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AVIATION SAFETY DIGEST

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PART I

AVIATION NEWS AND VIEWS

Your Approach to Landing

INCIDENT and accident reports are being received at frequent intervals describing approaches in which aircraft have struck obstacles or have touched down before reaching the runway threshold or the aerodrome boundary markers. In many cases this has resulted in damage to the aircraft and in some cases there have been serious accidents or a narrow escape from a serious accident.

It is evident in a very high proportion of cases that the "undershoot" has been inadvertent but caused by some unexpected factor occurring during the final stage of the approach. It is not always so evident that the approach has been planned and carried out with adequate provision for such conditions as turbulence, subsidence, aircraft defect or any other of the many circumstances which a pilot has to meet and deal with suddenly during an approach including, of course, the possibility of his own error in judgment.

One airline pilot admitted that he planned his approach to land on the "underrun" as he knew this area was firm and smooth. This is deliberately and unnecessarily throwing away a safety factor on the approach which could be vital in the event of meeting any circumstances leading to an inadvertent or uncontrollable undershoot.

The Flight Safety Foundation in the U.S.A. has published the interesting views of the head of the flight technical department in an overseas airline on this subject. We do not completely agree with one or two of the views expressed but it is a thought-provoking article bearing directly on a problem which has assumed some significance of late in airline operations in Australia.

. . . .

Stopping Distances

While certain factors outside the pilot's control (cockpit cut-off, approach landing aids, nature and color of surrounding ground, precipitation or ice) might influence the point of flare-out and touchdown, there is little excuse for dangerously short landings under normal conditions on runways exceeding the minimum required length for the type of aircraft involved.

Consider the following information concerning stopping distances and the minimum required runway length, and if necessary amend your operation accordingly:

Minimum stopping distance is calculated as follows:

— *crossing the threshold at 50′ from a normal glidepath;*

— *crossing the threshold at* $1.3 \times V_{s_0}$

(V_{s_0} *= stalling speed in landing configuration);*

— *use of moderate wheel braking.*

The use of reverse thrust, heavier wheel braking, and crossing the threshold at a *height somewhat less than 50 feet are additional reserves in stopping shorter than the calculated minimum stopping distance. Moreover, this required stopping distance is only 60% of the minimum required runway length when landing at a terminal, and 70% of the minimum when landing at an alternate. (Note:—Australian Standard is 60% in both cases.)*

Minimum Runway Length

Every pilot should know the minimum required runway length for the type of aircraft he is flying when landing at maximum landing weight on a level runway in zero wind.

Try to keep a constant aiming point on the runway, making timely and adequate power applications to maintain it.

Actively consider wind and its effect on the rate of descent to stay on a given glidepath. Do not rely on hope rather than power and speed to make the threshold.

Pilots have been advised not to use brakes nor reverse thrust on long runways. This regulation (i.e. company instruction) was to reduce wear and tear on brakes and propeller reverse mechanism. However, increasing traffic which necessitates clearing the active runway as quickly as possible is making this regulation obsolete. Furthermore, it should never induce pilots to approach with minimum speed, and touchdown as closely as possible to the runway threshold.

Some of these remarks may seem elementary but remember that experienced pilots sometimes land too short under conditions that defy explanation.

Runway Usability

There is a distinct difference between a landing and a take-off with respect to usability of the runway. Under the following conditions the normal length of runway suitable for take-off cannot or should not be used for landing:—

- *when obstacles are situated in the approach area;*
- *when weather conditions are such that the aircraft has to remain coupled to the glidepath down to the lowest minima;*
- *when there is no suitably prepared "underrun" capable of withstanding inadvertent touchdown, or where the approach to the runway is over water.*

(Note—Threshold markings are normally positioned to allow for these factors.)

Aiming Point

A touchdown at the beginning of the concrete has its inherent dangers. Pilots should keep in mind that the approach technique with modern heavy aircraft involves an aiming point further down the runway. This point is called the "landing threshold" and is for instrument runways located in the vicinity of the ILS reference point. It is about the nearest point on the runway where an aircraft could touchdown when approaching under the present lowest weather minima.

A similar approach technique should be used under VFR conditions. In case of absolute emergency, remember that a less severe accident is likely to result from hitting an object at the up-wind end of the runway than hitting at flying speed anything at the threshold end.

. . . .

We suggest that you take some time out to critically analyse your own approach technique. Of course, you have done this many times before but have you really established the reference points which you are using during an approach, do they provide the best clues for a safe approach and is your aircraft handling technique designed to respond immediately and safely to unexpected deviations from the planned approach path?

These problems are at present being carefully examined by a number of groups in the Department and in the industry with a view to establishing safer standards and procedures. These groups have no monopoly on the ideas and we would appreciate your views on these problems, particularly where they are at variance with the practices you see being carried out from day to day around you.

Liquids in the Cockpit

SOME time ago the Flight Safety Foundation in the U.S.A. published the circumstances of an incident in a military aircraft as follows:—

"SOUP'S ON!

Recently an overwater C-97 flight with 65 passengers aboard encountered an overspeed condition on all four turbo superchargers. Fortunately, the manifold pressure was brought under control and the aircraft landed safely. 'The overspeed condition was the result of a short in the electrical circuit, caused by coffee spilled on the turbo over-ride switches. Previous to this incident, various C-97 airplanes have suffered various communications failure and mechanical malfunctions caused by coffee, fruit juices, soups, and other liquids being spilled on the control switches. Careless food handling is not only unsanitary but downright dangerous. Watch your table manners, and if you gotta eat, please be neat!' "

In case your reaction to this report is "that sort of thing only happens in the air force", "to someone else", or "in the U.S.A.", here is a report of an incident that occurred quite recently here in Australia—

"ALKASELTZER INDUCES HEAD-ACHE!

The captain of a Viscount aircraft reports that shortly after take-off, when at a height of 12,000 ft., the first officer requested a glass of Alkaseltzer from the hostess. Whilst receiving the drink, the aircraft bumped in turbulence and a very small amount of the effervescent liquid was spilt on the pedestal. The captain immediately requested a cloth but before it could be obtained one inverter switch had shorted out, blowing the fuses. The area was rapidly dried, and the second inverter was put on with similar results. As the aircraft was flying in a heavy cloud formation with moderate turbulence, a turn on to a reciprocal course was commenced whilst an effort was made to activate the standby inverter. This circuit had also been shorted out. The captain flew a reciprocal course and returned to his departure point, which was sighted through a break in the cloud, and a landing made."

This incident reveals a weakness that is present in practically all modern aircraft. Several minor incidents due to spillage in various aircraft have been reported both locally and overseas. The circuits and units most likely to be affected are those using A.C. and those D.C. control switches which are inched during normal operation. In such aircraft as the Convair 240, 340 and Douglas DC.6 it is possible to cause propeller reversing in flight by spilling liquid over the control switches in the pedestal.

There are two ways of preventing this type of incident:—

1. Shroud all switches and other equipment in the flight compartment to prevent spillage from entering the equipment, or
2. Prohibit the drinking of liquids in the cockpit—at least in turbulent conditions.

The shrouding of switches and equipment would be very complex and costly as, in most cases, special mouldings would have to be designed and produced. The alternative, whilst practical, is nevertheless a ban which is unnecessary if pilots realise the danger and take due care.

Paste These in Your Hat

The Flight Safety Foundation in the U.S.A. publish regularly accident prevention bulletins which should receive a wider circulation in this country. Since it is probable you have not seen many of these bulletins we publish here a few "snippets", some old, some new, but all of interest and value to personnel of the aviation industry.

"THE FACTS OF FLIGHT

Safety can be defined as the elimination of unwanted, unplanned events. To eliminate them we must first know that they occur.

How many 'incidents' occur but are not reported because only chance intervened to prevent damage or injury?

It is easy to recall fatal accidents resulting from lack of compliance with planned take-off or approach paths in bad weather by experienced pilots. They may have accomplished the same dangerous procedure many times in bad weather without knowing how close they came to disaster. Being unknown even to the pilot, these incidents go unreported. But if a false instrument reading or a wind shift happens to occur at such a critical time, the danger is compounded, and then an accident may occur.

We must acknowledge that pilot integrity has been a very important factor in achieving our present safety record, that even without regulations well-intentioned pilots will correct deviations from safe practices if the dangers are brought to their attention.

Suppose a pilot has been making approaches in dangerous terrain in bad weather without following established practice. He continues to feel very satisfied with his ability. But if there were some device that later showed that in, say, one out of every five approaches he was brushing dangerously close to an unseen mountain, he would stop the dangerous procedure. The near miss would be recorded before the accident occurred."

(This article in the *Bulletin* was aimed at showing the value of installing flight recorders in aircraft. This equipment is not used or projected for use in Australian aircraft but we think the article has a secondary value of nicely stating the dangers associated with your own "pet" approach procedure which is different from the standard procedure. A considerable amount of research, including flight trials in visual conditions, goes into the prescription of an instrument approach procedure. It allows for all the significant factors which might affect the aircraft during the approach and yet it is designed to give the maximum expedition consistent with the safety standards which both you and your passengers desire.

If you think an approach procedure can be improved, we would be very happy to hear your views. We do not want to record your opinion in an accident report.)

"HARD AS SPINSTER'S HEART

The increase in stage lengths of air carrier flight has introduced a new problem to pilots, namely, rough landings. Conversely at the end of short-haul trips pilots almost always make very good landings. Why?

The problem seems to lie in the eyes' indisposition to accurate distance and depth perception after relatively long periods of flying at high altitudes. There being nothing outside the cockpit for the pilot's eyes to focus on, his focal distance becomes established at a mere three and a half feet. Therefore, at the end of the trip, when the pilot comes in for his landing, this induced muscular lethargy of the eyes produces inaccurate distance and depth perception. The result: a landing you can't brag about.

On short-stage flights where altitudes are relatively low and frequent landings are made, the pilot's eyes are constantly exercised by focusing on objects first inside then outside the cockpit. The result: good landings, smooth as a . . . well, really smooth and gentle.

Pilots flying the high-up and fairly long trips recommend the following as a solution to the problem:

On your let-down to the airport and beginning at an altitude of about 1,000 feet, give your eyes some tune-up by looking back and forth from the instruments inside the cockpit to objects on the ground. Then by the time you come in over the threshold, your eyes will have 'limbered up' to give you instant and accurate depth and distance perception. The result: continued good landings.

Try it, if you've made some rough landings lately."

"LET UP ON THE LIGHT-UP

To irritate your eyes, impair your flight vision and depth perception, and reduce your altitude tolerance, take small doses of carbon monoxide. How? Just smoke! The serious effects on your system increase with dosage.

