft would have been within the pilots' range of vision for at least 26 seconds, the time it took for the aircraft to close one mile.

At the time of the accident, VH-BKO was flying a mile and a half south of the aerodrome on a westerly heading. Being in the vicinity of the aerodrome, it would be expected to conform with or avoid the pattern of traffic formed by other aircraft as required by Air Navigation Regulation 143 (b). There are no special directions regarding aircraft in the circuit area at Narromine aerodrome and therefore in accordance with Regulation 143(c) the circuit pattern was to the left. Aircraft VH-BKO was being flown against this. Although the sun was at an altitude of five degrees above the horizon, and the pilot's forward vision would have been affected to a considerable degree by glare, it is considered that in view of this condition the pilot should have exercised the utmost care, particularly in the vicinity of the aerodrome.

The pilot of aircraft VH-BKO was a private pilot licence holder with a total flying experience of 48 hours, all on DH.82s of which 29 hours had been flown under instruction and 19 hours solo.

An examination of those parts of the structure, joints and attachments still intact showed that they were in a satisfactory condition, and all failures appeared new and consistent with the forces of collision or impact with the ground.

CAUSE

The cause of the accident was the failure of the pilots in both aircraft to take such precautions as would enable them to see other aircraft.

A contributory cause was that the pilot of aircraft VH-BKO flew his aircraft in the vicinity of the aerodrome against the traffic pattern in apparent disregard of Air Navigation Regulation 143.

PART IV

INCIDENT REPORTS

Near Miss during I.F.R. Descent, Rome

(6/855/63)

AN Australian Constellation aircraft en-route from Cairo to Rome was cleared for an I.F.R. descent into Rome and to report at I.K.O. N.D.B. inbound at 3,000 feet. Whilst approaching the N.D.B. southbound at 3,000 feet, the captain noticed another Constellation flying at the same height but heading north. The captain took immediate avoiding action by diving beneath the other aircraft with the result that the aircraft passed within 250 to 300 feet of each other. The other aircraft which was on a V.F.R. clearance out of Rome was obviously unaware of the danger and took no avoiding action.

The matter was referred to the Rome authorities who advised that the other Constellation was en-route Rome-Zurich and was climbing on a V.F.R. clearance. The Italian Civil Aviation Authorities follow the ICAO procedure whereby if a pilot files an I.F.R. flight plan for flight in a control area he receives separation only from other aircraft operating on I.F.R. flight plans. He is neither separated from nor advised of aircraft operating under V.F.R. clearances. Under this concept, therefore, if a pilot is operating I.F.R., but in V.F.R. conditions, he must still be on the alert for V.F.R. aircraft.

Traffic operating along controlled air routes in Australia is controlled so as to maintain positive separation between V.F.R. and I.F.R. aircraft. For the benefit of pilots on international flights, this incident is reported as a reminder of the control concepts currently in use in other countries, including Italy and the United States.

The Need for Vigilance in the Control Zone

(6/356/9)

DURING a summer evening at Brisbane airport an incident occurred which illustrates well the necessity for maximum vigilance by pilots and controllers when operating in a control zone under night visual conditions. Arriving traffic at the time consisted of two DC.4s (VH-ANC and VH-TAB) approaching Brisbane from the south, one DC.3 (VH-ANM) from the north and one Viscount (VH-TVD) from the south, and they were due to arrive in that order. Departing traffic at this time was one DC.4 (VH-EBN) bound for Sydney.

VH-ANC landed first on runway 26 without incident but VH-TAB experienced hydraulic trouble when on final approach and obtained permission to orbit south-east of the field whilst endeavouring to rectify the trouble. In the meantime VH-EBN had asked for taxying instructions and VH-ANM had reported 20 miles north of Brisbane airport. VH-EBN was given runway 08 for take-off (i.e. the reciprocal of the landing duty runway), the controller endeavouring to keep taxying distance and traffic delays for this aircraft to a minimum. VH-ANM was given No. 2 in the traffic sequence following VH-ANC and replacing VH-TAB. VH-TVD which had just reported 20 miles south of Brisbane airport was asked to report passing Archerfield, to land on runway 26 and was advised No. 2 in traffic (VH-ANC had landed by this time).

VH-EBN was cleared for take-off into the east setting course on the 125°M diversion track whilst VH-ANM from the north had

been requested to make a left circuit and land No. 1 into the west. The captain of VH-TVD omitted to report passing Archerfield and in addition made a rather wide sweep to the east of circuit area to lose height and at the same time line up on the duty runway. He did not keep the airport controller informed of this action. As VH-TVD entered the circuit area from the south-east the crew noticed VH-EBN take-off and turn climbing towards them on the diversion track. They flashed a landing light to identify their position and then turned away to the left to avoid the departing aircraft. As they did so VH-ANM on left downward leg and No. 1 to land passed immediately beneath the Viscount. Both aircraft then landed safely in the correct sequence.

