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PART I

AVIATION NEWS AND VIEWS

Crewmanship – A Veteran Pilot's Views

(Because of its general interest the following article is reproduced from Pilot's Safety Exchange Bulletin 54-109, issued by the Flight Safety Foundation, New York, U.S.A.)

NOT long ago I visited the scene of a major air accident. The positions of the radio receivers and the heading on which the aircraft struck indicated that some confusion as to the proper approach procedures had contributed to the accident.

"Since about half of my ten thousand hours has been spent as co-pilot and half as captain, I tried to visualize what went on in the cockpit just prior to the crash. My assumptions are based upon the hundred or so captains I have co-piloted for and an equal number of co-pilots I have had with me.

"In the first place, it was definitely determined that the captain was flying the ship at the time of the accident. In most accidents I have been familiar with, the captain was at the controls at the time of the crash. In this case, the co-pilot either did not see the error or else he saw it and remained silent.

"Incredible, you say? A co-pilot saw an accident coming and didn't say anything? Let's create an imaginary accident and see if this is possible.

"Iron-Butt" Captains

"Captain Doe is a very fine pilot — one of the best. Among the other captains he rates the tops in respect to his knowledge, ability and judgment. The co-pilots all agree to these fine pilot characteristics, but they also add that he's an 'iron butt'. Every airline has several of these 'iron butts'; they are the captains who scream and shout at co-pilots, or maybe don't allow the co-pilot to do even the most menial chores.

"Let's put a new, eager co-pilot on a trip with Captain Doe. He's heard of Doe's reputation and he's deeply concerned. He wants to keep his job badly; and to do so, he knows he must not aggravate Captain Doe.

"So on the trip, Captain Doe shoots an approach at an airport, using his own short cut — BUT SAFE — procedure. His co-pilot has his manual opened and notices the procedure being flown isn't what the book shows. Very cautiously he reports this fact to Captain Doe.

"Listen, you, Captain Doe screams, 'You're just a new idiot. You sit there and keep your eyes open and your mouth shut. I've been flying since you were born; you just watch and keep your mouth shut'. Or some such strangely worded phrase.

"We all know one or two such characters; I even get a laugh out of their briskness. But to a co-pilot anxious to please, it isn't a bit funny. He promises himself to keep his mouth shut from now on. All co-pilots say they will speak up at the last minute to avoid an accident, but who can define the start of that last minute?

"So several approaches later, Captain Doe makes a mistake. He shoots the procedure turn on the wrong side of the leg. A stupid mistake, you say. There must be a means of conteracting mistakes to avoid trouble.

"The co-pilot sees the error of the incorrect turn, but he remembers the earlier incident and tells himself that Captain Doe is using some other unorthodox procedure. There is no warning time left; the last possible chance to rectify the error has been removed. The ship and all its passengers are lost.

"The underlying cause of this accident is poor crewmanship. The fact the crew did not function as a crew, but as separate individuals, caused this accident.

"Possible, but not probable, you say. In recent years some of the airlines may have inadvertently urged these very unhealthy conditions, building a wall between captain and co-pilot, so that the co-pilot rarely flew. Although I'm sure the company did not desire it, their co-pilots became mere 'push buttons' for the captains.

"This Is Not Crewmanship!

"Since World War II there has been a vast amount of experience in the right seat —often as much or more than in the left. Some captains have treated co-pilot's almost as equals. In pre-war days, when captains had all the experience and co-pilots were still students, this was an unheard-of situation. Today the very low accident rate in face of very complex equipment shows that the World War II co-pilots are valuable assets in the right seat.

Use All Talents

"In my opinion an airline crew should utilize to the maximum, all the available experience in the crew. True, there must be a chief, and this must be the captain. But when two possible courses of action are open for consideration, he should utilize all the talent he can for his decision. He is not relinquishing his authority by doing this, as it is he alone who makes the final decision.

"Every co-pilot at the controls is under the direct and positive supervision of his captain. Very few captains will sit and watch a co-pilot overshoot a runway, etc., without instructing the co-pilot in corrective measures.

"On the other hand, a captain's only active supervision comes once a year on a line check ride and twice a year under a six months' check. Any bad habits which a captain might have developed may be disguised on this periodic check. Thus we have a co-pilot, when he flies, having expert advice and guidance. The captain, on the other hand, is practically alone when he is flying. It is easy to see why the captain is generally flying at the time of the accident.

Voluntary Correction

"The only possible way to correct this situation is for the captains themselves (not by regulation, which would destroy the harmony or crewmanship) to allow the co-pilot to question any act he does. Any co-pilot who abuses this privilege should be disciplined on the ground.

"One other consideration on this subject of crewmanship which is extremely difficult to explore is that of the few dangerous captains. I believe these 'accident prone' pilots are few and far indeed. The very few I've known are all dead and no longer a problem.

"In summary, I personally believe that the airlines should check and train, if necessary, in crewmanship. Re-educate the procedures of their 'iron-butt' captains; and use the total experience of all crew members on the flight. They pay considerable money for the experience in the right seat; don't throw it out the window."

Planning A Travel Flight In A Light Aircraft

(During 1954 Dr. J. N. Haldeman and his wife made a private tourist flight from South Africa to Australia. Before setting out they circulated a letter to interested organizations which is reproduced below. The value of the information it contains, to such organizations as Air Traffic Control and the way in which it would facilitate the flight and any search and rescue action will be readily appreciated. This example could with advantage be copied by other pilots of light aircraft on international flights to or from Australia or even by light-plane pilots on extended travel flights within Australia.)

FOR those who did not receive our first circular, I, Dr. J. N. Haldeman, Pilot, and Mrs. Wyn Haldeman, crew, are planning a private tourist flight to Australia in "Winnie", red Bellanca Cruisaire, ZS-DEN. We will be writing stories on our trip. Our plane has a 150 h.p. Franklin engine, gross weight 2,150 lb.; cruising speed 140 miles per hour. In this aircraft we have travelled across sixty countries and territories in North America, Africa and Europe. We are Canadian citizens, resident in South Africa. Our passports are good for "All Countries". We have smallpox, yellow fever, cholera and typhoid international certificates; area club customs carnet; Shell and Vacuum fuel carnets. We will be carrying no freight, cargo or passengers, only personal effects and emergency equipment and supplies. We will require 80 octane petrol although, if necessary, higher octane can be used.

"Wyn and I have reduced our weight thirty pounds each to allow an additional sixty pounds emergency supplies and fuel. This was an unhappy but worthwhile effort.

"Search and Rescue.—To assist 'Search and Rescue' en-route, please take note of the following information. We have one thousand mile range if we fill our spare tank. We fly strictly contact. We have never required overdue action and it is unlikely that it will be required on this trip, but just in case—our plane is vermillion red, which is the easiest colour to see, but we realize that a light plane is very difficult to find so we are prepared to survive indefinitely at any point en-route. If we do not land at intended or alternate aerodromes, most probably we will be sitting on some landing strip on or near our route, which has no communication facilities. Our plane has a stalling speed of forty miles per hour. The next probable place that we will be found is on a road, beach, field or any open ground. We usually try to fly within gliding, or at least walking distance (20 miles) of roads, railroads, rivers or coasts.

" 'Winnie' has retractable undercart. The next probable place is that we may have landed in swamp or water. Our plane is a low wing monoplane, with reinforced cabin. In case we had to stall it in on some bush there is a good chance of walking out without serious injury. If we should land in water, the wooden wings with air pockets will keep the plane afloat, but in addition we have an air mattress which we use to sleep on, that will support six hundred pounds. This will further aid in keeping ourselves and plane afloat. We have Mae Wests and shark repellent. We have had experience in rugged country and have studied everything from the "Bombard Story" to "Survival" issued by the Department of the Air Force, United States. This is the best information we have found. We carry food, two gallons of water, a Coleman G.I. camp stove, air mattress and blankets. When we wish to make a dawn take-off we like to sleep in or beside our airplane.

"Radio.—As we have received no information that radio is compulsory on this route we have removed our radio as we have found on previous trips it is not worth the weight and drag. Equipment to meet the varying radio requirements en-route is too heavy and expensive to use in a light plane. VHF has such short range that it is only useful for aircraft control. We have found that radio for airport control is unnecessary at familiar aerodromes, but complicates vital actions and detracts from the careful lookout essential for safety in coming into strange aerodromes. (*Editorial Note:*— Whilst conceding that Dr. Haldeman's views on the carriage of radio equipment were conditioned by the unusual require-

ments for a flight through many countries, the Department considers that there are advantages to be gained from the use of radio in light aircraft on travel flights within Australia). We are used to much heavier air traffic than anything that will be experienced on this route. Unless we are informed there are regulations otherwise we will come directly to the aerodrome and start a close in left-hand circuit at one thousand feet which will be completely out of the way of heavier aircraft. When we find that everything is clear for us to come in, we will let the wheels down and start our circuit for a landing. If there is someone in the tower and we are doing alright, we will expect a steady green light, if we are not, we will expect a steady red one. Will acknowledge lights by dipping the wings. As we have many other things to watch, light signals of short duration may be overlooked. Over desert stretches we will circle intermediate aerodromes where there is a lookout and also the first aerodrome after a water crossing.

At each stop we would like to obtain location of intermediate landing strips not on our maps, and conditions of these. All we want to know about the weather is — is there now, or likely to be, any surface winds over forty m.p.h., or any cloud on the ground en-route or place of next landing. Anything else we will cope with as we find it or return to the nearest aerodrome.