Carbon monoxide, which results from the incomplete combustion of tobacco, is the same gas that comes from an engine. Incomplete burning of tobacco puts a small percentage of CO in the smoke and whether you inhale or not, the carbon monoxide is absorbed by the blood stream in place of oxygen. If you are a heavy smoker, you can get as high as 10 per cent. CO blood saturation. It takes only 3 per cent. to cause measurable impairment of vision and altitude tolerance. With 10 per cent. saturation you are in pretty bad shape and might not be able to continue reasonably safe control of your airplane because of a throbbing headache, visual impairment, reduced power of concentration, and muscular incoordination.

Smoking just three cigarettes in a relatively short period before take-off will reduce your night vision as much as the effects of 8,000 feet of altitude.

Nicotine, another product of smoking, also causes problems. Nicotine raises your oxygen requirement by 10 to 15 per cent. It also increases your nervous instability and tires your mental processes. Night vision is reduced, and your depth perception can really get knocked off centre.

The pilot who wants to fly at optimum efficiency and safety will try to reduce his smoking, especially just before flights, and most especially before night flights."

STOP PRESS

TIGER MOTH SPINNING

Preliminary investigation of a Tiger Moth accident at Buchan, Victoria, on 7th June, 1956, discloses that after deliberately spinning for 3 turns the pilot then endeavoured to recover. A total of approximately 15 turns was completed when the aircraft crashed still spinning. It had been modified for agricultural operations.

All pilots are warned that the Certificates of Airworthiness of DH.82's modified for agricultural operations do not permit aerobatic flying, because the additional equipment installed adversely affects recovery from spins.

In all DH.82's the use of opposite aileron should not be used during spin recovery as it may also delay recovery.

PART II

OVERSEAS ACCIDENTS

DC.3 Take-off Accident: Los Angeles, California

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

(18/27/9)

A DC.3 crashed shortly after take-off from Los Angeles Airport, California. The two crew members were injured and a company aircraft inspector on board was killed.

THE FLIGHT

The aircraft was on a local test flight and soon after becoming airborne, it appeared that control of the aircraft had been lost. At a height of 15-20 feet, the right wing dropped and struck the ground, whilst the tail rose. The aircraft then veered to the right of the runway, cartwheeled over its nose, and came to rest upside down. Fire broke out a few seconds later in the forward portion of the fuselage but was extinguished within a few minutes by the fire crew.

Examination of marks on the runway showed that first contact by the right wing tip was 1,879 feet from the take-off end of runway 25R. This mark was 68½ feet long. Forty feet beyond, another wing mark started, continuing for 335 feet.

The aircraft came to rest inverted, about 950 feet from the point where the right wing tip first contacted the runway. The right wing, with its aileron and flap attached, lay on the ground in an upright position, torn from the fuselage. The entire fuselage, with its undamaged left wing and aileron attached, lay inverted. The nose section of the fuselage from the wing leading edge forward, was completely severed by impact and fire, and the cockpit area was demolished.

INVESTIGATION

The aileron trim tab control drum of the right wing was found with its cable attached to the centre of the drum and with four loops of this cable on both sides of the centre, corresponding with the control trim tab being in neutral. Similarly, the rudder and elevator control trim tabs were observed to be in neutral positions. This corresponded with their indicated positions on the control pedestal.

Examination of the control system revealed that the aileron control cable within the control column housing had been reversed. Specifically, the replacement pulleys, one aluminium and one micarta, located at the elbows of both control columns, had been transposed during assembly. The correct position of these pulleys is, aluminium pulley aft, micarta pulley forward. Over each of these pulleys passes a control cable. The ends of these cables attach to ends of a bicycle chain that runs over a sprocket attached to the shaft of the control wheel. The aforementioned pulleys being transposed, the assembly mechanic, from then on correctly following a diagram in the Overhaul Manual, fastened the cable passing over the micarta pulley to the upper end of the bicycle chain and the one passing over the aluminium pulley to the lower end of the chain. The abovementioned error resulted from the mechanic assuming that the

diagram was of the captain's left side looking forward. Although this diagram was ambiguous in that it did not illustrate graphically which wheel was depicted nor the direction from which it was viewed, instructions applicable to the diagram indicate that it referred to the co-pilot's wheel looking aft. The result was a reversed motion of the ailerons.

Before the subject flight was started, the captain made a "walk around" visual inspection of the aircraft. This type of inspection did not, and could not, reveal the abnormality in the aileron control system. Upon boarding the aircraft, the captain went through his cockpit check list. This included moving all controls to ascertain if they moved freely and fully. It did not include a check of the proper direction of control surface travel in relation to the control wheel. This latter check was not then required of flight crews. Accordingly, take-off was started with the crew unaware of the aileron system being improperly connected.

It was determined that a misinterpretation of a diagram in the Overhaul Manual by the assembly mechanic was the cause of the reversed assembly.

On July 3, 1953, four days after the accident, the operator specified that checks be made by maintenance, inspection and flight crews of not only free and full travel of controls but direction of the control surface travel relative to movement of the cockpit controls.

PROBABLE CAUSE

The Board determined that the probable cause of this accident was the reversed installation of aileron control cables and pulleys, and the failure of the inspection department to detect this mistake.

DC.3 Take-off Accident: Atlanta, Georgia

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

(18/27/37)

At about 1747 hours on the 15th June, 1954, a DC.3 crashed immediately after taking off from Atlanta Airport, Atlanta, Georgia. The crew of two, the only occupants of the aircraft, received minor injuries and the aircraft was substantially damaged.

THE FLIGHT

The aircraft was about to commence a scheduled freighter flight from Atlanta, Georgia, to Chicago, Illinois.
The aircraft was taxied to the take-off point. Upon completion of the take-off check, the captain asked the tower for permission to make a right turn after take-off in order to avoid the approaching rain shower. This request was granted and the flight was cleared for take-off.

A normal take-off was accomplished and as the aircraft became airborne, the landing gear was retracted and light rain was encountered. Before a reduction in r.p.m. was made the aircraft began to settle and the airspeed was observed to decrease rapidly from over 105 to 80 knots. The nose was lowered to level flight, the turn stopped, and full power applied. With the increased airspeed, the settling appeared to lessen considerably; however, this was only momentary, for the airspeed then dropped abruptly to 60 knots. As the aircraft continued to settle, it became obvious that it would strike the ground, and the first officer attempted to raise the nose. As the aircraft struck the ground, both throttles were closed and the aircraft skidded to a stop in a wooded area approximately 600 feet north-west of the end of the runway.

INVESTIGATION

Examination of the damaged airframe and control systems did not disclose any evidence of malfunctioning or failure prior to the accident.

At the time of take-off the surface wind was from the north-west, 7 to 10 miles per hour. The wind officially reported at 1748, only a minute or so after the accident, was from the south-west at 30 miles per hour with gusts up to 64 miles per hour. The unexpected nature of the rain shower is evident by the experience of a local light plane operator. He thought the shower of no consequence and, as a result, one of his airplanes, not tied down, was turned on its back by the strong wind and another was moved a considerable distance away. Other witnesses testified that when this rain shower was approaching the airport, it did not appear to be violent in nature and that it seemed to be like many other inconsequential summer rain showers. Witnesses near the scene of the accident at the time it occurred testified that it was raining and that the surface wind was strong and gusty from an east or south-easterly direction.

ANALYSIS

It appears from the testimony of the crew and the examination of the aircraft and engines that this was a weather accident. What seemed to the crew and others to be a light rain shower actually contained a downdraft, resulting in a localized area of strong, divergent, gusty winds at and near the surface. The aircraft's contact with this wind pattern resulted in its settling to the ground.

A theory which could explain the action of the aircraft, as described by the pilots, was that on approaching the rain shower the aircraft encountered a strong south-westerly (head) wind. As the aircraft progressed into the core of the storm the head wind abruptly ceased and changed to a tail wind as the aircraft emerged from the opposite side. This sequence of events, occurring in a sufficiently brief period of time, could explain the abrupt speed changes reported by the pilots and the subsequent settling to the ground. The final speed of 60 knots reported by the pilots was 5 knots below the stalling speed of the aircraft considering its load.

PROBABLE CAUSE

The Board determined that the probable cause of this accident was a rapid loss of airspeed immediately following take-off caused by unexpected, strong gusts or divergent winds accompanying a local rain shower.

DC.3 Approach Accident: Bristol, Tennessee

(This summary is based on the report of the Civil Aeronautics Board, U.S.A.) (18/27/17)

ON 28th February, 1954, at about 2140 hours, a DC.3 collided with a tree-top while making an instrument approach to the Tri-City Airport at Bristol, Tennessee. Recovery and pull-out was effected and the aircraft proceeded to Winston-Salem, North Carolina, its alternate. No injuries were suffered by the three crew members or the six passengers, but the aircraft was substantially damaged.

THE FLIGHT

The aircraft was on a scheduled flight from Lynchburg, Virginia to Bristol, Tennessee. The aircraft was cleared to the Tri-City Range to descend and maintain 7,500 feet and eleven minutes later was cleared for an ILS approach. Tri-City weather passed to the aircraft was ceiling 600 feet, visibility ¾ mile, light snow. The captain reported over the outer marker at 4,500 feet and advised he would circle and come over the outer marker a second time. Three minutes later approach control was advised that he was over the outer marker at 3,200 feet inbound. Three minutes later he advised he was pulling up after "hitting the ground" and requested a clearance to Winston-Salem.

En route some roughness in the port engine and smoke in the cockpit were encountered. Oil from the port engine dripping on the exhaust manifold caused smoke to enter the cockpit through the heater duct. The heaters were shut off and the smoke dissipated and the aircraft made a normal landing at Winston-Salem.

INVESTIGATION

Investigation disclosed that the aircraft contacted a tree during the approach and not the ground as reported by the crew. This tree was located on a bearing of 80 degrees, 7,500 feet from the approach end of runway 27 and 1,300 feet north, to the right, of the extension of the localizer course. The top of the tree was 319 feet below the glide path

and the upper ten feet of it was severed by the aircraft.

According to a chart in the company's flight manual two ILS approaches at Tri-City are approved (see diagram on this page):

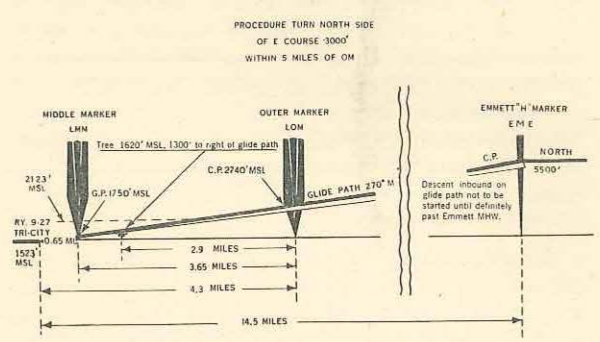
(a) Descent inbound to begin at 5,500 feet MSL from the Emmett MHW marker, which is 14.5 miles from runway 27, after a procedure turn east of the marker and north of the localizer course has been made.