This was certainly an unnecessary incident which could have had more serious results. The investigation showed that the responsibility should be borne equally by the airport controller and the captain of VH-TVD. Obviously the airport controller lost track of VH-TVD after it reported being 20 miles south of the airport and this was partly due to the omission by the captain of VH-TVD to report at Archerfield, and also his action in making a wide sweep to the east without advising the airport controller. The controller could have and should have queried the position of VH-TVD when the Archerfield report became overdue but he assumed that, since the aircraft could not be seen along the usual circuit entry track, it was not in or near the circuit. A reasonable exchange of information between the pilot and the controller could have avoided this incident.

The action of the airport controller in allowing VH-EBN to take-off in the reciprocal direction to the landing traffic was not of itself unsafe but his decision to allow the take-off in the middle of a landing sequence without full knowledge of the positions of all approaching aircraft was incorrect. VH-EBN should have been held until all arriving aircraft had landed or at least until it was positively known that the departure track would be clear of other traffic.

This incident emphasises that careful note should be made of traffic information passed by the airport controller so that each pilot can establish at least a mental picture of the traffic disposition, how it will probably develop, and where his aircraft fits into it. Keep this picture up-to-date and check it by listening to other communications traffic on the airport control frequency as you approach and operate in the airport circuit.

V.F.R. and "Visual" Approaches

OBJECTIONS have been raised by pilots holding in the vicinity of, or approaching, the destination aerodrome, to the effect that when visual flight has been established well above the landing minima and possibly without the necessity for an instrument approach, refusal has been given for a V.F.R. approach when there has been another aircraft in the area making a "visual" approach.

This situation can arise whenever the weather is such that it may be possible to establish visual flight some distance from the aerodrome but the weather at the aerodrome precludes the authorization of V.F.R. approaches. Under these circumstances the controller may permit a "visual" approach as distinct from a V.F.R. approach. That is, the pilot must be able to proceed with continuous visual reference to the terrain, and the "ground" visibility must be equal to or greater than the highest minimum prescribed for the aerodrome.

However, it should be noted that separation with all other aircraft will be based on the normal I.F.R. standards for the aerodrome unless the aircraft performing the "visual" approach can be sighted by the controller, when control may be based on visual observation. Naturally the application of I.F.R. separation standards will require other aircraft in the sequence to maintain assigned altitudes and possibly hold at an intermediate point en route to the aerodrome.

No doubt some of the confusion in the past has arisen due to the loose use of the term V.F.R. approach. In the future the terms visual approach and V.F.R. approach will be used in their proper sense.

Where you can assist A.T.C.