We appreciate any assistance given us and will endeavour to co-operate in meeting local requirements."

Surface Conditions At Outback Aerodromes

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FROM time to time aircraft operating into remote aerodromes in the outback areas of Australia and in Papua-New Guinea suffer damage or delays which can be attributed at least in part to poor aerodrome surface conditions or even to deteriorated aerodrome markings and windsocks. Sometimes the grass is dangerously long or perhaps erosion gullies, ant-hills or areas of poor drainage have appeared. On occasions we believe these ant-hills have appeared overnight but other types of deterioration can usually be detected over a longer period. It is often evident that prior to the incident the pilot involved, or other pilots have operated at frequent intervals into the particular aerodrome when signs of the deterioration must have been apparent but have not been reported.

These outback aerodromes are inspected by aerodrome maintenance officers at predetermined intervals unless any report is received that an earlier inspection is needed. However, it is very difficult in sub-tropical or tropical areas to anticipate the rate of grass growth or ground erosion because rainfall is often irregular and poorly reported. Most of these aerodromes are used frequently by pilots between regular inspections and it would be of great assistance if they would report immediately any condition of an aerodrome which has, or could adversely affect the safe operation of aircraft. Steps can then be taken to ensure that Notam information is accurate and that the aerodrome is restored to full serviceability as soon as possible.

Because of the frequency of their visits and their appreciation of minimum serviceability requirements pilots are ideal reporting agents of aerodrome conditions and we would appreciate your co-operation in this way.

PART II

OVERSEAS ACCIDENTS

Super Constellation Inadvertently Ditches In Shannon River, Ireland

(This summary is based upon the report of the formal investigation published by the Department of Industry and Commerce, Ireland.)

ON 5th September, 1954, at 0230 hours (local time) a Lockheed Super Constellation owned and operated by K.L.M. Royal Dutch Airlines, designated Flight 633 Amsterdam to New York, took-off from Shannon River Airport, Ireland, for Gander Airport, Canada. A crew of ten, forty-six passengers plus cargo were on board.

Take-off from Runway 14/32 to the south-east appears to have been normal up to lift off speed (V2). Thirty-five to forty seconds later an inadvertent, but almost perfect ditching had been made in the River Shannon, 8,170 feet from the departure end of the runway used. Twenty-eight lives were lost and the aircraft eventually became a total loss through the effects of ditching, exposure and salvage operations.

The pilot in command, who was 49 years of age, had accumulated 18,884 hours of aeronautical experience, including 174 Atlantic crossings with the company and was endorsed on a number of modern heavy transport aircraft types. The first officer, 31 years of age, had accumulated 5,317 hours including 77 Atlantic crossings and was endorsed as pilot in command of DC.3 CV.240 and CV.340 types and as co-pilot on L.749 and L.1049 types.

The weather at the time of the accident can only be described as nearly perfect since there was broken cloud at 8,000 feet, visibility was 25 miles and the wind was 140 degrees, 12 knots.

Runway 14 at Shannon Airport is 5,643 feet in length, is three feet above sea level and is bounded at the north-western end by an embankment rising to 14 feet above the runway level and marked by red obstruction lights.

Tidal waters in the Shannon Estuary extend to this embankment leaving, at low water, an extensive area of mudflats through which run several gullies and creeks.

So far as could be determined there was no pre-crash failure or malfunctioning in any of the engines and the indications were that all four were under power at the time of impact. Although some portions of the aircraft structure could not be examined thoroughly, since they were under water, there was no evidence of structural failure, instrument failure or system malfunction. However, it was apparent that the wing flaps were in the "up" position and that the left main landing gear was "up" and locked, whilst the nose and right main gear were not locked "up" at impact.

The gross load of the aircraft was well within the maximum allowable for take-off and the centre-of-gravity was within acceptable limits.

Reconstructing the take-off operation it is apparent that the aircraft was airborne at 125 knots (just above V2 speed) after a ground run of 4,000 feet. As the aircraft passed over the remaining 2,450 feet to the embankment the undercarriage commenced to retract and the embankment was crossed at rather a lower height than normal. Almost immediately, a somewhat

steeper climb was initiated and METO power ordered at 140 knots. An eyewitness described how the initiation of this steeper climb was followed almost immediately by a shallow descent. However, this was apparently not noticed in the cockpit and at 150 knots flap was ordered "up". At 160 knots climb power was ordered and a few seconds later the aircraft made first contact with the water this being some 31 seconds after it passed over the end of the runway.

The aircraft came to rest on a shallow mudbank, 8,170 feet from the end of the runway, and sustained major damage to the airframe. The highest altitude observed by the pilot in command during the flight was 250 feet and just before the crash he observed an altitude of 100 feet with the climb and descent indicator showing a descent rate passing through 1,000 feet per minute. The pilot in command took immediate recovery action by pulling the control column back but at that stage nothing could have prevented an accident and his action fortunately prevented a heavier impact.

The Court of Investigation has stated that after take-off the landing gear should be up and locked before flap is retracted. The fact that flap was found to have been retracted, whilst two units of the landing gear were not locked up, indicates that this procedure was not accomplished. However the bulb of the red indicator lamp, indicating the landing gear to be unlocked and/or in a transient condition was found to be burnt out and it was accepted that this had occurred during retraction giving a false indication of landing gear "up". It was also found from tests that if, in this type aircraft, flap is selected whilst the landing gear is in the retracting stage, the flap will first retract, delaying the landing gear and in some cases allow re-extension. It is quite possible that this did occur, thereby causing unexpected drag, creating a condition wholly unexpected by the pilot in command. However the performance of this type aircraft is such that this situation could reasonably have been handled with adequate safety and therefore, this condition contributed to, rather than caused, the accident.

In endeavouring to provide an explanation of the accident the Court drew attention to the fact that the events which had an immediate and direct bearing on the final disaster began to develop at the moment of flap retraction, that is only about 15 seconds before the moment of contact with the water. The first indication of the necessity for corrective action by the pilot in command should have been given by his artificial horizon displaying a definite lowering of the nose, though not indicating a nose-down attitude. The occurrence of this attitude change, notwithstanding a positive nose-up correcting action for flap retraction taken by him several seconds earlier, must very probably have been promoted by the fact that the landing gear was in the course of re-extension, and possibly the fact that the pilot-in-command did not retrim the aircraft for flap retraction.

Even if the change of attitude to a more or less level position had not been noticed immediately by the pilot in command, the first indications of a descent could have been noticed about three seconds later on the altimeter. The fact that at the moment a scan of his instruments did not reveal an undesirable flight condition must be attributed to one or both of the following causes.

(a) After the first five or six seconds, when he is accustomed to less continuously scan his instruments, the pilot in command's observations of the horizon and the altimeter movement were inadequate; he placed too much reliance on the slow reacting climb and descent indicator.

(b) He did not appreciate, to the full extent, the anticipating character of the horizon indication in that a change of the horizon bar position indicates a change of flight conditions which will not become apparent from the other instruments until some seconds later.

The Court also formed the opinion that the pilot in command did not utilize the climb performance of the aircraft to the extent possible. If he had concentrated less on building up speed and more on gaining height in take-off, he would have had a better opportunity for coping with unexpected incidents. He was at a further disadvantage in dealing with unexpected hazards in his assumption that 250 feet indicated altitude placed him in a position

of sufficient safety against all known take-off risks. On this point it was determined that the true height of the aircraft was never more than 170 feet and the discrepancy between true and indicated heights was probably due to the cumulative effects of instrument error, altimeter setting error and position error.

The Court found that the accident was due to the following causes:—

(a) Failure of the Captain properly to correlate and interpret his instrument indications during flap retraction, resulting in necessary action not being taken in sufficient time. This failure was partially accounted for by the effect on instrument indications of inadvertent and unexpected landing gear re-extension.

(b) Loss of aircraft performance due to inadvertent landing gear re-extension.

(c) The Captain failed to maintain sufficient climb to give him an opportunity of meeting unexpected occurrences.

The Court also made recommendations arising out of the evidence presented and some of these were—

(a) "That warning or signal lights indicating an unlocked or transient condition of the landing gear as on the Lockheed 1049 Super Constellation, be duplicated."

(b) "That self-sufficient emergency lighting be provided in passenger accommodation of transport category aircraft." (This stemmed from the fact that the aircraft was plunged into darkness immediately after impact thus hampering evacuation and rescue.)

(c) "That flash lights of flight crew personnel be so designed that they may be functional while leaving the hands free."

(d) "That flight personnel be made aware of the danger that power-on ditching may remove power plants from the wings in turn causing damage to the wings and possible loss of dinghies stowed therein." (In this accident two dinghies were released and automatically inflated as a result of impact damage. They could have easily floated away beyond recovery.)

(e) "That flight personnel and all other services concerned be made aware of the extreme danger of fumes in a confined space, such as the cabin of an aircraft resulting from ingress (or in-flow) of petrol." (In this accident 26 of the 28 deaths were due to asphyxiation by petrol fumes.)

(f) "That portable oxygen equipment for emergency use by more than one crew member be available on transport category aircraft." (Rescue operations by the crew members were hampered by the shortness of the periods they were able to stay in the cabin.)