(b) Descent inbound to begin at the outer marker (glide path interception altitude minimum of 2,740 feet MSL) after a procedure turn at 3,000 feet MSL outbound and north of the localizer course.

Minima

Minima for a straight-in approach to runway 27 were 600 feet ceiling and ¾ of a mile visibility. In addition to the charts in the company's manual, an excerpt from a Chief Pilot Letter gives the following instruction to all company pilots: "Glide Path Check—After the completion of the turn (procedure) the aircraft should be flown to the outer marker at the altitude specified in the ILS procedure chart for glide path interception (i.e., 2,740 feet)."

ILS GLIDE PATH SHOWING RELATIVE POSITION AND ALTITUDE OF TREE STRUCK BY D C 3



ANALYSIS

It is evident that his ILS approach was not made in accordance with the company's flight manual and the chief pilot's instructions. Both passages over the outer marker inbound were higher than the glide path interception altitude. The procedure turn outbound was 1,500 feet above the specified minimum altitude and this altitude was maintained inbound to the outer marker. The 360-degree right descending turn to 3,200 feet MSL at the outer marker did not allow sufficient time or distance to establish a stabilized course or air speed for the final approach. The second attempt to intercept the glide path was too high; therefore, the corrective action by the captain should have been to execute a missed approach procedure, or, after advising approach control, to proceed outbound again on the localizer course a sufficient distance to make his procedure turn and return inbound descending to the specified altitude. It seems probable that with the aircraft over the outer marker nearly 500 feet above the glide path the descent was steepened in an attempt to get on the glide path and the aircraft went through and below the glide path before the "pull-up" was made. According to the captain contact with the top of the tree occurred within 30 seconds after he had started his missed approach. The tree which was struck is 2.9 miles west of the outer marker and 1,300 feet to the right of the localizer course and 319 feet below the glide path. If the captain had maintained a constant air speed of 120 m.p.h. and a constant descent of not more than 535 feet per minute after passing the outer marker inbound, according to his testimony he would have been several hundred feet above the top of the tree and above the glide path. It is obvious, considering that the point of impact was 1,300 feet to the right of the localizer course, that the aircraft had deviated seriously from the intended course.

PROBABLE CAUSE

The Board determined that the probable cause of the accident was the action of the pilot in not following the approved procedures for an ILS approach, which resulted in the aircraft striking a tree.

DC.6 Propeller Reversal in Flight

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

(18/27/74)

THE ACCIDENT

A DC.6 owned by an American airline operator was being used on 4th April, 1955, by a checking pilot to complete periodic instrument proficiency checks upon two airline captains. At 1550 hours a take-off was commenced on McArthur Field, Islip, New York, and the aircraft became airborne approximately 1,500 to 1,800 feet down the runway. The take-off appeared normal, as did the initial portion of the climb, and the aircraft remained on the runway heading. When about 50 feet high, the right wing lowered and the aircraft started turning to the right, at which time the landing gear was retracting. The aircraft continued a climbing turn and the degree of bank increased to approximately vertical by the time the heading changed about 90 degrees and the aircraft had attained an estimated altitude of 150 feet. The nose dropped sharply and the aircraft dived into the ground, striking on the right wing and nose. It then cartwheeled and came to rest right side up. An intense fire started and consumed a large portion of the wreckage in spite of the prompt arrival of fire-fighting equipment on the field. The three occupants were killed in the accident.

The weather conditions at the time were fine and clear with the wind strength at 20 knots, gusting to 30 knots. The gross weight of the aircraft at take-off was approximately 61,050 pounds, which was well below the maximum permissible. The load was correctly distributed with respect to centre-of-gravity limits.

The checking pilot, 45 years of age, had 9,763 pilot hours, including 549 hours on DC.6's, and had been a check pilot for a period of 2½ years. The pilot occupying the left-hand pilot's seat at the time of this take-off was aged 40 and had 9,018 pilot hours, including 1,156 hours on DC.6's. The third pilot, whose flying experience was similar, occupied the flight engineer's seat.

INVESTIGATION

Early in the investigation, the general integrity of the fuselage, wing, and control surfaces was the subject of careful examination to determine if any malfunction or failure occurred during take-off. No malfunction or failure was indicated by these examinations. The landing gear was retracted at impact and the flaps were extended 15 to 20 degrees (normal for take-off). The automatic pilot was disengaged. All trim tabs were in place in their hinges and no evidence of failure or malfunctioning was noted. The gust lock was disengaged, and all mixture controls were found in auto rich; these positions were normal for take-off. No evidence of malfunction or failure in any of the flight control systems was found.

All four engines were severely damaged by impact and fire. No evidence of failure in operation was found in any of the engine wreckage. Examination of the propellers indicated that each engine was developing power at impact, though the degree of power output could not be ascertained.

The propeller governors were positioned for take-off r.p.m. No. 4 propeller was rotating in its normal direction at impact but in reverse pitch. The No. 4 propeller shim plates showed that it was in full reverse pitch, or minus eight degrees. Nos. 1, 2, and 3 propellers were found at 34 degrees positive pitch, normal for take-off. Examination of all four propellers disclosed no evidence of faulty operation.

Examination of all electrical units concerned with control of No. 4 propeller disclosed no evidence of operational malfunction or failure. Examination of additional items of the aircraft's electrical system failed to disclose any system malfunction. All damage observed was determined to have been caused by impact or fire after impact.

The propellers of the DC.6 airplane may be used to provide reverse thrust for braking while the aircraft is on the ground. Propeller reversal is initiated by retarding the throttles aft of the forward idle position at which time an electrical control system is activated causing the blades of the propellers to rotate within their hubs to a position wherein reverse thrust is developed. The extent of engine power and reverse thrust developed is in proportion to the extent of rearward throttle movement. The propellers are unreversed, and forward thrust is restored by returning the throttles to the forward idle position or beyond.

Whilst the aircraft is airborne a throttle latch mechanism prevents inadvertent throttle movement aft of the forward idle position and thus prevents unwanted reversal. Operation of the throttle latch is controlled by switches, on the landing gear struts, that close when the aircraft's weight is on the landing gear. This action energizes a solenoid which in turn releases the throttle latch. At the same time the reverse warning flag swings up into view on the control pedestal to show that the latch is out of the way. Mechanically linked to the solenoid, this red metal flag may be raised manually by the crew to operate the latch should the solenoid fail to operate.

When the aircraft becomes airborne the strut switches open and the solenoid becomes de-energized. The latch returns to the locked position and the flag swings down out of sight.

Approximately three years previously, the operator, concerned over the possibility of an unwanted inflight propeller reversal due to an electrical malfunction, modified the propeller control circuits of its DC.6 fleet. This modification results in the automatic removal of electrical power from the circuits controlling propeller reversal whenever the aircraft is airborne. Electrical power is restored to these circuits when the aircraft is on the ground. Removal and restoration of electrical power is accomplished automatically through the addition of a relay (known as the H-relay) controlled by switches which are in turn actuated by the throttle latch solenoid. The propeller control circuit of the subject aircraft had been so modified.

Investigation disclosed that once a propeller starts into reverse position it need not cycle completely but can be unreversed from any negative blade angle. Should the propeller become reversed due to movement of the throttle rearward past the forward idle position, while the aircraft is on the take-off run and, should the aircraft then become airborne in this configuration, the propeller may be unreversed by (1) feathering or (2) lifting the reverse warning flag and advancing the throttle. Raising the flag serves the same function as the landing gear switch when the aircraft is on the ground, i.e., the reverse control system of the propeller is again energized permitting unreversal to take place. If the flag is not lifted when the throttle is moved forward the blades will remain in reverse pitch and the amount of reverse thrust developed will depend upon the amount of throttle applied.

Within a few days following this accident the operator conducted a series of flight tests to investigate, among other things, the effects of a reversed outboard propeller upon the handling characteristics of a DC.6 at low airspeeds. These tests indicated, among other things, that in the take-off configuration with METO power or higher on No. 1, No. 2 and No. 3 engines, the aircraft almost immediately became uncontrollable when full power was applied in reverse on No. 4 engine and the aircraft speed was 100 knots or less. In this test the roll was delayed for a short time by using full opposite aileron. The violent yawing continued, however, with an attendant loss of airspeed, and within a few seconds a violent roll and pitch developed. The resulting aircraft manoeuvre closely approximated the manoeuvre which was observed just prior to this accident.

One of the most significant points developed during the tests related to the positioning of the throttle following an unintentional displacement of the throttle into the reverse range. The tests confirmed the fact that if the throttle is moved into the reverse range during a take-off run, moving the throttle back into the forward thrust range after becoming airborne will not bring the propeller out of reverse but will only result in increased thrust power. This follows since, as described earlier, the reversing circuitry is de-energized upon becoming airborne, and the propeller remains in the reverse range, in which position it was placed while on the ground. Unreversing can only be accomplished under this condition by depressing the feathering button or by raising the reverse warning flag and advancing the throttle.

In the investigation, computations were made to determine what the V1 and V2 speeds would have been for the aircraft at the time of take-off. This brought out that the V1 speed was approximately 80 knots and the V2 speed approximately 92 knots. The take-off distance, as measured, showed that the aircraft became airborne at about V2. Witnesses stated that the take-off appeared normal in all respects.

Following acquisition of DC.7 equipment and favourable operating experience with the sequence gate latch (or Martin bar) on those aircraft, the operator decided to equip its DC.6 and DC.6B with the device. In principle, it consists of a bar placed across the throttles at the idle position. It may be moved out of the way by the pilot when he wishes to pull the throttles back into reverse; when in position, it is impossible to pull the throttles back into reverse. Orders were placed for the Martin bar kits several months prior to this accident and the first DC.6 was modified about a week before the accident occurred. A company engineer testified that although the present propeller control system has functioned quite satisfactorily, the mechanical lock feature of the Martin bar (actuated by the pilot) should make it a more reliable and safer device than the previous installation (as in this aircraft), with its numerous switches, relays, and automatic operation.

Reverse thrust indicator lights were not installed on this aircraft. At the time of the accident a programme was in being to install them on DC.6's and DC.6B's. The light comes on as a warning to the pilot that a propeller is reversing when the propeller passes the zero degree blade angle.

ANALYSIS

The flight experiments showed that at take-off configuration and airspeed, the aircraft will become uncontrollable with an outboard propeller in reverse pitch and its engine operating at full power. Control will be lost so quickly that there is little, if anything, that the pilot can do if it occurs at low altitude. He must recognize what is occurring, analyse it, and take action to unreverse in a very limited amount of time. It is doubtful that unreversing could have been accomplished in this instance before control was lost. Owing to the time element, it is also questionable that propeller reversing warning lights would have been of any aid in this instance.