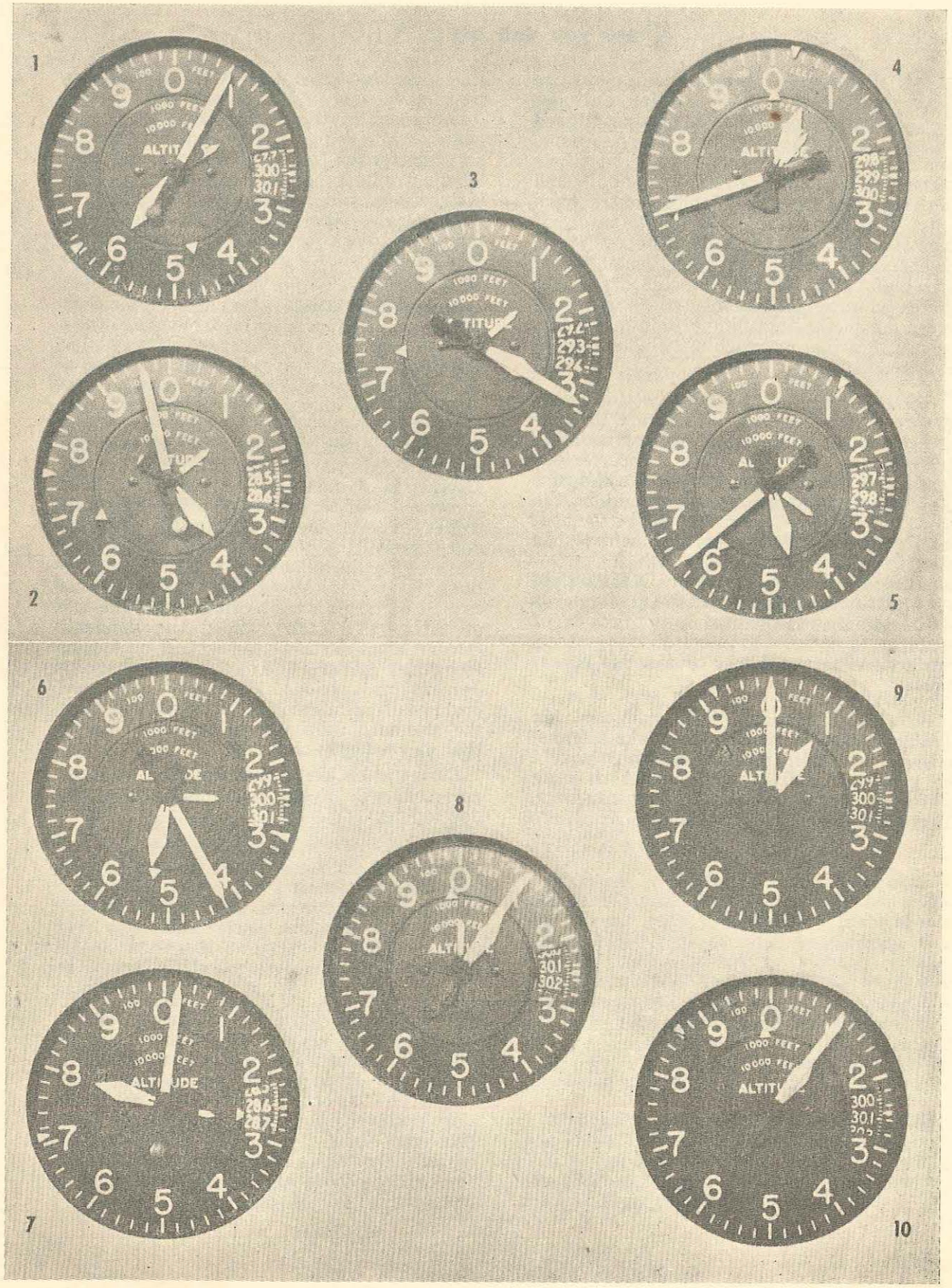
UNDER certain circumstances, pilots are required to report vacating altitudes when proceeding to a newly assigned altitude. In the past, on numerous occasions, pilots have omitted this item from their transmissions and because it has not affected the traffic situation, Air Traffic Control have not always pressed the pilot for the information. However, with the build up of traffic over recent years and the introduction of faster and high-flying aircraft capable of greatly increased rates of descent and ascent, it is becoming increasingly important that pilots report vacating, or reaching, altitudes as is required by the A.I.P.'s.

Similarly, unless otherwise notified, Air Traffic Control expect an aircraft to commence descent immediately an instruction is acknowledged by the pilot. For various reasons, a pilot may not wish to commence descent immediately; if this should be the case Air Traffic Control should be immediately advised. This aspect of control has always been important but with the introduction of separation based on DME distance — which will reduce the existing standards — immediate compliance, or notification of inability to do so, will be an absolute necessity to ensure the safety of aircraft operations.

It will be realized that whenever Air Traffic Control is required to make a transmission to obtain information which should be given voluntarily, the channel is being cluttered up with unnecessary transmissions. There are many other examples of where this question arises (e.g. VFR approaches, position reports — particularly check points — approaching the circuit area) and in an endeavour to reduce the amount of unnecessary chatter the Department is ensuring that all air traffic controllers use clear, concise instructions and where possible, standard phraseologies. It should then be unnecessary for pilots to ask for a repeat or explanation of instructions — we are attempting to alleviate the problem, the rest is up to you.

And one last point — taxying. Under peak traffic conditions airport controllers are fully occupied making the best use of available runways and taxiways. Works are in progress throughout Australia to improve facilities but no amount of organization will prevent incidents caused by pilots misunderstanding the holding point to which they are cleared and entering the runway when an aircraft is on final; or sitting on the duty runway out of communication with the controller (possibly due to flat aircraft batteries and engine RPM too low to cut in the generators) ; or the misinterpretation of instructions received on the cockpit speaker—in this case headphones were available and the use of these may have avoided the incident. Occurrences of these types are occurring frequently and any one of them might easily develop into a serious incident. All concerned could easily eliminate such hazards and raise the standard of flying safety even higher than is presently obtained.

Closer attention to matters such as those referred will avoid hazardous situations developing.


1
2
3
4
5
6
7
8
9
10