The first positive indication that this aircraft had crashed was received at 0512 hours (i.e., 2 hours 34 minutes after the take-off) when a survivor arrived in a distressed condition at the airport fire station. Rescue operations were commenced immediately and proceeded generally in a satisfactory manner. Neither the airport controller nor the fire station look-out watched the aircraft out of sight because they turned away to perform the departure logging and notification duties. Despite the fact that the aircraft did not respond to radio calls after departure the fears of the airport controller for the immediate safety of the aircraft were allayed by a statement from the G.C.A. Director that he had picked up an outbound "blip" at 23½ miles west at 0248 hours (i.e., 10 minutes after take-off).

No blame was attached to the airport controller or fire station look-out for not continuing to observe the aircraft but the Court considered that a grave error of judgment was committed by the G.C.A. Director in identifying a "blip" with this aircraft without qualifying the report that the path of the aircraft had not been followed from the vicinity of the airport and had, in fact, only been seen on the screen for some ten seconds duration.

The Court made several recommendations for improvements to ground services and facilities at Shannon Airport based on the evidence presented in the investigation.

Fuel Exhaustion in DC.3 Near Pittsburgh, U.S.A.

(This summary is based upon the report of the Civil Aeronautics Board, U.S.A., released on 8th April, 1955) (18/27/56)

ON 22nd December, 1954, a Douglas DC.3 departed Newark, New Jersey, for Pittsburgh, Pennsylvania, a distance of some 270 miles. The aircraft was owned by a civilian operator, manned by a civilian crew of five and was carrying 23 military personnel and their baggage. The flight departed at 2038 hours (local time) and on flight plan was due at Allegheny County Airport, Pittsburgh, 1 hour 40 minutes later. The weather over the entire route was fine and the flight was to be made in accordance with the visual flight rules. According to the weight and balance manifest the aircraft carried 225 gallons of fuel (company flight plans at 80 g.p.h.) and the all-up-weight was 29 lb. under the maximum permissible.

En-route the flight encountered winds, substantially as forecast, but on passing Philipsburgh (an available refuelling point) the co-pilot advised the captain that to continue without refuelling would involve the use of fuel reserves. The captain decided to continue but, on reaching the vicinity of Johnstown airport, he advised Pittsburgh of his fuel shortage and endeavoured to locate Johnstown. He was unable to do so, despite the use of A.D.F. facilities and the fact that all the airport lights were on, and so the aircraft continued to Pittsburgh.

The aircraft approached Allegheny County Airport, Pittsburgh, at 3,200 feet and was cleared for a straight in approach. The pilot reported three miles out on final approach and a minute later that his fuel was exhausted, both engines were feathered, he had two miles to go and he doubted whether he could reach the runway. The captain then advised "we are going to set it down" and the aircraft was observed from the control tower to turn away from the airport and disappear behind some low hills. It was ditched at 2300 hours in the Monogahela River, and the aircraft sank after about fifteen minutes. None of the passengers or crew received injuries during the ditching and the occupants evacuated the cabin via the emergency exits onto the wings. Some of the passengers could not swim and the icy waters made it difficult for even good swimmers to reach the shore. The pilot in command and nine passengers were drowned.

The aircraft was subsequently recovered and the examination revealed that both the aircraft and engines were capable of normal operation at the time of the accident. This was confirmed by the co-pilot's statement that the engines and aircraft functioned in a normal manner throughout the entire flight. There had been no previously reported defects in the fuel system and the examination confirmed the fact that the fuel had been exhausted.

The investigating authority has stated that "the general conduct of this flight clearly indicates poor judgment, carelessness and lack of supervision and training." In this regard the following factors revealed in the investigation are worthy of note:—

(a) The pilot in command of the flight was a company check pilot with 7,600 flying hours including 1,500 hours on the DC.3 type. All of the other crew members also had substantial flying hours in total and on the DC.3 type.

(b) The pilot-in-command filed a flight plan by telephone before departure to fly over a route which had been discontinued for more than a year.

(c) No written flight plan or navigation log was prepared before departure. This was corrected by the co-pilot after departure but without consulting the pilot in command as to his intentions. Consequently, a route, different from that notified verbally by the captain, was entered on the flight plan and followed by the aircraft.

(d) This flight plan and navigation log prepared in the air included many mistakes such as; wind velocities differing from those forecast; a higher true airspeed than is reasonable to expect of a DC.3 at 4,000 feet; some stations, courses and radio frequencies were not consistent with either the filed CAA flight plan or the company flight plan; and errors in ground speed calculations and estimates of up to 22 knots.

(e) A carefully prepared flight plan would have indicated a total time interval for the flight of 2 hours 7 minutes instead of 1 hour 40 minutes as planned.

(f) The cruising power used on the flight was 100 h.p. higher than that laid down in the company operations manual.

(g) The co-pilot on this flight had been hired by the pilot in command only five days previously and had received no ground training nor taken the written examinations required by the company's operations manual.

(h) Although the weight and balance manifest indicated that 225 gallons of fuel were being carried, the accuracy of this figure could not be conclusively established but, at least, this quantity was not sufficient for a safe flight from Newark to Pittsburgh by any route; considering the distance flown and all other known factors affecting fuel consumption it is calculated that approximately 260 gallons of fuel were consumed. This would have made the aircraft overloaded at take-off.

(i) The crew baggage (for five persons) was not included on the weight and balance manifest as was required by the operations manual and to this extent the aircraft was further overloaded.

(j) The passengers baggage was recovered in a clean condition, thoroughly dried and weighed. The total weight was found to be 260 lb. in excess of that shown on the weight and balance form.

(k) The baggage in the rear compartment was found to weigh 58 lb. more than the maximum permissible load for this compartment. However, the centre-of-gravity of the aircraft was within permissible limits.

(l) It was obvious that the aircraft was overloaded at take-off but it was not possible to determine precisely the amount of overload.

The investigating authority remarked that "it is incredible that an air carrier aircraft flown by accredited personnel could be forced down for lack of fuel on a short night flight in good weather when we think of the great progress aviation has made to date, particularly with respect to pilot training, aircraft instrumentation, navigational aids and airport lighting".

The significant findings were—

(i) The company did not properly check the competency of the crew in accordance with their operations manual prior to flight assignment.

(ii) The aircraft was overloaded at time of take-off.

(iii) The flight was improperly planned and was not conducted in accordance with the company's operations manual.

(iv) The captain, contrary to the company's operations manual passed a suitable refuelling facility after being advised that, if the flight continued to its destination, it would be necessary to use reserve fuel.

(v) The probable cause of this accident was fuel exhaustion brought about by inadequate flight planning. Contributory factors were inadequate crew supervision and training.

Emergency Landing In Convair 340 As Result Of Elevator Failure

(This summary is based upon the report of the Civil Aeronautics Board U.S.A., released on 7th September, 1955)

ON 19th January, 1955, a Convair 340 aircraft owned and operated by United Airlines Inc. made a wheels up emergency landing in a snow covered cornfield 30 miles west of the departure airport, Des Moines, Iowa. There were minor

injuries to some of the 36 passengers, no injuries to the crew, but the aircraft was substantially damaged.

The aircraft departed Des Moines for Omaha, Nebraska at 1608 hours at a gross weight 1685 lb. less than the maximum permissible of 46,900 lb. The climb was uneventual until at 5,000 feet the crew noticed vibration and a slight fore and aft movement of the control column. The aircraft was levelled off at 6,000 feet and a number of measures tried in an endeavour to eliminate the vibration, without success. Suddenly a failure in the control system was felt and it was with extreme difficulty that any semblance of elevator control was maintained. Various flap settings were tried to help in maintaining control and the best results were obtained at the 15 degree position. A distress call was initiated on the radio and an attempt to return to Des Moines was commenced.

The buffeting soon became so severe that it was necessary for the first officer to help the captain hold the control column. The aircraft was de-pressurized and the passengers prepared for an emergency landing. By this time the aircraft had descended below 3,000 feet and both throttles were retarded in turn to test if the engines were the source of the vibration, without avail. The vibration built up to a high level and suddenly another failure in the control system was felt and the aircraft went into a steep climb. As it seemed that a stall was imminent the captain quickly moved the propellers to a high r.p.m. and opened the throttles to approximately 50 inches of manifold pressure. The aircraft then nosed over and began to dive at a very steep angle. During this rapid descent the captain reduced power and headed towards open country. When the aircraft reached 500 feet above the ground the captain was successful in flaring the aircraft and it struck the ground in a flat attitude. The aircraft came to rest in an upright position with its wheels retracted in a level snow covered cornfield.

The ground markings indicated that the aircraft had first contacted the ground, level laterally and slightly nose-high. At the second contact point 900 feet further on the aircraft had bounced over a barbed wire fence for a further 390 feet, hurdled another fence and skidded in a slight curve to the right for an additional 1,485 feet. The fuselage was crushed, the propellers and engine mounts broken and the mainplane leading edges dented. The snow which was uniformly five or six inches deep on the ground considerably lessened the damage the aircraft received during its slide.

The captain, aged 35, had a total of 7,578 pilot hours of which 750 hours were in the Convair 340 type. The first officer, aged 29, had a total of 2123 pilot hours of which 1147 hours were in this type. The aircraft had a total of 1502 hours since new.

The empennage section of the aircraft was intact and virtually undamaged by ground contact. During an examination of the elevator torque tube assembly it was observed that there was a vertical fracture on the right side. This completely disconnected the starboard elevator from the main torque tube assembly but the port elevator was still attached to the assembly and partial elevator control could still be effected. It was also discovered that the aft push-pull tube attached to the port elevator servo tab horn had broken transversely about 12 inches forward of its rear terminal and this had allowed the tab to oscillate violently and overtravel, tearing rearwards the tab hinge cutouts.