The tests brought out that if the throttle of the reversed propeller is at either forward or reverse idle, the engine will stall when the aircraft is airborne. There was evidence that the No. 4 engine was running at impact. The tests also showed that in order to approximate a flight path similar to that of the aircraft in this accident, full reverse power was required on No. 4 engine (with the propeller in reverse), and the other three engines developing METO power. Further, it would be a natural reaction for the pilot to move the throttle from the reverse range in an effort to unreverse. However, if the reverse warning flag were not lifted additional reverse power would continue to be delivered. These pieces of evidence lead to the conclusion that the throttle was in some position other than idle and an undetermined amount of reverse thrust was being delivered.

The reverse pitch position of the No. 4 propeller could have been the result of (1) failure or malfunction in the propeller control system, or (2) unintentional action by the check pilot in retarding the throttle too far just before becoming airborne.

Examination of all relays, switches and other components of the electrical system of No. 4 propeller failed to disclose any evidence of operational failure or malfunction. It is reasonable to conclude, therefore, that propeller reversal did not occur as a result of electrical system failure or malfunction.

Investigation showed several things which indicate an instrument take-off and simulation of engine failure. In accordance with company requirements, No. 4 was the proper engine to select for the simulated failure; this was the logical point in the check to give these two items; and the short delay at the end of the runway coincided with the practice of making a final check of all items before an instrument take-off. An instrument take-off would normally be followed by a simulated engine failure; had an instrument take-off not been made, there might be some question that a simulated engine

failure was given. These things, plus the fact that examination of the propeller control system produced nothing indicating malfunction, make it more probable that the pilot unintentionally brought the throttle too far back rather than a malfunction having occurred.

FINDINGS

Some of the findings made by the Civil Aeronautics Board arising out of its investigation were:—

1. In reducing power to zero thrust during an instrument take-off with a simulated engine out, No. 4 propeller was unintentionally reversed before the aircraft became airborne.

2. Evidence indicated that No. 4 throttle was moved out of reverse by the pilot into the forward position in an attempt to unreverse, but the reverse warning flag was not lifted, resulting in increased reverse thrust.

3. An outboard propeller on a DC.6 reversing as the aircraft becomes airborne, in conjunction with high power output of the other three engines, at take-off configuration and airspeed causes the aircraft to become almost immediately uncontrollable.

4. There was insufficient time and altitude for any pilot corrective measures to become effective.

5. The probable cause of this accident was unintentional movement of No. 4 throttle into the reverse range just before breaking ground, with the other three engines operating at high power output, which resulted in the aircraft very quickly becoming uncontrollable once airborne.

PART III

AUSTRALIAN ACCIDENTS

DH.82 Collision with Power Lines

(18/1/9)

A STUDENT pilot, with some 50 hours' experience, set out from Bankstown to carry out a solo cross country flight via Bargo, Camden, Kurrajong and return to Bankstown. On the leg Camden to Kurrajong the aircraft was observed by a number of ground witnesses to be flying at a very low altitude along the Nepean River. When just short of Kurrajong the aircraft was seen to collide with power cables spanning the river and it fell into the water and grounded a short distance downstream in the shallows. The pilot was killed on impact and the aircraft was a total loss.

The power lines at the point of collision were about 40 feet above the river level and some 10 feet below the high banks on either side. The supporting poles are some distance from the banks and were obscured by trees from the pilot's view. Since the eyewitnesses stated that the flight path of the aircraft did not perceptibly change immediately prior to the collision, it seems most likely that the pilot did not see the power lines, or only when it was too late to take avoiding action.

The evidence establishes that the pilot was engaged in low flying in contravention of Air Navigation Regulation 133 (2) (b), and it is considered that the cause of the accident was that the pilot, whilst so doing, apparently failed to see or suspect the presence of the electric power lines.

DH.82 Collides with a Tree after Take-off

(18/16/1)

SUPERPHOSPHATE spreading operations on a station, 1,900 feet above sea level were commenced in a DH.82, near Tharwa, Australian Capital Territory. Landing and take-off operations were conducted in a suitable field close to the area being top-dressed. Despite the fact that the wind strength did not exceed 4 knots the pilot elected to take-off into wind rather than along the prepared strip, which was some 45 degrees out of wind. The prepared strip was 2,700 feet in length with clear approaches but, in the take-off direction used by the pilot on this occasion, the available length was reduced to 900 feet by the presence of 50 foot trees in the south-west corner of the field.

On the second take-off the pilot looked around to ascertain the position of another aircraft just after becoming airborne and, on looking ahead again, he saw a large dead tree immediately ahead but too close to avoid a collision. After striking the tree the aircraft crashed into the field beyond, causing extensive damage to the aircraft and serious injury to the pilot.

The pilot's flying experience amounted to 561 hours, which included 369 hours on aerial agriculture operations. There was no evidence of any defect in the aircraft which may have contributed to the accident, and it was loaded within the permissible limits. The weather at the time was overcast at 3,000 feet, fine but dull, with a visibility of 10 to 15 miles.

It is apparent that the pilot made an error of judgment in the selection of his take-off path, since any advantage of this run over that along the prepared strip must have been heavily outweighed by the shortened effective length to clear the trees. Furthermore, in the direction used, the field did not meet the minimum dimensions prescribed in AIP/AGA-4.

The pilot was aware of the position of the trees (he had carried out the first take-off in the same direction), but despite this he allowed his attention to be distracted from the job in hand before he had reached a safe altitude. The pilot was also wearing tinted goggles at the time of the accident and it was considered that this would have reduced his visual acuity to such an extent, in dull conditions, that the correct estimation of distance from the dead tree as seen against the mountains in the background would have been a difficult task.

From the evidence it was concluded that:—

(a) The cause of the accident was an error of judgment in the assessment of distance whilst taking-off, due to the pilot's failure to exercise the degree of care required in the circumstances.

(b) A contributory cause of the accident was that the pilot was wearing anti-glare glasses in dull overcast conditions whilst taking-off towards a dark background. These factors undoubtedly resulted in a marked reduction in his visual acuity.

(c) In attempting to take-off from a field in a direction which did not meet the physical requirements for authorised landing grounds for DH.82 types, the pilot apparently disregarded the provisions of AIP/AGA — 4

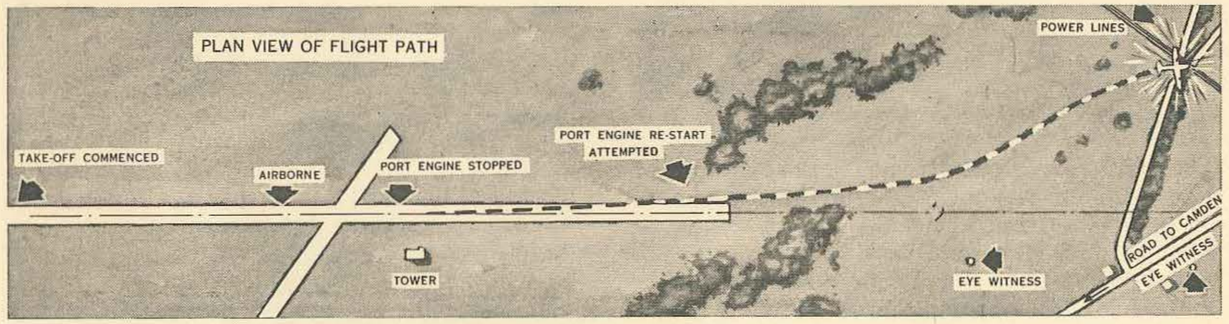
(d) In selecting a take-off path which was not the longest available having regard to the wind conditions, the pilot apparently contravened Air Navigation Regulation 236.

Fatal Accident in De Havilland Dove

(16/2/25)

SUMMARY

During training operations at the Camden aerodrome on the De Havilland Dove type, an engine failure in take-off was simulated. The aircraft, whilst operating on one engine, failed to gain sufficient height to clear obstacles in the take-off path and crashed



into a wooden pole at a point some two-thirds of a mile beyond the upwind end of the runway (see diagram of flight path).

THE ACCIDENT

Not long after a new DH.104 Dove Series 2B arrived in Australia, the owners invited the Department of Civil Aviation to allow two of its pilot examiners in Sydney to undertake licence endorsement training on this aircraft. The invitation was accepted and the training commenced under the instruction of the company pilot, who had journeyed to the United Kingdom, obtained an endorsement there and then ferried the aircraft back to Australia.

Each of the examiners completed their first periods of instruction separately and without incident. Some days later the aircraft, with the instructing pilot and both examiners aboard, left Bankstown for Camden aerodrome, where it was intended to carry out landing and take-off training in asymmetric configurations. The senior examiner occupied the left-hand pilot's seat from the commencement of the flight, with the instructing pilot in the right-hand seat and the other examiner observing the instruction and operation from a standing position immediately behind these seats. In-flight single-engine practice was carried out on the way to Camden, including a single-engine minimum control speed exercise. A normal power landing was made at Camden and the aircraft returned to the runway threshold.

It was agreed that the senior examiner would then carry out a take-off, in the course of which he himself would simulate an engine failure. The instructing pilot advised him to wait until a little height was gained in view of the rising terrain beyond the upwind end of the runway and the cockpit check was completed, including the setting of 20 degrees flap down. The runway being used was 5,333 feet in length but its effective operational length for take-off in this direction was 3,100 feet (i.e., based on a take-off gradient of 1:40). The wind strength did not exceed 5 knots and the aircraft was airborne after a ground run of some 2,100 feet.

Very soon after becoming airborne and at a height of approximately 35 feet, the senior examiner closed down the port engine and feathered the associated propeller. Speed at the time of failure simulation was probably a little in excess of 78 knots (the minimum safe speed for single-engine flight). Almost immediately the instructing pilot directed that the port engine be restarted and this was attempted, as the aircraft passed the upwind end of the runway, but without success. The aircraft, now very close to the rising ground, flew a weaving course with diminishing airspeed up the undulating slope until, at a point some 3,500 feet beyond the upwind end of the runway, it crashed through trees and struck a wooden pole carrying high voltage power cables. The aircraft fell into a cleared field beyond the pole and was wrecked. There was no fire but the senior examiner who had been undergoing instruction died of injuries soon after the accident, the instructing pilot was seriously injured and the supernumerary examiner escaped with bruises and a shaking. The sketches on page 17 detail the flight path of the aircraft in plan and in elevation.

WRECKAGE EXAMINATION

An examination of the wreckage did not reveal any defect or malfunctioning of the airframe or its associated systems and controls which could have affected the performances of the aircraft prior to the initial impact. The starboard engine, which was undamaged, was run in a test stand and subsequently examined without detecting any condition which would have prevented it developing full power. The condition of the engine and propeller indicated a strong probability that it was delivering full power at the time of the impact. The port engine could not be test run but a strip examination did not reveal any defect and the nature of damage to the associated propeller indicated clearly that, at the time of impact, it was not rotating, whilst the pitch setting was only 11 degrees from the fine pitch stop (i.e., it was not feathered).

The wreckage examination also revealed that the wing flaps were still in the 20 degrees down position and the undercarriage was still extended at the time of impact. The flap down condition corresponded with the flap selector position but the undercarriage selector was found to be in the "up" position. A careful examination of the undercarriage selector system confirmed beyond all doubt that this selector had been forced to the "up" position during the impact. It was also concluded that, during the whole of the flight prior to initial impact, it had been in the "down" position corresponding with the position of the undercarriage itself.

THE INVESTIGATION

In view of the evidence obtained in the wreckage examination it became necessary to compare the crew's handling of the aircraft with the procedures laid down by the manufacturer and to examine the performance capacities of the aircraft in the various configurations of power and undercarriage and flap position. It was determined that, from the point of power failure simulation, the aircraft would have had to attain an average rate of climb of 100 feet per minute to achieve the barest clearance over obstructions up to and beyond the point of impact. Experience has shown that, if the procedures for engine failure in take-off are correctly carried out, a rate of climb of approximately 230 feet per minute is available with full power on the "live" engine at a speed of 90-95 knots and at an all-up-weight of 8,500 lb. (maximum permissible). The all-up-weight of the aircraft at the time of the accident is estimated to have been 7,953 lb. The evidence of witnesses indicated that at the time of impact the aircraft was in a very nose-high attitude and it was travelling at or very close to the stalling speed.

The aircraft manufacturer has prescribed a procedure to be adopted in this type of aircraft when an engine fails during take-off at a speed at or above 78 knots. Since the accident, flight tests have been conducted by the Department and a new procedure taking account of the found performance qualities is being prepared. However, at the time of this accident the procedure prescribed by the manufacturer was the only guide available to the pilots, and this procedure is—

(a) retract the undercarriage and flaps and feather the dead propeller as soon as possible; and

(b) once clear of obstructions, allow the speed to increase to 90-95 knots and climb away.

It will be noted that the immediate action necessary is to "clean" the aircraft and, in the event that this is not done or is only partly done, the climb performance available in the DH.104 type is substantially reduced. It is apparent in this accident that both the flaps and undercarriage were left extended and, although the port propeller was initially feathered, it was almost immediately unfeathered and remained at a setting inducing substantial drag. It is estimated that, in the circumstances in which this aircraft was flown, neglecting "ground effect", the optimum performance which could be expected was a rate of descent of some 150 feet per minute. With this aircraft ground effect has a substantial influence on performance and since it flew close to the ground over most of the flight path it is considered that its positive climb performance on this occasion can be attributed almost entirely to this factor (see sketch of flight path).

It is apparent that it was the intention of both pilots on this occasion to leave 20 degrees of flap extended until an altitude of some 500 feet was reached. This was the customary practice of the instructing pilot, which was contrary to the procedure prescribed by the manufacturer, and was based on a misconception of the effects of both extending and retracting flap in this aircraft during take-off. Although this error would reduce climb performance it is improbable that, on its own, it would have prevented the aircraft from climbing over the obstructions.

It is probable that the failure to retract the undercarriage in this take-off was an oversight on the part of both operating pilots and it is apparent that they continued the flight in the belief that the undercarriage had been selected "up" and was retracted. Consideration was given to the peculiar characteristics of the undercarriage selector and the possibility of an abortive "up" selection having been made. However, both pilots had used this selector on a number of previous occasions without difficulty and, although this possibility could not be entirely dismissed, it is considered that a more likely explanation is that the selection action was overlooked. The factors affecting this oversight were the early engine failure simulation and the almost immediate and continuing action to restart the port engine. Neither of the surviving pilots had any clear recollection of the "up" selection having been made.

The decision to restart the port engine was made almost as soon as it had come to a stop with the propeller feathered. The instructing pilot issued the instruction when he noticed that the feathering action had been taken at about 78 knots. Although the manufacturer had laid down that this speed provided adequate directional control for single-engine flying, it is apparent that the instructing pilot considered that the speed was not safe. The decision to re-start and the actions which followed overlooked a number of important considerations.

(a) the speed at which feathering took place was safe despite the rising terrain ahead (this assumes that the undercarriage was retracted as the instructing pilot believed at the time);

(b) the additional drag induced by unfeathering the propeller would endanger the aircraft in these circumstances;

(c) at this speed and in this aircraft there was a high probability that the propeller would not rotate on unfeathering;

(d) the emergency re-start procedure (i.e., using the electric starter to initiate rotation) was not used; and

(e) this emergency procedure could not be quickly used as the energy for both unfeathering and for starting rotation are derived from the same source and both circuits are not available simultaneously.

For these reasons it is considered that the decision to restart was inadvisable and reflected the instructing pilot's limited experience on this and other types of aircraft possessing propeller feathering facilities.

In this type of aircraft the effect on the single-engine performance of having both undercarriage and 20 degrees of flap extended is so great that this accident was most likely even if the port propeller had remained feathered. The unfeathering action served only to make the accident more certain, at least to the extent that it distracted the attention of both pilots from the essential action of ensuring that the undercarriage was retracted.

CONCLUSIONS

The conclusions of the investigation included the following:—

(a) The cause of the accident was that the operating crew failed to retract the undercarriage and flaps when the port engine was stopped, thereby reducing the climb performance of the aircraft to such an extent that it was unable to avoid rising terrain in the take-off path.

(b) The pilot-under-instruction apparently forgot to retract the undercarriage and the pilot-in-command failed to rectify this omission. The probability of the subsequent correction of this omission by either pilot was lessened by the action to restart the port engine.

(c) There was apparently no intention on the part of either pilot to retract the flaps immediately following the simulated engine failure and this procedure was contrary to the instructions set down in the Pilots' Flight Manual for this aircraft type published by the manufacturer.

(d) The supervision by the pilot-in-command during this take-off was inadequate, having regard to the asymmetric performance characteristics of the aircraft type, the limited experience of the pilot-under-instruction on the type and the nature of the terrain in the take-off path.

(e) The pilot-in-command was inexperienced as an instructing pilot on multi-engine aircraft and his knowledge of the aircraft's performance characteristics and the correct handling procedure in critical configurations was not adequate for the responsibilities of instructing pilots for endorsement on this type.

OBSERVATIONS

There were a number of subsidiary but interesting factors which the investigators commented upon in relation to this accident. In the first place there was the unusual relationship between the instructing pilot and the pilot-under-instruction. The latter was a highly skilled and experienced pilot and the senior pilot examiner for the Department in New South Wales. The former was also a pilot of exceptional skill, but found himself in this role only because of his endorsement on this particular type. Nevertheless, he did not expect or even desire to attain the normal instructor/pupil relationship and he acted more as an adviser and safety pilot, allowing the senior examiner a large measure of latitude in shaping his own endorsement training. Although this situation would affect the instructing pilot's supervising methods it is considered that his responsibilities as safety pilot and as pilot-in-command could not be disregarded, especially in critical exercises and emergency situations.

Then again, the instructing pilot, whose flying experience amounted to almost 3,000 hours, had only 94 hours on the DH.104 type and negligible time on other types of modern multi-engine aircraft. His enthusiasm for this new aircraft was obvious but his practices and operating concepts reflected his short experience of the type and of aircraft in this category. Nevertheless, he was, in the terms of the Department's requirements then existing, adequately qualified to perform these duties and, furthermore, the examiners receiving instruction were fully aware of his overall and type experience. His decision to undertake this instruction work was therefore entirely reasonable. Since this accident the Air Navigation Order governing type endorsements on licences has been amended.

The decision to feather the propeller of the failed engine, rather than to set a powered condition of zero thrust, was apparently agreed by both pilots, but, nevertheless, this is contrary to the general practice in the industry for asymmetric training on twin-engine aircraft. It is considered that the decision was unwise, particularly in this type of aircraft and in the particular circumstances of this take-off. Its effect on the accident was to set a flight condition which, although safe in itself, eliminated the availability of a potent safety reserve in the event that any other factor endangered the safety of the aircraft. It is considered that this accident provides ample illustration of the advisability of not feathering in these circumstances.

Both pilots had their seat belts fastened but shoulder harnesses were not available to them. Although the provision of such harness is not mandatory, it is considered that the serious injuries sustained by the instructing pilot would have been substantially reduced if a shoulder harness had been worn. As in the majority of take-off accidents, the deceleration was not severe and the value of this equipment to the pilot, particularly during training operations, is obvious.

Finally, the investigators commented upon the fortitude of the surviving crew members immediately following the accident, and, in particular, upon the courage shown by the instructing pilot (despite his very serious injuries) and his consideration for the care of his colleagues.

DH.83 Foxmoth Overturns in Taking-off

(18/7/1)

SOME years ago, Abau, a natural grassed strip on the south coast of Papua, was restored to serviceability by the Department. The strip, 200 feet wide and 2,500 feet long, was smooth and close cut when the New Guinea Administration took over its maintenance.

Normal operations were conducted on the strip until some six months later, when a DH.83 arrived from Port Moresby with two passengers aboard. On the following morning the aircraft, carrying an additional passenger, was prepared for take-off and return to Port Moresby. The aircraft became airborne after using the full length of the strip, but it was unable to clear long grass at the western end. The airspeed dropped off and the pilot abandoned the take-off, endeavouring to land straight ahead in the long grass. After running a short distance the aircraft entered a shallow depression, slowly tipped over on to its back, and was extensively damaged. The pilot sustained minor injuries, but the three passengers escaped without injury.

The pilot, who held a senior commercial licence and had some 5,600 hours of flying experience, had used Abau strip on a number of previous occasions. There was no evidence of any defect in the aircraft which might have contributed to the accident, and its all-up-weight was less than the maximum permissible for the type.

The investigation of this accident revealed that the strip had not been maintained to the Department's standards and the current Notam information did not reflect its condition. The grass on the western end of the strip which the aircraft had been unable to clear was 5 to 6 feet high and this had reduced the usable length of the strip by some 650 feet. Similarly, long grass was encroaching on the sides and the eastern end of the strip and, even on the area which had been used for take-off, the length of the grass varied between 6 and 16 inches. The strip was immediately closed after the accident and the New Guinea Administration took steps to ensure that it was restored again and properly maintained.

The evidence of witnesses indicated that the aircraft had been virtually bounced into the air, presumably at a low airspeed, after running almost the full length of the available 1,650 feet. Since it is estimated that a DH.83 should become airborne at maximum weight in a distance of approximately 1,000 feet, it is obvious that the long grass had a substantial effect on the acceleration of the aircraft. The pilot made no particular inspection of the strip before take-off other than what he could see during the preceding landing and taxying. It should have been apparent to the pilot, at least after landing, that the strip was unsuitable for aircraft operations.