On opening the inspection doors it was also found that the servo tab idler was completely detached from its support in the elevator, as the supporting bolt had fractured. The associated nut and washers were found loose in the elevator but the cotter pin could not be found.

An investigation of maintenance work done on this aircraft on the day preceding the accident revealed that excessive play in the elevator servo tab had been noticed and this traced to considerable wear in the idler support bolt. As a replacement bolt was not immediately available and had to be ordered the mechanic had, under instruction, replaced the worn bolt with the nut finger tight and not pinned. No explanation of this temporary replacement was entered on the job card. At the subsequent change of shift the oncoming crew chief was not briefed with respect to the worn bolt and the new mechanic assigned to the job reported that he could find no excessive play in the servo tab assembly. This was

checked by the supervisor and inspector and, being confirmed, the job card was signed off.

It appears that during the subsequent operation of the aircraft the unpinned castellated nut backed off the idler support bolt, because of vibration, allowing the bolt to free itself from the outboard of the two supporting brackets which it traverses. With the idler then supported only by the bolt traversing one bracket, forces were exerted which broke the bolt one inch from the head. This allowed the idler to drop down and the servo tab began to oscillate causing the initial vibration felt in the cockpit. Loads were then induced in the rear push pull tube causing it to fail leaving the tab to oscillate without restraint and this in turn caused the port elevator to oscillate about its hinge line. The resultant loads caused by the port and starboard elevators being out of phase broke the starboard torque tube connection plate thus preventing cockpit control of the starboard elevator. The port elevator torque tube assembly was also deformed resulting in almost negligible control of this elevator from the cockpit. A thorough study of the operator's maintenance procedures revealed that they were adequate but had broken down because of the frailties of the human element. The operator's procedures required that an explanation of all work performed be written on the job card and that the relieving crew chief be briefed on all work performed during the foregoing shift. These procedures were not followed in this case.

The fact that the final inspection did not reveal any play in the elevator servo tab assembly can be explained by the chance rotation of the bolt during its removal and replacement. However since the job card had been written up for work to be done and there was no entry to indicate that such work had been done it was considered that the inspector should have made a more thorough inspection of the servo tab system. Nevertheless, the critical omission was the failure to write an explanation on the job card that the bolt had been removed and replaced only finger tight pending the arrival of a new bolt.

The investigating authority believes that the crew was confronted with an extremely hazardous situation and that it was only by employing the utmost judgment and skill that a disaster was avoided.

It was concluded that the probable cause of the accident was a series of omissions made by maintenance personnel during a scheduled inspection which resulted in the release of the aircraft in an unairworthy condition and an almost complete loss of elevator control during flight.

PART III

AUSTRALIAN ACCIDENTS

DC.3 At Sydney, N.S.W. – Undercarriage Collapse

(1208/53)

A DOUGLAS DC.3 sustained minor damage when the undercarriage collapsed, during the landing roll, following a practice single engine landing at Sydney (Kingsford-Smith) Airport, New South Wales. No one was injured.

The Circumstances

After an engine change earlier in the day the aircraft took off from Sydney Airport for a test flight. It was under the command of a company check captain, occupying the right hand pilot seat, whilst a company captain, who was being given a periodical flight check for his licence renewal, flew the aircraft from the left hand seat. The take-off and a series of manoeuvres were carried out by the captain-under-check, under the blind flying screens, culminating in an A.D.F. approach to the minimum altitude. At this stage the screens were removed and the aircraft joined the downwind leg of the aerodrome circuit for a landing on Runway 16. After requesting and obtaining permission from the airport controller to carry out an asymmetric landing, the check captain feathered the starboard propeller and instructed the captain-under-check to proceed with the landing. As the aircraft was turning onto final the captain-under-check called for the undercarriage to be lowered and the check captain promptly placed the selector lever in the down position. The check captain states that the undercarriage hydraulic pressure appeared to be slow in building up and as the aircraft, at this stage, was nearing the runway he elected to land without full pressure and returned the selector lever to neutral and placed the undercarriage latch in the positive lock position. As the aircraft neared the runway threshold both pilots observed that the undercarriage warning lights were showing red, whereupon the check captain released the undercarriage latch and placed the selector lever in the down position. He then immediately selected flaps down. Towards the end of the landing roll and as the brakes were applied first the port, then the starboard undercarriage, slowly collapsed.

Discussion of the Evidence

No defects or evidence of malfunctioning of the undercarriage or main hydraulic system were found during the inspection carried out after the accident. The engine pump selector lever was apparently in the normal position, i.e., port engine (operative engine) to main hydraulic system, during the approach and thus maximum and continuous pressure would have been available for the operation of the undercarriage. The evidence indicates that the undercarriage was not mechanically locked on landing and, although hydraulic pressure apparently supported the undercarriage during the early part of the landing roll, the application of the brakes and the consequent rotative force on the undercarriage suspension overcame the hydraulic pressure and resulted in the undercarriage collapsing.

The check captain, after initially selecting the undercarriage down, returned the selector lever to neutral before the undercarriage pressure had built up to the desired figure and then engaged the positive lock before checking that the undercarriage warning lights showed green. The action of placing the undercarriage latch in the positive lock position, before the undercarriage is fully extended and the spring engaged, has the effect of preventing full extension and

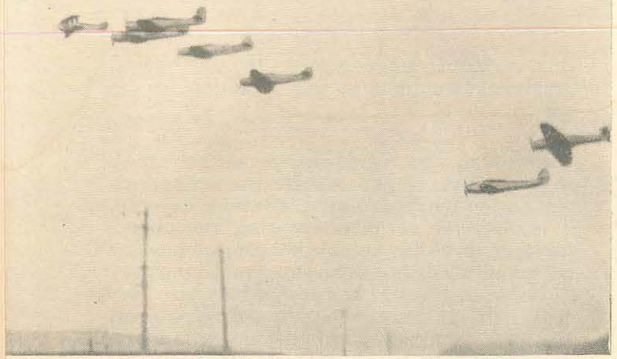
locking. As the only positive means of establishing that the undercarriage is spring locked is by obtaining green lights and/or no warning horn, it is apparent that the latch should not be placed in the positive lock position until such an indication is obtained. The usual practice is to engage the positive lock when the desired pressure is registered and check the light later. This procedure is satisfactory as the desired pressure almost certainly indicates that the undercarriage is spring locked. However, in this instance, the check captain returned the lever to neutral before the desired pressure had been built up and, therefore, he could not be reasonably certain that the spring lock was engaged and he should have checked for green lights before placing the latch in the positive lock position. In this regard he may have been misled by the company's operations manual which, under landing gear management, lists "undercarriage positively latched" before "check lights", which, as shown above, is not strictly correct.

When the check captain realized the undercarriage was not locked down, after his premature manipulation of the levers, he again selected down. From the fact that the undercarriage did not collapse until the brakes were applied it is apparent that it was almost fully extended on touch down. Therefore, it is considered that, if the lowering of the undercarriage had not been arrested by the premature completion of the drill, there would have been sufficient time for it to have been fully extended and locked prior to touch down.

It appears from the evidence that the check captain was unduly concerned with returning the selector lever to neutral and engaging the positive lock, which suggests that he considered these operations were vitally necessary to lock the undercarriage. As previously discussed, the spring lock automatically effects the essential locking of the undercarriage and premature operation of the selector lever serves no purpose unless the undercarriage is spring locked whilst premature operation of the latch will prevent the spring locks from engaging. Therefore, it is considered that if the check captain had been fully familiar with the functioning of the undercarriage he would, as time was critical, have left the selector lever in the down position until the desired pressure had been built up. As a result of this accident the company has introduced precise instructions in the operation of the undercarriage.

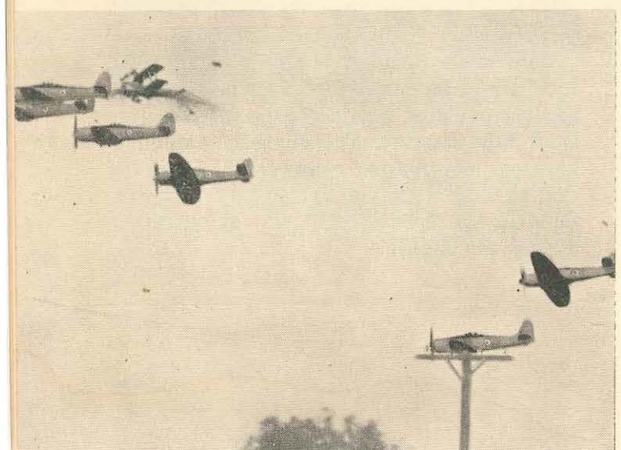
Although the performance of the DC.3 is such that height can be maintained on one engine with the undercarriage lowered, it is desirable to delay lowering the undercarriage until the actual descent for landing is commenced in order to avoid applying considerable power to the good engine. The operations manual of the company concerned specifies that, on a single-engine landing, the undercarriage must be lowered on the base leg, which permits it to be lowered, locked and checked at a safe altitude. From the testimony of the pilots it appears that, on this occasion, the lowering of the undercarriage was purposely delayed until the aircraft was turning onto final because considerable drift was experienced on the base leg, which suggested to them a strong headwind on final. However, the recorded wind strength at the time of the accident was only 15 m.p.h. Furthermore, it appears from the evidence of the captain-under-check, that he did not have time, after he called for the undercarriage to be lowered, to properly check that it was down and locked before having to concentrate on the landing. In view of the evidence that the undercarriage was functioning normally during the approach, it is considered more likely that the low pressure was occasioned by the relative closeness of the aircraft to the runway when the undercarriage was selected down. Furthermore, the fact that there was very little time for any appropriate action to be taken when it was realised that the undercarriage was not locked prior to landing indicates that it was selected down at a relatively late stage of the approach. Therefore, it is considered that the undercarriage was initially selected down at a stage when there was barely sufficient time for it to be fully extended, locked and properly checked prior to landing.