It was concluded that:—

(a) The cause of the accident was an error of judgment on the part of the pilot in attempting to take-off under the existing conditions.

(b) At the time of the accident the length of Abau airstrip, owned and maintained by the New Guinea Administration, was 650 feet less than that stated in Class 2, Notam No. 29011, and the surface, because of long grass, was unsuitable for aircraft operations.

DH.84 Crash after Take-off at Archerfield

(18/21/4)

A DH.84 Dragon took off at Archerfield aerodrome, Queensland, and after reaching a height of approximately 100 feet lost height and crashed on to a gravel taxiway 675 feet outside the south-eastern boundary of the aerodrome. The pilot had endeavoured to carry out an emergency landing on the taxiway but the starboard wing struck a mound of earth. The aircraft was wrecked by impact forces and subsequent fire. The pilot and one passenger were slightly injured, whilst the only other passenger escaped uninjured.

The pilot, who owned the aircraft, held a private licence and had some 762 hours of flying experience, including 295 hours on the DH.84 type. At the time of the accident he was setting out on a private flight to Gladstone, Queensland, via Maryborough, Bundaberg and Rockhampton, carrying two personal friends as passengers and a quantity of newspapers for delivery at various stopping points. The aircraft was loaded within its permissible limits, but there were a number of deficiencies in the manner of loading the aircraft and in the compilation of loading documents.

The pilot stated that the port engine lost power when the aircraft was over the up-wind boundary fence and, finding that height could not be maintained, he attempted to land straight ahead on the taxiway. A thorough examination of this engine failed to reveal any reason why full power was not available, but the fact that the aircraft reached 100 feet and then lost height, as was confirmed by a number of eyewitnesses, supports the pilot's statement. This type of aircraft cannot maintain height on one engine and even a partial power loss of one engine can be critical during take-off.

It was concluded that the probable cause of the accident was loss of power on the port engine during the initial climb, necessitating an immediate forced landing, but the cause of such a power loss could not be determined.

DH.82 Take-off Accident on Unsuitable Field

(18/2/11)

Whilst taking-off from a field being used as a landing area for aerial top-dressing operations, a DH.82 collided with a fence post and crashed to the ground. The aircraft was extensively damaged but the pilot was uninjured.

The landing ground comprised two relatively small fields from which part of the dividing fence had been removed, providing a gap 159 feet wide. The take-off run through this gap was 1,150 feet in length and the terrain was undulating to such an extent that the longitudinal and transverse grades exceeded the maxima permitted by the Department for an authorised landing ground. The slope up to the west and a timbered hill at the western end of the area made landings from and take-offs into the west prohibitive. At the eastern end, the approach gradient was 1 in 7½, far steeper than the permissible maximum of 1 in 30. Quite obviously, this landing ground should not have been used, being far below the requirements for an authorised landing ground as specified in AIP/AGA-4.

After carrying out a take-off and landing without any load on this ground, the pilot decided it was unsuitable for operations and prepared to take-off and look for another landing area. On this take-off the pilot stated that the aircraft carried 374 lb. of superphosphate, giving an all-up-weight of approximately 1,800 lb. (i.e., 25 lb. less than the maximum specified in its certificate of airworthiness).

For the first 650 feet of the take-off run the aircraft was aligned to pass through the centre of the gap. However, it then turned 10 degrees right and continued for a further 150 feet before becoming airborne, approximately 150 feet prior to reaching the fence line. As the ground immediately past the end of the strip sloped steeply to a creek bed the pilot was committed to staying in the air. Substantially straight and level flight was maintained until the aircraft collided with trees lining the creek.

It was concluded that:—

(a) The cause of the accident was that the pilot failed to realise that the aircraft had swung to the right beyond safe limits during take-off run.

(b) A contributory cause of the accident was the unsuitable nature of the take-off area.

Helicopter Landing Accident near Aramia, New Guinea

(18/27/27)

During an approach to land, a helicopter crashed among logs adjacent to the landing platform in heliport D26 near Aramia, New Guinea. The pilot was uninjured but the helicopter was substantially damaged.

The heliport is a cleared area some 300 feet in length and 100 feet wide, surrounded by vegetation approximately 100 feet high. A landing platform is situated near one end but the trees cut down to make the heliport were not removed from the clearing.

The helicopter departed from heliport C8 on a private flight to heliport D26, a distance of about two miles. The weather was fine with unlimited visibility and nil wind when the helicopter arrived over heliport D26. A descending right turn was made and when just short of the landing platform and at a height of about 20 feet, the forward speed was reduced and power applied to lower the helicopter on to the landing platform. Some right rudder had been applied during the descent and the pilot stated that, as he applied power preparatory to touchdown, he found that he was unable to move the rudder to the left, as is necessary to counteract the rotor torque, and the helicopter commenced turning to the right. Whilst turning to the right, the helicopter settled on to the logs adjacent to the landing platform and then rolled on to its starboard side.

The pilot was the holder of a commercial pilot licence. His total experience on conventional aircraft amounted to approximately 700 hours, and his helicopter experience was 580 hours.

An examination of the wreckage revealed no evidence of malfunctioning of the aircraft components which could have caused jamming of the rudder controls or loss of directional control. However, a can of orange juice, which had been carried in the helicopter, was located in the wreckage and found to be squashed on the sides. Further, the tail rotor control tubes had been flattened, implying that the can had jammed the tail rotor controls when the pilot applied pressure to the left rudder. The can was part of the emergency rations which were carried loosely in the nose of the helicopter and adjacent to the tail rotor control tubes.

It was concluded that the probable cause of the accident was that the pilot was deprived of effective control at a very low height when a loosely stowed item of the emergency rations jammed the tail rotor controls.

Fatal Stall in DH.82

(18/19/2)

A DH.82, flown by a commercial pilot, was engaged in spraying insecticide on a property approximately six miles north-west of Minyip, Victoria. After completing the spraying run the pilot executed a steep climbing turn to the left intending to then turn right and approach to land. However, as the aircraft was about to turn right it stalled, spun at a height of approximately 80 feet, and crashed into an open paddock. The pilot died as a result of severe head injuries.

An examination of the wreckage revealed that the control settings appeared to be normal except that the selector operating the slats was found in the locked position. As two distinct actions are required to lock or unlock the slats, it is considered that they were locked at the time of the accident and this accentuated the stall and non-recovery.

There was no apparent necessity for the pilot to carry out a steep climbing turn on completion of the spraying run and, as this was the last run to complete the spray coverage of the field, it is difficult to avoid the conclusion that the manoeuvre was undertaken solely to impress the ground watchers.

It was concluded that:—

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

(b) The pilot displayed poor airmanship in conducting the flight with the slats locked.

Power Cables Net Another Low Flying DH.82

(18/3/3)

LATE one spring afternoon a privately owned DH.82 left Wangaratta, Victoria, for a flight to another field some 10 miles away in a south-westerly direction. On board were the aircraft's owner, travelling as a passenger in the front cockpit, and the pilot.

Initially, the aircraft ascended to 500 feet on course but, soon after, descended to a very low altitude. Whilst endeavouring to pass through a narrow gap in trees bordering a road, the aircraft struck power and telephone cables and crashed to the ground. The aircraft was substantially damaged, and the passenger received minor injuries. The pilot escaped unhurt.

The pilot's flying experience amounted to some 800 hours and he had been engaged on aerial agriculture operations for several months prior to the accident.

Eyewitnesses saw the aircraft flying very low across farm properties immediately prior to the accident stampeding cattle as it went. There was no evidence or any suggestion of defect or malfunctioning of the aircraft engine, structure or controls.

The accident occurred some six miles, and on the opposite side of a range of hills, from the destination field. The area was not designated as a low flying area by the Director-General.

The weather in the area was fine and cloudless with no wind but it was noted that the time of the accident was about one hour before sunset. Since the aircraft was heading towards the south-west it is probable that the pilot's forward vision was affected by glare and it is also probable that the power cables were indistinguishable against the dark side of the range of hills which the aircraft was approaching.

It was determined that the cause of the accident was that the pilot, whilst engaged on unauthorised low flying, failed to see telephone and electric power cables in time to take avoiding action. A contributory cause of the accident was the apparent failure of the pilot to observe the requirements of Air Navigation Regulation 133(2) (b) by engaging in flight at a lower height than 500 feet above terrain outside an area designated by the Director-General as a low flying area.

As a result of the accident the pilot had to meet very heavy charges for repairs to the aircraft and to electric power installations.

Proctor Forced Landing Accident at Mordialloc

(18/19/3)

A Proctor V departed from Moorabbin aerodrome, on a private flight to Carisbrook, Victoria. Soon after take-off the engine failed and, whilst carrying out a forced landing on the Mordialloc Beach, the aircraft struck a low breakwater and came to rest in an inverted position in approximately three feet of water. The pilot received minor injuries, but the passenger was uninjured. The aircraft was extensively damaged by impact forces, by immersion in salt water and during rescue operations.

The aircraft was fitted with four fuel tanks, two tanks in the centre section and one tank in each mainplane. On the day of the accident both wing tanks were full, the starboard centre-section tank was empty and the port centre-section tank contained approximately one gallon of fuel. The engine failure which was apparently due to fuel starvation could have been caused by either of the following:—

(a) The pilot took off with both the starboard wing tank and the front centre tank selected. As the port centre section tank contained only one gallon of fuel when the the engine had been started some ten minutes previously, it could have been exhausted during the take-off, whereupon air would have been drawn into the lines and caused the engine to fail.

(b) The pilot turned off the port centre section tank immediately prior to take-off and only seconds after the tank was exhausted. As the take-off was commenced immediately after turning off this tank the fuel in the lines may have been sufficient to enable the aircraft to reach a height of 500 feet before the air in the lines reached the pumps and caused the engine to fail.

It is considered that the former alternative is more probable in this case as the pilot stated that he turned the fuel off after the accident. The wing tank selector was found to be in the off position but the centre section tank selector was found to be still selected to the port tank. Apparently the pilot intended to and believed he had turned this latter cock to the off position before commencing take-off and so, after the accident, his safety precaution of turning off the fuel supply was only related to the wing tank selector.

It was concluded that—

1. The cause of the accident was a loss of power shortly after take-off and when at a low altitude which necessitated an immediate forced landing on unsuitable terrain.
2. The probable cause of the loss of power was fuel starvation due to incorrect handling of the fuel system.

DH.84 Accident Whilst Low Flying

(16/2/20)

ON 23rd October, 1954, a DH.84 crashed, immediately after striking a tree, into Doboy Creek, a quarter of a mile south-east of Murarrie, Queensland. The pilot, who was killed, was accompanied by his two sons, one of whom was killed, whilst the other received minor injuries. The aircraft was rendered a total loss by damage sustained on impact, by submersion in salt water and by the subsequent salvage operations.