Both pilots involved in this accident held 1st class airline transport pilot licences and had accumulated considerable experience on DC.3 type aircraft. The check captain had been on duty for ten hours on this day, including 6.20 hours of flying duty and this factor could have affected his concentration during the flight.



The Naval Sea Fury formation closes on the DH.82 from the rear over the building area at Wagga aerodrome. Note that the pilots of the three leading aircraft have not seen the DH.82 but apparently Nos. 4 and 6 of the formation have and are commencing to "break" to starboard.

In the view below the formation leader has just hit the DH.82 with propeller, canopy and fin whilst Nos. 4 and 6 continue breaking away. In the view above the DH.82 is seen disintegrating further whilst the damage to the leader's fin and rudder is visible.



Conclusions

1. The cause of the accident was the incorrect manipulation of the undercarriage by the pilot in command, which resulted in the aircraft landing with the undercarriage not mechanically locked.
2. A contributory cause was an error of judgment on the part of the pilot in command in failing to ensure that the undercarriage was lowered and locked prior to being committed to a landing.
3. The incorrect manipulation of the undercarriage by the pilot in command was apparently due to his lack of knowledge of the functioning of the undercarriage system.
4. Fatigue and/or pre-occupation may possibly have contributed to the poor airmanship displayed by the pilot in command.
5. The captain-under-check made an error of judgment in delaying the lowering of the undercarriage until the aircraft was so close to the runway that there was barely sufficient time for the undercarriage to be lowered, locked and properly checked prior to landing.

Mid-air Collision At Wagga, N.S.W

(410/4/95)

A FORMATION of six R.A.N. Sea Furies took off from Forrest Hill aerodrome, Wagga, for local flying and return to their base at Nowra. Soon afterwards, at about 1020 hours, they returned over the aerodrome at low altitude where the leader collided with a civil DH.82 which had pust taken off on local flying practice.

The DH.82 crashed on the aerodrome, the pilot escaping serious injury. The Sea Fury crashed two miles away and the pilot was killed.

Events Preceding the Accident

Prior to take-off, the leader of the formation visited the control tower where the flight plan was filed and discussed with the duty airport controller. The leader mentioned that he would take the flight over Wagga township and the Uranquinty area before setting course for Nowra. As Uranquinty is outside the Wagga control zone, the airport controller requested the leader to call the tower if and when returning to the zone.

After take-off, at about 1015 hours, the Sea Furies made formation over the aerodrome and were lost to sight flying at a low altitude towards Wagga township.

Shortly after the departure of the formation a civil DH.82, being flown by a student pilot, was given permission to take-off on practice circuits and landings. The take-off was made on the grass strip into the north-east. The aircraft became airborne approximately halfway along the strip and the climb was continued straight ahead. Whilst the DH.82 was still over the aerodrome at a height of about 150 feet, the airport controller received a radio call from the formation advising that they were setting course for Nowra. At the same moment he looked up from briefing a visiting pilot and saw the Sea Furies close to the south-west boundary of the aerodrome at approximately 150 feet and heading across the aerodrome. They were flying at about 250 knots and in the same direction as the DH.82 which was ahead and slightly below them.

The aircraft closed without either the DH.82 or the formation leader changing course and the leading Sea Fury hit the DH.82 from astern and below with its propeller, cockpit canopy and fin.

Three photographs, taken independently by amateur photographers, are reproduced on page opposite and show the aircraft immediately before and after the collision.

Discussion of the Evidence

Neither the R.A.A.F. liaison officer, who accompanied the leader of the formation to the control tower prior to the take-off, nor the airport controller were aware of any arrangement for a fly past at Forrest Hill by the Naval formation, nor was it mentioned in the flight plan. However, both of these officers recall the leader mentioning that he proposed to fly over Uranquinty before setting course for Nowra and he was told by the airport controller to call on the radio should he wish to re-enter the Wagga control zone. The formation did not fly over Uranquinty and, during the eight minutes between take-off and the accident, they flew over Wagga township and back over Forrest Hill aerodrome which was approached from the vicinity of Lake Albert, some two miles to the west.

The control tower received no radio signal from the Sea Furies after the take-off until the call from near the aerodrome boundary when it was too late to issue instructions or information to the aircraft before the collision.

At least one member of the formation saw the DH.82 immediately before the collision, but it seems highly probable that the leader did not. Contributory factors may have been the pilot's poor visibility immediately below and ahead of a Sea Fury, or the temporary diversion of his attention to onlookers on the tarmac.

The pilot of the DH.82 did not suspect the presence of the other aircraft, and from the time he took off until the noise of collision made him realize that something was amiss, he was concentrating on a steady straight ahead climb.

Conclusion

The cause of the accident was that the leader of the formation led his aircraft back over the Forrest Hill aerodrome without indicating his intention to do so and without maintaining a lookout adequate to prevent collision with other aerodrome traffic.

Norseman – Undershot And Overturned

(410/6/44)

AS a Norseman aircraft was levelling out to land on Vanimo airstrip New Guinea, the port wheel struck a stump just short of the airstrip and, on subsequent touchdown, the aircraft nosed over and came to rest inverted. The aircraft sustained substantial damage and the pilot and two of the thirteen passengers received minor injuries.

Vanimo airstrip runs across an isthmus in a southeast-northwest direction. It is some 200 feet wide and approximately 1,700 feet in length, terminating at each end on a beach. At the time of the accident some 300 feet at the northwestern end was marked unserviceable and a Notam had been issued advising pilots accordingly.

The aircraft was on a charter flight from Wewak to Vanimo and was carrying one European and 12 native passengers. The pilot was an experienced New Guinea pilot and had landed some 50 times previously on Vanimo airstrip, 11 times in Norseman aircraft. This was his second flight into Vanimo on the day of the accident and on the earlier flight he had taxied over that part of the airstrip declared unserviceable by the current Notam.

The flight from Wewak was uneventful and, after completing a circuit of Vanimo airstrip, the pilot commenced an approach into the south-east. The weather was fine and the wind was from the north-east, i.e., across the airstrip, at about 10 knots and gusty. The pilot intended to touch down at the extreme northwestern end of the airstrip, on the area marked as being unserviceable. The approach was made with the port wing down to counteract drift. As the aircraft was levelled out over the beach preparatory to touch down, the port wheel struck a stump protruding out of the sand approximately eight inches and just short of the airstrip. The pilot felt the aircraft hit but continued with the landing. The aircraft touched down on the airstrip some 90 feet from the stump, ballooned for a further 80 feet then, on touching down again, nosed over and came to rest inverted.

Examination of the wreckage revealed, inter alia, that the upper torque link bolt on the port undercarriage was sheared — this had apparently occurred when the wheel struck the stump. This damage permitted the wheel to swivel out of track and, from the ground marks, was at right angles to the direction of landing on touch down. This resulted in the wheel digging in and causing the aircraft to nose over.

It was concluded that the cause of the accident was poor technique on the part of the pilot in that he landed short of the airstrip and damaged the port landing wheel in such a manner as to subsequently cause the aircraft to overturn.

Fatal Stall In DH.84 Dragon

(18/21/1)

A DH.84 Dragon flown by a licensed airline transport pilot was engaged in transporting a medical practitioner on his routine rounds to scattered settlements in central Queensland. The aircraft took-off during the afternoon from Cheviot Hills airstrip with the intention of returning to base at Charters Towers. In addition to the pilot, the occupants of the aircraft were the doctor, his wife, and a small boy being transported to Charters Towers for medical treatment accompanied by his mother.

The take-off was carried out in wind conditions which were generally calm but in this area some turbulence would be expected in the afternoon. Soon after becoming airborne the aircraft commenced a gradual climbing turn to starboard and, when the aircraft had turned through approximately 180 degrees the starboard wing dropped and the aircraft entered a steepening dive until it struck the ground at a very steep angle. The aircraft was wrecked by impact forces. The pilot and the doctor's wife sustained fatal injuries and the other occupants escaped with only minor injuries.

The density altitude at the time of take-off was approximately 6,000 feet and Cheviot Hills airstrip is 2,700 feet in length, i.e., 400 short of the minimum length of run for this type aircraft as required by AIP/AGA-4. At the time of the accident the only specific limit upon the operating weights of DH.84 aircraft was that contained in the certificate of airworthiness. In this case it was 4,500 lb. and the actual weight at take-off, 4,286 lb., was well within this limit. However, both the Department and the operator had advised pilots to take account of circumstances which would affect the performance of the aircraft and to determine a safe weight for each particular operation accordingly. The Department was preparing a take-off weight chart for DH.84 aircraft at the time of the accident and when this was subsequently published the maximum safe weight for take-off on this occasion as determined from the chart, was 4,050 lb. In the light of this more specific information, it was apparent that the all-up-weight of the aircraft was 236 lb. in excess of the safe maximum having regard to the circumstances of the operation.