The aircraft took off from a private airstrip to scatter the ashes of a late resident over his property. The weather was fine and cloudless with a wind of 6 knots. The aircraft was observed — shortly after take-off — flying at a very low altitude. Immediately prior to the accident, the aircraft made a relatively wide circuit to the right at a height of about 200 feet. A second circuit was then commenced and during this circuit the starboard wings of the aircraft struck a dead tree and after travelling a further 80 yards crashed through the tops of mangrove trees lining the banks of Doboy Creek and came to rest in the creek.

The extensive damage sustained by the aircraft made the examination of the wreckage very difficult. However, as far as it was possible to determine there were no defects or evidence of malfunctioning of the airframe or engines.

The pilot was the holder of a private pilot licence, and his total flying experience amounted to 785 hours of which 305 hours had been flown on DH.84 aircraft.

The tree with which the aircraft first collided was about 80 feet high, devoid of foliage. Along the pilot's line of sight it would have been difficult to distinguish it from the mangrove trees lining Doboy Creek in the background. The field east of the tree was clear except for a high tension power line. The accident occurred approximately 5 minutes after the sun had set but, immediately preceding the accident, the aircraft was on a westerly heading towards the sunset. It is considered that, in view of the visibility conditions at the time, the tree would not have been readily visible until it was too late to take avoiding action.

It was concluded that:—

(a) The probable cause of the accident was that, under the circumstances affecting the visibility, the pilot, who was engaged on unauthorised low flying, was unable to see the tree.

(b) A contributory cause was the pilot's failure to observe the requirements of Air Navigation Regulation 133 (2) (b) by engaging in flight at a lower height than 500 feet outside an area designated by the Director-General as a low flying area.

DC.4 Lands at Brisbane with Undercarriage Retracted

(16/2/22)

A DC.4 carrying nine passengers and a crew of four from Sydney arrived over Brisbane Airport at about 2135 hours and was cleared for a visual approach and landing on runway 12. The weather conditions were fine with no cloud, no wind and unrestricted visibility.

At about this time the pilot-in-command instructed the first officer to carry out the approach and landing from the right hand seat, whilst he himself carried out the duties of first officer from the left hand seat. Accordingly, the first officer proceeded to call the items from the check list and on the downwind leg he called for 18 degrees of flap down and this was set by the pilot-in-command.

As the aircraft turned on to base leg, landing gear down and 25 degrees of flap down were called. The pilot-in-command inadvertently set the flap at 35 degrees and there was a brief discussion on the desirability of this setting. The first officer was satisfied to allow it to remain at 35 degrees until further flap was required but nevertheless the pilot-in-command re-set it at 25 degrees. The first officer then asked if "three greens" (indicating undercarriage down and locked) were visible and the pilot-in-command replied in the affirmative.

The final approach was made with 14-15 inches of manifold pressure and 2250 r.p.m. and full flap was lowered at the appropriate height. As the aircraft neared the runway the flare-out commenced and the first officer reduced power. Almost immediately the undercarriage warning horn sounded and the the first officer commenced to re-apply power preparatory to climbing away. At the same time he asked if "three greens" were visible and received the reply from the pilot-in-command "yes three greens visible, go ahead and land". The first officer, therefore, closed the throttles and, with the undercarriage warning horn sounding, placed the aircraft in a landing attitude. Immediately before touch down he realized that the undercarriage was not extended but at this stage it was too late to climb away. The aircraft slid to a standstill along the runway on its undersurfaces. The occupants were uninjured and quickly evacuated the aircraft.

Examination of the aircraft revealed that the undercarriage was fully retracted at the time of touchdown and a series of retraction and extension tests did not reveal any defect in the undercarriage actuation system or in the visual position indication system. However, it was found that the warning horn did not sound until the throttles had been retarded to give 10 inches of manifold pressure at 2250 r.p.m. whereas the normal setting for actuating the horn is 19-21 inches of manifold pressure at this revolution speed.

The pilot-in-command aged 45 years, held a first class airline transport pilot licence and instrument rating and his flying experience at the time of the accident amounted to 23,230 hours. The licence was endorsed for DC.3, DC.4, and DC.6 aircraft types and his command experience on DC.4 aircraft amount to some 6,000 hours. The first officer, aged 29 years, held a third class airline transport licence and second class instrument

rating whilst his total flying experience at the time of the accident was 6,250 hours, most of which had been obtained as first officer on DC.3 and DC.4 type aircraft.

It became apparent that the cause of this accident would be found in the actions of the pilots during the circuit and final approach. A number of conditions and occurrences were considered as they affected their actions and these included—

(a) The diversion of attention caused by the re-setting of flap on base leg.

(b) A recent change in DC.4 pre-landing cockpit check procedure of this Company aligning it with the DC.6 procedure so that the undercarriage is lowered on base leg with the 25 degrees flap setting.

(c) The incorrect setting of the warning horn actuating circuit.

(d) The possibility of green light reflection in the vicinity of the undercarriage position indicating lights.

It also became apparent that, from the point in the approach where the warning horn first sounded, an overshoot procedure could have been safely carried out. In other words, whatever distractions or mistakes had preceded this point the accident was still avoidable. Factors (a), (b) and (c) above may have affected the train of events but they did not cause the accident. Factor (d) was investigated and eliminated as having no bearing upon the accident.

The cause of the accident lay in the decision to go ahead and land when the warning horn sounded, without first detecting and eliminating the source of the warning. This accident also raised again the interesting question of the proper relationship between the captain and the first officer when the latter is actually flying the aircraft and also that of the responsibility of the first officer in situations of dire danger to the aircraft, apparently unappreciated by the captain. In this case the first officer's reaction when the warning horn sounded was immediate and proper but apparently the captain's reassurance on the indicator lights and his order to continue with the landing allayed the first officer's fears sufficiently to allow him to continue.

The investigators concluded that:—

(a) The cause of the accident was that the pilot-in-command believing that he had lowered and checked the undercarriage, countermanded action by the first officer to carry out a baulked approach when the audible warning sounded during the final approach to land.

(b) The reasons for the pilot-in-command's erroneous conviction that the undercarriage was extended and locked throughout the final approach to the runway have not been determined.

(c) The throttle setting for actuating the warning horn was set lower than normal but had no bearing on the accident as it sounded at a stage when the aircraft could have been easily and safely climbed away.

Auster Hits Trees Whilst Flying in Poor Visibility

(16/2/23)

An Auster J5F departed from Bankstown aerodrome on a private flight to Toogong, New South Wales, a distance of 124 miles. Approximately 45 minutes later, the aircraft crashed in heavily timbered terrain 8½ miles east-south-east of the Jenolan Caves. The pilot was uninjured but the aircraft sustained major damage.

The aircraft was being flown solo by the owner and, as he did not hold an instrument rating and the aircraft was not equipped for instrument flight, it was to be conducted under the visual flight rules. The forecast weather along the route was "8/8th cloud, base 300-400 feet about the highlands and base at times 100 feet or less in rain on western part of the route".

As the aircraft neared Katoomba, 36 miles from Bankstown, the pilot found that he was unable to continue the flight under "visual" conditions and he decided to return to Bankstown. The pilot stated that shortly after altering course, he noticed that the weather appeared better to the south, whereupon he turned on to a southerly course. After flying south for approximately 10 miles he saw a break in the cloud through which he could see the other side of the range and attempted to fly through it. Suddenly he found the cloud "closing in all round" and he decided to turn back.

However, during the turn, the aircraft entered cloud and he "eased the stick forward hoping to come out of it again". At this stage he noticed that the airspeed had increased to 160 m.p.h. and the aircraft was apparently in a spiral dive to the left. The pilot states that he stopped the turn, reduced power and by "holding a gentle back pressure on the stick" reduced the airspeed to 70 m.p.h. At this moment, the aircraft came out of the cloud heading towards and in close proximity to trees. The pilot was unable to manoeuvre the aircraft away from the trees in the space available and the aircraft crashed into heavy timber.

The pilot, although uninjured in the accident was somewhat dazed and recovered consciousness to find himself walking around in rain and fog. Being unable to determine his position he decided to return to the aircraft. After searching unsuccessfully for the aircraft for a full day, there was still considerable fog in the area which did not show any sign of clearing and so he decided to attempt to walk out. Four days after the accident, he reached Cox's River Post Office, 16½ miles east of the scene of the accident, not unduly affected by the ordeal.

When the aircraft failed to arrive at Toogong, an extensive ground air search was carried out for several days. Due to the prohibitive weather and heavily timbered terrain the search had been unsuccessful.

The pilot held a commercial licence and his total flying experience at the time of the accident was 696 hours, 515 hours of which had been flown on Auster aircraft. He had accumulated a total of 10 hours on instrument flight.

On the morning of the accident, the pilot had attempted the flight to Toogong but was forced to return because of adverse weather. In the afternoon he contacted the weather office and was advised that there would be no improvement in the weather. In view of the weather forecast and the nature of the terrain, there was quite a probability that the flight could not be completed. Although there is no suggestion that the pilot deliberately attempted flight through cloud, it is considered that he made an error of judgement in continuing the flight in very marginal conditions to a point where he could not even turn maintaining visual flight.

Due to the pilot's limited instrument flying experience, it is considered that he lost control of the aircraft shortly after entering the cloud and, although he may have reduced the airspeed from 160 m.p.h. to 70 m.p.h., it is doubtful that he had fully regained control of the aircraft when it came out of the cloud. It is considered most unlikely that he could have sustained instrument flight to a clear area.

From the evidence it was concluded that—

(a) The cause of the accident was an error of judgement by the pilot in attempting to continue visual flight in prohibitive weather.

(b) The pilots error of judgement led him into conditions of visibility which demanded a skill beyond the limits of his experience and ability and resulted in his losing control of the aircraft.

PART IV

INCIDENT REPORTS

Accidental Disengagement of Auto-Pilot

(6/355/278)

THE captain of a DC.3 on a regular service, operating under instrument flight rules with the auto-pilot engaged, vacated his seat and in so doing caught his foot on the auto-pilot selector valve handle, causing the selector to move to the "off" position. The captain was unaware that he had disengaged the auto-pilot but, fortunately, his first officer noticed it before an appreciable change in the attitude of the aircraft took place.

The possibility of a hazard arising was considered insufficient to warrant a mandatory modification. The possibility in this instance is a multiple of the chances of the captain leaving his seat, accidentally interfering with the auto-pilot selector, being unaware that he has interfered with it and the first officer not becoming aware of the disconnection of the auto-pilot in a relatively short time.

However, the attention of all operators has been drawn to the possibility of such happenings and it has been suggested that, if similar trouble continues, steps should be taken to modify selector handles by reducing the length of the arms or by installing a suitable guard in order to prevent inadvertent movement.