The pilot had been operating in this area for only three months and his experience on DH.84 aircraft amounted to some 93 hours in a total experience of 2,730. Operations in central Queensland in DH.84 types require a degree of special skill and judgment because of such common factors as high density altitudes, turbulence, marginal airstrip conditions and the limited performance capacity of the type. It is considered that the pilot's short experience of these factors contributed to the accident in that a combination of over-load, short strip and the extra aerodynamic loading of a circling climb led to a loss of control at too low an altitude for recovery to be possible.

The findings of the investigation were:—

(a) The probable cause of the accident was a loss of control during the execution of a turn at low speed in operating conditions which did not provide an adequate margin of performance; and

(b) Contributory causes were:—

(i) The all-up-weight of the aircraft was in excess of the safe maximum;

(ii) The limited experience of the pilot on DH.84 aircraft and in the operating conditions encountered during the flight.

Aerial Ambulance Aircraft Ditched In Sea

(18/3/1)

FOLLOWING an emergency call from Iron Range, Queensland, an aerial ambulance aircraft set out from Cairns to bring in an aboriginal boy, suffering from snakebite, for treatment. The return flight from Iron Range commenced at 1723 hours and the E.T.A. Cairns was approximately 2015 hours, last light occurring at approximately 1840 hours. On board the aircraft were the pilot, an ambulance bearer and the patient. The aircraft a DH.89A Rapide, was equipped with a radio compass and was licensed only for visual flight. However, in operations of this nature, it is expected that an occasional emergency night flight will be necessary and this is acceptable provided that weather conditions are favourable and navigation facilities are adequate.

The pilot held a third-class airline transport licence and had 119 hours experience on DH.89s in a total experience of 6665 hours. At the commencement of the return flight he was undecided whether to land at Cooktown, just after dark, or to continue to Cairns where the nearest medical practitioner was located. As the patient's condition worsened and a terminal forecast for Cairns was received indicating a cloud base of 1200 feet and visibility 10 miles, the pilot decided to overfly Cooktown and proceed to Cairns in an endeavour to save the life of the patient.

The aircraft was cruising at 7,000 feet and the evidence indicates that, from a position just south of Cooktown, the flight was conducted above cloud with little or no reference to the ground. The pilot reported positions on track as the flight proceeded and at 1946 hours he reported a contact position 33 miles north of Cairns and then at 2007 hours, "landing in ten". However on E.T.A. he reported that he could not see Cairns and in a subsequent search of 18 minutes he still failed to locate it. During this period, direct link communication was established between the air traffic control units at Cairns and Townsville and the situation was discussed. At 2036 hours the remaining endurance of the aircraft was 107 minutes (based on flight plan endurance of 300 minutes) and the pilot stated that he was setting course back to Cooktown (90 miles distant).

Air Traffic Control at Townsville, suggested to the pilot that, as the weather at Townsville was favourable and in that direction lay much better radio and visual navigation aids, he might consider attempting to reach Townsville. This the pilot agreed to do and, after flying towards Townsville for 21 minutes, HDF bearings were obtained at Townsville indicating that the aircraft was some 40 miles off the coast north of Townsville. The aircraft was due at Townsville at 2206 hours with an apparent reserve of 17 minutes but at 2141 hours the pilot advised he was descending and almost out of fuel.

The aircraft was ditched in the sea some sixty-two miles north of Townsville off

Hinchinbrook Island at approximately 2155 hours. The aircraft sank quickly and the patient, who could not be extricated, was drowned. The pilot who was apparently injured in the ditching, escaped, but subsequently drowned and the ambulance bearer was picked up by a passing ship some six hours after the ditching.

From the HDF bearings obtained on the aircraft in the latter part of the flight, in conjunction with the known courses flown after setting course for Townsville and the ditching position it appears that, when the pilot estimated he was over Cairns, he was, in fact, many miles south-east of this position. This suggests that the pilot's navigation and position reporting on the flight from Iron Range to Cairns were inaccurate. This, of course, was known to no-one but the pilot. The regular reporting of visual "on-track" positions with no requests from the pilot for special assistance led the ATC organization to believe that the flight was proceeding normally and would terminate safely. The full search and rescue organization was activated as soon as the pilot reported being unable to locate Cairns but there were obvious difficulties in attempting to establish the position of an aircraft commencing from an unknown position. To add to these difficulties the aircraft's fuel was exhausted some 272 minutes after departure from Iron Range, whereas the pilot had notified an endurance of 300 minutes, indicating that he had underestimated the fuel consumption of the aircraft.

The navigation facilities available in this aircraft were very limited and having regard to the terminal and route weathers passed to the aircraft it is considered that the pilot made an error of judgment in overflying Cooktown and attempting to reach Cairns on this night. The terminal forecast for Cairns indicated that there would be complete cloud cover at various levels below the aircraft's cruising altitude and it is apparent that navigation en-route by visual reference at 7,000 feet was impossible after passing Cooktown. A satisfactory navigation plot could not be maintained by the pilot in this aircraft and the radio compass was of a type which could not be expected to provide a reliable indication except at very short range. In these circumstances there were very substantial hazards in attempting to reach Cairns at night and it is considered that the proper action would have been to land at Cooktown.

Nevertheless, there was a very real pressure on the pilot arising from the patient's deteriorating condition and it is considered that in making this decision, he was placed in an unenviable position. The existence of precise written instructions from his employers or the ambulance organization dealing with circumstances such as this would have been of great assistance to him and would probably have influenced him to land at Cooktown. The instructions that did exist were of a general and verbal nature and there is some doubt as to whether they were conveyed to and understood by the pilot.

The aircraft's radio compass proved to be useless in locating Cairns, probably because of the combination of "night-effect", atmospheric interference, and the inherent range limitations of the particular airborne equipment.

It was concluded that:—

(a) The cause of the accident was the inability of the pilot to determine his position after he had become lost at night whilst flying above cloud.

(b) The pilot became lost as a result of an error of judgment in attempting to reach Cairns at night in unfavourable weather conditions in an aircraft not equipped with adequate radio-navigation aids and because he failed to navigate the aircraft with the degree of care demanded by the circumstances of the flight.

(c) A contributory cause of the accident was a lack of interchange of navigational information between Air Traffic Control and the pilot in command of the aircraft, which precluded more effective navigation advice being provided.

(d) The pilot's motives in endeavouring to secure quickly, the best possible medical care for the patient must be highly commended, although his actions were not in the best interests of safety.

(e) Adequate instructions relating to the conduct of urgent medical flights in darkness or in unfavourable weather conditions had not been provided, either by the pilot's employers or the owners of the aircraft.

(f) The pilot underestimated the fuel consumption of the aircraft.

Since this accident the Department has issued instructions to both pilots and air traffic controllers describing the action they must take when it becomes necessary in a medical emergency to operate a VFR aircraft in IFR conditions. It is considered that, by a complete exchange of information commencing from the earliest possible time, a large measure of assistance can be provided to the pilot in these circumstances. Similarly the aircraft operator has issued further instructions in connection with emergency medical flights which should assist its pilots to decide whether, despite the medical emergency, an IFR flight should be undertaken.

Take-off Accident – Moth Minor

(1529/53)

A MOTH MINOR, taking-off at Nhill aerodrome, Victoria, became airborne after a run of approximately 600 feet. Before the aerodrome boundary had been reached, a tight turn to port was commenced at a height of about 100 feet. During the turn, the aircraft rapidly lost height and struck the ground about 45 feet inside the boundary fence and then slid for approximately 100 feet before coming to rest. The aircraft sustained extensive damage but neither of the two occupants was injured.

The investigation of the accident revealed that the airbrake had been lowered for taxying in the belief that it would help to stabilise the aircraft on the ground in the existing gusty wind conditions. Subsequently, the pilot omitted to raise the airbrake before take-off.

The evidence indicates that the pilot failed to realise that the airbrake was down until a turn onto course was commenced shortly after becoming airborne and at a relatively low altitude. Thus, it appears that the turn was entered with insufficient airspeed in view of the fact that the airbrake was extended, and in the gusty wind conditions. As a result, the aircraft rapidly lost height during the turn, the port wing stalled and the aircraft struck the ground.

The pilot states that when the wing dropped a "terrific effort" was made to raise the nose. Although it is seriously doubted that recovery could have been effected in the altitude available, the pilot's action in attempting to raise the nose when the aircraft was in a stalled condition only made things worse.

The accident has been attributed to carelessness on the part of the pilot in failing to carry out a thorough pre-take-off cockpit check.

Norseman Encounters Soft Patch on New Guinea Strip and Overturns

(18/2/2)

A NORSEMAN was being flown from Wewak to Telefomin in New Guinea with a load of general cargo and one passenger. During the landing run at Telefomin the aircraft encountered a soft patch into which the main wheels sank to the axles and the aircraft overturned and was extensively damaged. Although the pilot in command escaped uninjured, the pilot under instruction and the passenger were both injured.

The aircraft, being flown at the time by the pilot in command, touched down close to the threshold and a little to the left of the strip centre-line. It had run for some 1,800 feet on the ground before the accident occurred. The pilot was familiar with the strip, the type of aircraft and operating conditions in New Guinea and an examination of the aircraft did not reveal any defects which might have contributed to the accident.

The soft patch on the strip was in the nature of a drainage "soak" but its presence was not easily discernible to the eye either from the air or on the ground. Although there had been some rain at Telefomin during the preceding 48 hours the remainder of the strip was quite firm and suitable for operations. For these reasons it was considered that the pilot could not be criticized for failing to avoid the soft ground.

Telefomin airstrip is owned and maintained by the New Guinea Administration and, although the softening of this area would probably have been gradual, it is considered that proper strip inspections would have revealed this condition before it became dangerous to aircraft. Action could then have been taken to effect repairs or to warn pilots.

It was concluded therefore that—

(a) The accident was due to the failure of the owners of the Telefomin airstrip to maintain the airstrip at a satisfactory standard for aircraft operations; and

(b) The deterioration of the airstrip which resulted in this accident was probably not readily apparent to pilots from the cockpit of an aircraft.

DH.83 Fox-Moth – Caught in Subsidence in Lee of Mountain Range, New Guinea

(18/21/2)

A DH.83 Fox-Moth departed Port Moresby at 0930 hours on a charter flight to Kokoda in New Guinea carrying general freezer cargo. The route involved a crossing of the Owen Stanley Ranges (peaks to 13,000 feet), via the Kokoda Gap, which can be traversed at a minimum safe altitude of approximately 6500 feet. Whilst negotiating the Gap the aircraft struck a tree and crashed onto a steep slope, clear of trees, at an altitude of about 6500 feet. The aircraft was being flown by a commercial pilot who had considerable experience on this and other light aircraft in New Guinea. He escaped with minor injuries. The aircraft and its cargo were destroyed by impact forces, and abandoned. The weather conditions in the area at the time of the accident were scattered low cloud, overcast at 12,000 feet, visibility 40 miles and the wind was from the north-west at about 15 knots. Thus the flight had to approach the ranges from the lee-side.

The pilot has stated that after take-off he climbed to an altitude of 7,400 feet in a position close to the southern approaches to the Gap before attempting to negotiate it. During the approach to the Gap he encountered moderate to severe turbulence with long periods of up and down drafts. As the aircraft reached the narrowest part of the Gap a strong down draft was encountered and the aircraft commenced to lose height. The pilot then attempted a turn to the right to fly out of the Gap and, whilst still losing height in this turn, struck a tree on the eastern side and crashed out of control.

The pilot stated that the aircraft was functioning normally right up to the time of the accident. However, the performance capacity of the DH.83 does not provide any substantial safety margin when operating at the higher altitudes close to mountainous terrain. On this occasion the aircraft took some 65 minutes to climb to 7,40ᴜ feet and, at that altitude, there would be no reserve climb performance to meet down draft conditions.

It was concluded that:—

(a) The accident was due to the failure of the pilot to abandon the flight when severe turbulence and strong subsidence were encountered before the aircraft reached a position where it could not be manoeuvred out of the Gap.

(b) A contributory cause was an error of judgment by the pilot in attempting to fly through the Gap at an altitude which did not provide a safe margin of terrain clearance under the existing conditions.

Fatal Spin In DH.82

(18/2/3)

IN the late afternoon at Moorabbin Aerodrome, Victoria, a private pilot took-off in a DH.82, with a young student pilot as passenger, for one hour of general flying practice. Some fifteen minutes later it was seen by a number of eyewitnesses a few miles north-west of Dandenong to enter a spin which continued until it struck the ground. The aircraft crashed into the yard of a house and was extensively damaged. The passenger in the front cockpit was killed and the pilot sustained minor injuries.

The occupant of the house and another person were conversing in the yard where the aircraft crashed and both were struck by the aircraft. The householder received very serious injuries and the other person was struck a glancing blow, causing only minor injuries.

After the accident the pilot stated that the spin was entered inadvertently whilst executing a steep turn at an altitude of 3,800 feet and despite the repeated use of the normal spin recovery procedures the aircraft continued spinning to the ground. Before the pilot flew again he was thoroughly examined in his techniques for steep turns, spin recovery and general aircraft handling. His test performance was good and, in particular, his steep turn and spin recovery techniques were correctly carried out. Even with deliberate intent he found it very difficult, in this test, to enter a spin off a steep turn by misuse of controls.

The pilot stated that the aircraft was behaving normally prior to the spin and a thorough examination of the wreckage did not reveal any evidence of defects which might have existed before impact.

In view of the standard of flying displayed by the pilot, the known difficulty of making this type aircraft spin without the most obvious misuse of controls and the statement of an eyewitness that the spin commenced after the aircraft had slowed down during straight and level flight, the pilot's statement could not be accepted without some reservation. Therefore, the cause of the spin could not be conclusively established from the available evidence.

Similarly, the reason for the aircraft failing to recover from the spin could not be determined in view of the later established ability of the pilot and the known recovery characteristics of the aircraft type. Normally a DH.82 would be expected to recover from a spin entered at this altitude even if the controls were released. To continue spinning it would have to be held in the spin.

DH.82 – Unauthorised Low Flying

(18/1/1)

A PRIVATE PILOT licence holder took-off in an aero club DH.82 from Moorabbin aerodrome in the late afternoon. He was authorized to carry out a flight of 30 minutes duration in the approved training area and the aircraft carried a passenger in the front cockpit.

Some 30 minutes later this aircraft was seen by several ground witnesses flying at a very low altitude down a valley near Lysterfield, Victoria, which is situated several miles outside the approved general training and low flying areas. The aircraft was seen to collide with power cables strung across this valley, somersault and crash to the ground. The aircraft was wrecked and both occupants received very serious injuries.

The flight path of the aircraft indicated that the pilot did not see the power lines or, at least, not until it was too late to take any avoiding action. It was concluded that—

(a) The cause of the accident was the inability of the pilot, whilst engaged in unauthorized low flying, to see or suspect the presence of high tension wires; and

(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.

DH.82 Hits Tree Whilst Flying In Cloud

(18/1/7)

TWO members of an aero club ferried a DH.82 from Sydney to Goulburn, New South Wales, so that week-end flying training could be conducted at the Goulburn aerodrome. Late on the Sunday afternoon, they set out to return over the 90 odd miles to their base aerodrome in Sydney. Before departing the pilot in command obtained a weather forecast for the route which indicated that the cloud base would be approximately 1,500 feet above the general level of the terrain with thunderstorms in the area and he was informed that, at the time of his enquiry, the cloud base at Bankstown was 800 feet. After discussing the situation with the senior operations officer at Sydney the pilot decided to "give it a go" and lodged the appropriate flight details.

The aircraft departed Goulburn at 1615 hours and levelled out at 500 feet following the main southern railway line to Sydney. This cruising level was only 200 feet below the cloud base, and some 25 minutes after departure some lower patches of cloud appeared on the track and the aircraft descended to pass under them. The pilot then observed even lower cloud moving in from the north and he decided to return to Goulburn. Just as he completed a turn to the left onto the reciprocal track the aircraft entered cloud and the pilot endeavoured to hold the aircraft on an even keel whilst descending slowly to regain visual reference. Before this could be obtained the port wing struck a tree and the aircraft swung violently to the right, struck another tree and crashed into a small clearing.

The accident occurred less than a mile from the town of Wingello which is on the railway line and 2,200 feet above sea level. The aircraft was substantially damaged but the two occupants escaped with only minor injuries.

The flying experiences of both the occupants were similar, amounting to some 110 hours, most of which had been obtained on DH.82. They both held valid private licences. There was no evidence of any defect or malfunctioning in the aircraft which might have contributed to the accident.

In view of the weather forecast provided to the pilot and the nature of the terrain to be traversed, there was quite a probability at the outset that the flight would not get through and, indeed, this was apparently appreciated by the pilot. However, it is considered that the pilot should not have continued the flight beyond the point at which he noticed lower cloud appearing whilst cruising just below the base at 500 feet. It would have been sensible to have abandoned the flight and returned to Goulburn at this point but he persisted in trying to get through until he could not even make a turn without entering cloud. Once the aircraft had entered cloud in these circumstances then the accident which followed had become a distinct probability in view of the limited experience of the pilot.

From the evidence it was concluded that:—

(a) The pilot complied with the Department's requirements for pre-flight briefing and notification and, having regard to the information provided to the pilot, the flight was properly commenced.

(b) The cause of the accident was an error of judgment by the pilot in attempting to continue the flight in such conditions of weather that visual flight could not be maintained.

(c) The pilot's error of judgment led him into flight conditions which demanded a skill beyond the limits of his experience and ability.

(d) The pilot probably flew the aircraft at a lower height than 500 feet above terrain without unavoidable cause contrary to the provisions of Air Navigation Regulation 133(2) (b).

Wackett Trainer – Fatal Stall During Low Flying

(18/1/8)

AN annual carnival was held at Taree, New South Wales, and included boat races on the Manning River. A former resident of the town and holder of a private pilot licence set out from Newcastle in a Wackett Trainer aircraft carrying a passenger to attend the carnival and arrived over Taree at about 1045 hours. The pilot saw a motor boat being driven at speed on the river and, apparently recognizing it as being driven by a friend, he descended and passed over it at a height somewhat less than 100 feet. The aircraft then commenced a climbing turn to port through 300 degrees with progressively steepening bank and diminishing airspeed. It crashed in a steeply banked attitude still under power onto river flats and burst into flames. Both occupants were killed on impact and the aircraft was destroyed by fire.

The pilot's flying experience amounted to some 200 hours of which 83 hours had been flown in this type of aircraft. No evidence of aircraft defect could be found and the load was well below the maximum permissible. The weather conditions were fine with good visibility and light winds.

It was obvious that the pilot had engaged in low flying in contravention of Air Navigation Regulation 133(2) and it is considered that the probable cause of the accident was loss of control due to poor technique on the part of the pilot in the execution of a steep turn close to the ground.