Be Careful with D.M.E. Distance Reporting

(6/155/411)

A DC.3 passenger aircraft departed from Adelaide at 2002 hours for Nhill and Melbourne. The initial cruising altitude was 6,000 feet but 37 minutes after departure, Melbourne A.T.C. requested Adelaide to have the aircraft descend to 4,000 feet by 2048 hours so that its descent into Nhill would not be delayed by confliction with a DC.4 aircraft proceeding Melbourne to Adelaide at 5,000 feet.

Co-ordination between the two A.T.C. centres was not good in that the suggestion from the Melbourne centre was received in Adelaide too late for action to be taken before the DC.3 and DC.4 were so close that the altitude change could not be permitted. This circumstance was not made known to the Melbourne controller.

At 2047 hours the DC.3 reported position to Melbourne via Nhill aeradio and this report was received by the Melbourne controller as "42 miles from Nhill, requesting descent from 40." He immediately assumed that his previous suggestion had been adopted and that the DC.3 was at 4,000 feet requesting a descent clearance into Nhill. The clearance was given and only later was it discovered that the figure "40" in the aircraft's request referred to 40 miles and not to 4,000 feet. The DC.3 at that time was at 6,000 feet and the descent was made through the flight level of the DC.4 with less than the prescribed minimum separation.

As the communication circuits used on this occasion are not recorded it is not possible to trace the origin of the ambiguity in the message which misled the Melbourne controller. It may have originated in the aircraft but since the message passed through two communication officers before reaching the controller it could conceivably have been distorted in transit. In any event the prime purpose of incident investigation is not to fix the blame on any person but to detect and eradicate conditions which might lead to an accident.

The lesson is quite clear in this case and it has equal application to pilots, communications officers and controllers. Aircraft reports must be originated and passed in clear terms and in accordance with the prescribed principles for message phrasing (see AIP/-RAC 1-8-5; paragraph 4.20). In this case the addition or retention of the word "miles" after 40 would have eliminated an ambiguity which could have had more serious results.

Homing Heron Goes Astray

(6/255/333)

SUMMARY

At 1658 hours one afternoon in October last year a DH-114 Heron aircraft departed from St. George in Southern Queensland for Sydney, N.S.W. It was due at Sydney at 1935 hours (i.e. 87 minutes after last light) but, shortly before this time, the pilot indicated that he was unsure of his position and, with the aid of ground services, it was soon established that the aircraft was over the sea some 40 miles north-east of Sydney. The aircraft located the northern leg of the Sydney V.A.R. and landed at Sydney at 2013 hours (i.e. 38 minutes after E.T.A.).

THE INCIDENT

The authorised route for this flight is via Collarenebri, Walgett and Lithgow to Sydney (see chart on opposite page). Nevertheless, the pilot planned and set out to conduct the flight without overflying Walgett and Lithgow. Not only was this contrary to the terms of the airline licence but it involved a flight of 385 miles with absolutely no navigation aids other than abeam bearings from isolated commercial radio stations or NDB's and an NDB at the destination. There was also a VAR available at the destination but the flight planned direct route did not provide for an interception on either of the two courses available. If the flight had proceeded as per the airline licence the aircraft would have been able to "home" on the Lithgow NDB (60 miles west of Sydney) and also intercept the western leg of the Sydney VAR, and it is because of these facilities for position fixing that Lithgow is specified in the airline licence as an air position. The forecast indicated that, at the flight planned altitude of 7,500 feet, the flight would be conducted on top of cloud. Furthermore it was carried out for 50 minutes before sunset and was flight planned to arrive at Sydney 107 minutes after sunset, yet the pilot apparently did not appreciate the need to fly over the radio stations and NDB's along the specified route, to reduce the margin for error introduced by "night-effect".

The heading to be flown from St. George to overfly Collarenebri was calculated correctly (169°M) but from the flight record it appears that a heading of 164°M was flown (i.e. 5° to port) which would have positioned the aircraft about 7 miles east of Collarenebri. Apparently the aircraft did not pass over Collarenebri for the flight record indicates that the position was abeam. From this position a heading was flown which had been computed using the direct track from over Collarenebri to Sydney. However, the computations were incorrect in that a heading of 138°M was computed when the heading should have been 143°M (i.e. the heading flown was 5° to port of that required to make good the intended track). Also, the magnetic track shown on the flight plan was 142°M when the average magnetic track is actually 143°M i.e. a further error of 1° to port. Therefore, the heading flown from Collarenebri for Sydney direct was approximately 6° port of that required, and when it is realized that a stage length of 297 miles was involved the error at destination would be approximately 30 miles.

A visual fix was obtained at Collarenebri but from this position until over Sydney the aircraft was either in or over cloud. After flying approximately 123 miles the aircraft passed abeam of the first available aid to navigation—a commercial radio station at Gunnedah approximately 17 miles abeam of track. The pilot was unable to obtain a bearing and presumed that the ADF equipment was unserviceable, but it is more likely that

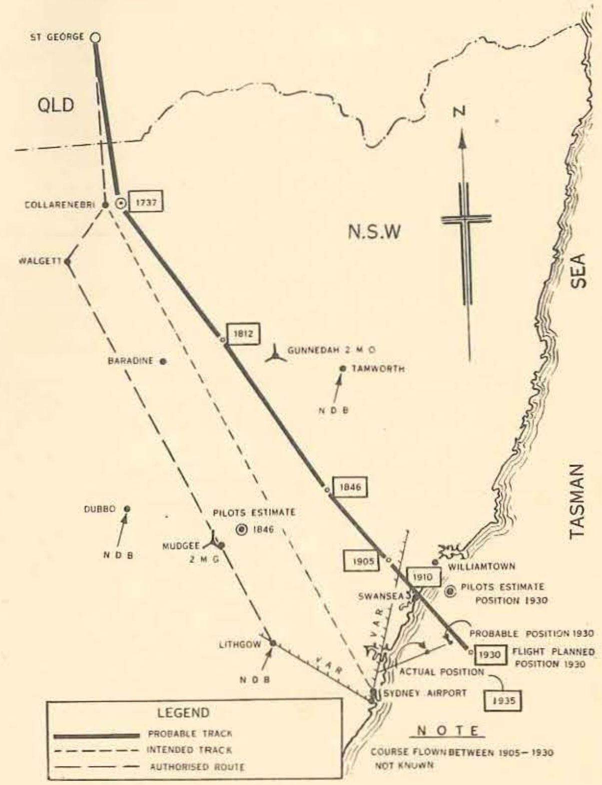
the cause was "night effect" as the time was some 15 minutes after sunset. The pilot did not log or employ any bearings from the NDB's at Tamworth or Dubbo.

After flying some 183 miles beyond Collarenebri the aircraft was abeam of Mudgee commercial radio station which was the next available navigational aid. The pilot, despite his belief that the ADF was unserviceable, attempted to obtain a position by a timed rate of change of bearing. On the basis of this timing he decided his position was 15 miles abeam of Mudgee, whereas if he had been on track he should have been 37 miles abeam. This method of obtaining a fix is purely approximate under the best of conditions and is normally used as a check on navigation, not as its basis. The pilot already had doubts as to the serviceability of the aircraft ADF equipment, yet he was prepared to accept this position to the extent of altering heading by 10 degrees port. It is considered that by altering heading to rejoin the direct track on which there were no navigational aids the pilot displayed poor airmanship. If the aircraft had been in the position calculated by the pilot—15 miles north of Mudgee—it would have been a far wiser policy to have altered course for Lithgow some 65 miles distant where it would have been possible to "home" on the NDB and also intercept the western aural leg of the Sydney VAR.

Nevertheless the flight was continued in instrument conditions on what the pilot thought was the direct track. Five minutes before ETA abeam of Lithgow the pilot states that he switched on the aircraft VAR and received yellow N indications which he treated as being ridiculous as this meant the aircraft had passed abeam of Lithgow and was over, or east of the coast north of Sydney. On the information available it is most likely that this was the aircraft's position for it would only have required the aircraft to have been 6 minutes early on flight plan to have been in a position where yellow N signals could have been received. The pilot apparently maintained his current heading and on ETA abeam of Lithgow (5 minutes later) reported his position as abeam of Lithgow by dead reckoning. This position was queried by air traffic control, and the pilot reported that his radio compass was unserviceable. As it is estimated that the aircraft was some 75-80 miles distant from Lithgow it is possible that under the prevailing conditions it was beyond the range of the aircraft ADF. At this stage of the flight the pilot apparently made no attempt to utilize the high-powered NDB at Sydney, which, under the prevailing conditions, could be expected to have had a range of approximately 100 miles and certainly 60 miles, which was about the distance of the aircraft from Sydney.

On receipt of the information that the aircraft radio compass was unserviceable air traffic control instructed the aircraft to join the aural leg of the Sydney VAR. This message was passed to the aircraft at 1922 hours which was 3 minutes after air traffic control became aware of the alleged unserviceable ADF and 12 minutes after the aircraft's D/R position abeam of Lithgow. This time lapse was due to difficulty in communicating with the aircraft which, as it is now known, was endeavouring to use VHF beyond the workable range of the equipment. Due to these communication difficulties contact with the aircraft was not made again until seven minutes later — 1929 hours — and at 1930 hours it was established that the last positive fix the pilot had obtained during the flight was Collarenebri. On receipt of this information

Flight Path from St. George to Sydney



air traffic control considered that an emergency situation existed. Action was taken to set up a plot and Williamtown RAAF radar was requested to search for the aircraft.

At 1930 hours the pilot reported that he had fixed his position as 10 miles east of Swansea (60 miles north-north-east of Sydney) by radio compass using Sydney and Belford NDB's. At 1933 hours air traffic control requested information as to whether the aircraft had at any time received the Sydney VAR and at 1934 hours the pilot reported that the aircraft was in the yellow N sector. This was the first time the pilot had intimated this fact to air traffic control despite the fact that he had been receiving these indications for 29 minutes. The aircraft was instructed to intercept the northern visual leg of the VAR and to accomplish this a heading of 225°M was flown. It is estimated that when this instruction was given at 1935 hours the aircraft's position was 40 miles north-east of Sydney (see chart).

The RAAF radar at Williamtown was unable to locate the aircraft and at 1945 hours it was requested to set up VDF on 119.7 mc. (the frequency then being used by the aircraft). At 1949 hours the first bearing was obtained on the aircraft which placed it on the on-course of the VAR about 12 miles north of Sydney. At the same time the pilot reported receiving the on-course of the VAR. At 1958 hours the aircraft passed over the range site, still in cloud, and was then permitted to descend, a landing being made at 2013 hours.

CONCLUSIONS

It was concluded that—

(a) The cause of the incident was that the pilot-in-command failed to exercise sufficient care in the navigation of the aircraft.

(b) A contributory cause of the incident was the initial error in the flight plan computations.