DH.82 Strikes Tree on Approach at Maylands, Western Australia

(18/3/2)

A DH.82 owned by the Department of Civil Aviation was engaged on local flying in the Perth area and at about 1050 hours an approach was made into the southwest to land on Maylands aerodrome. During the approach the aircraft struck the top of a tree near the aerodrome boundary, knocked over a boundary fence post, wrecked the undercarriage on striking a levee bank just inside the boundary and slithered to a halt on the aerodrome proper in an upright position. The two occupants of the aircraft were not injured, but the aircraft sustained major damage.

The aircraft was being flown by a departmental officer who held a private licence and whose experience amounted to some 1,300 hours. The passenger in the front cockpit did not hold a pilot's licence and the dual controls had not been removed from that cockpit as is required by the Air Navigation Regulations, There was no evidence of any defect or malfunctioning in the aircraft which might have contributed to the accident.

Although the lowest clear approach path to the aerodrome from this direction does not meet the general standards of the Department and is steeper than the normal powered approach angle for a DH.82, these circumstances were well known to the pilot. From the evidence it was concluded that the accident was due to the failure of the pilot to take sufficient care to ensure that the approach was made clear of all obstructions.

Wackett Trainer – Major Structural Failure In The Air

(18/1/12)

TWO student pilots left Ararat aerodrome, Victoria, on a local training flight in a Wackett Trainer aircraft and, some 35 minutes later, when the aircraft was almost over the town of Streatham at an altitude between 2,000 and 2,500 feet, it was observed by a number of eyewitnesses on the ground to commence a gentle level turn to starboard. Almost immediately the port wing was seen to be-

come detached from the aircraft. The aircraft struck the ground ¾ mile from Streatham and the port wing landed a further ¾ mile away. The main wreckage burst into flames and was destroyed. Both occupants of the aircraft were killed on impact.

The pilot authorized to fly the aircraft had some 62 hours flying experience and he had qualified for, but had not obtained, his private pilot's licence. The other occupant of the aircraft, who was carried as a passenger in contravention of Air Navigation Regulation 52(9), also held a student pilot's licence and had 54 hours of flying experience. The aircraft was loaded within permissible limits and the weather at the time of the accident was fine, with very little cloud, unlimited visibility and a north-westerly wind was blowing at 30-40 m.p.h.

Earlier in the day of the accident the aircraft had been inspected by a licensed engineer and passed as serviceable for flight, and during the morning another student pilot had flown it for one hour on general flying training. The aircraft, which was built in 1942, had flown 1,204 hours since new, 216 hours since the last complete overhaul, and 40 hours since the last inspection for a certificate of safety.

An examination of the wreckage revealed that the port wing had failed at the root, folding upwards and to the rear. As it failed the port fuel tank, with pieces of the upper skin, fell away separately and as the port wing came off the aircraft it apparently struck the top of the rudder and dislodged the fin which floated to the ground near the port wing.

An examination of the detached port wing revealed that the initial failure had occurred in the rear spar and, probably, at a point where the lower boom of this spar had been spliced some three years previously. It was obvious that this splice, which had separated, had not been designed in accordance with the repair and overhaul manual and the standard of workmanship was poor. The splice stiffener block was quite ineffective and the glueing of the splice faces was such as to be only partly effective. The plywood web of the spar had also failed and this was very close to a similar failure which had previously occurred and had been repaired by patching, approximately one month prior to the accident. Here again the repair work had been incorrectly designed and poorly carried out (see photograph reproduced on page 27). It was apparent that at some time prior to the accident the lower boom of the rear spar had separated at the splice and consequently the bending stresses in the spar were being borne only by the plywood web and upper boom. In such circumstances a structural failure in this spar even under normal flight loads would be almost inevitable.

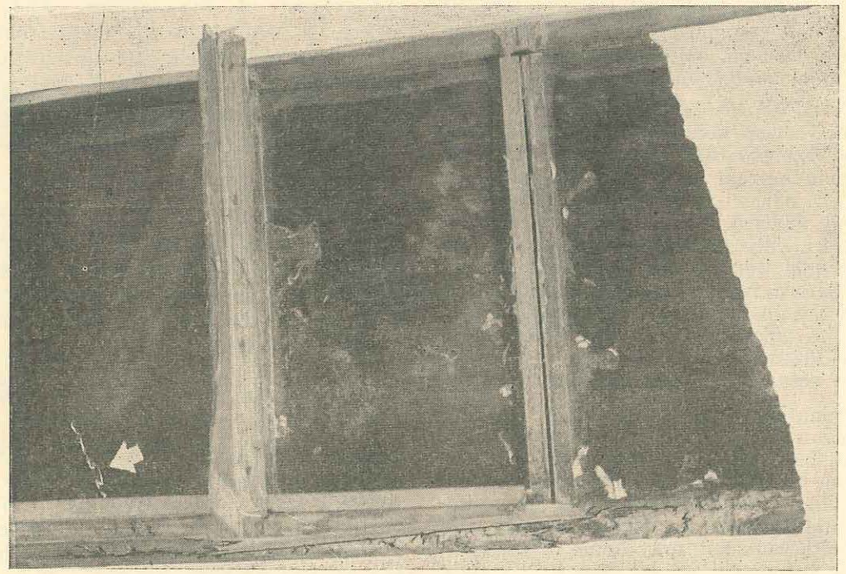
It could not be conclusively established at what point in the history of the aircraft's operating life this boom had failed. It is quite possible that the crack in the spar web, which had been detected and repaired previously may have been the result of this lower boom separating at the splice at that time. However a number of engineers who inspected the area then did not notice any such boom failure. Then again, during training operations three days prior to the accident, the aircraft was subjected to a heavy landing and, although it was then inspected, it is unlikely that a boom failure could be visually detected in such an inspection and it may have been present at this time. It is also possible that the final boom and web failure occurred during the flight on which the accident occurred as a result of the considerable reduction in strength of the spar arising out of the poor workmanship in repairs, and the general reduction in strength from glue and timber deterioration. However, it is considered that the inferior repair workmanship was a prime factor leading to the failure of the spar.

As a result of this accident action was taken against the licence privileges of two maintenance engineers. A number of other similar type aircraft were inspected and similar faults rectified. The attention of all engineers licensed in the relevant categories was directed to the proper methods and standards of repair work. Revised orders were issued calling for the close inspection of Wackett Trainer aircraft after heavy landings and it is in this respect that all pilots flying these aircraft can assist towards their own protection. It is likely that damage caused by previous heavy landings played a large part in the final failure of the wing in this accident and, for obvious reasons, these landings should

be reported so that the proper inspections can be made. It is interesting to note that in an inspection following a heavy landing which occurred in another Wackett subsequent to this accident a very similar failure of the spar web was found.

From the evidence relating to this accident it was concluded that:—

1. The port wing parted from the aircraft following the structural failure of the rear-spar under normal operating loads.
2. The failure of the rear-spar was due to either—
   2.1—A heavy landing three days prior to the accident which cracked the port rear-spar near a splice in the lower boom at station 32. This crack and the final failure of the rear-spar was made easier by the separation of a badly designed and poorly executed splice in the lower boom at station 32
   or
   2.2—Separation of a badly designed and poorly executed splice in the rear-spar lower boom at station 32 port which resulted in abnormal loads being placed on the other members of the rear-spar with consequent failure under normal operating loads. The inevitable failure of the rear-spar with the boom discontinuous due to the ineffective splice was probably hastened by a heavy landing three days prior to the accident.
3. The splice in the rear-spar lower boom at station 32 port, which was carried out in March, 1951, did not conform with the repair method given in the aircraft manufacturer's overhaul and repair manual, as certified in the airframe log book.
4. Damage, found in December, 1953, to the port wing of the aircraft included a crack in the rear-spar boom at station 32 port and was probably due to a heavy landing or severe ground loop.
5. The repair to the crack in the rear-spar web, whilst effective in transferring loads across the crack, was poorly executed.



Section of port wing rear spar showing (a) separated splice in the lower boom (bottom centre) and the poor standard of glueing in its vicinity (b) effectiveness of splice stiffener lost by sectionalization between spar ribs (c) location of previous crack in plywood web (bottom left) and (d) final break in plywood web (right).

PART IV

INCIDENT REPORTS

Door Warnings In Pressurized Aircraft

(1618/54)

WHEN ready for departure the door warning light in the cockpit of a Convair 240 indicated that a door was not locked. The despatch officer checked the belly compartment doors and, at the same time, the first officer checked the forward upper cargo compartment door. The light remained on and the first officer went aft and lowered and raised the passenger ramp and also checked the rear loading door. He reported to the captain that the loading door latches were visually checked. The captain has stated that, during the latter checks, the warning light flickered but remained on and, as all doors had been checked, he assumed that a micro switch was faulty and decided to proceed with the flight.

About seven minutes after take-off a hostess reported that there was a pressure leak from the rear loading door, whereupon, the first officer inspected the door and promptly advised the captain that the latch bolts were only just holding, although the door handle was in the fully locked position. Before returning to the cockpit he warned the hostesses to keep a safe distance from the door and to keep passengers seated. Pressurization was dumped and the aircraft returned to the departure point.

Examination of the door locking mechanism showed that an actuating linkage had been bent with the result that the effective length of the connection to the latches had been shortened and, when the door handle was in the locked position, the latch bolts were not fully home in the door frame housings.

It is probable that the door locking handle had been forced towards the locked position at some time when the door had been partially closed and with the latch bolts not lined up with the housings in the open frame.

The decision to proceed with the flight and pressurize was based on the assumption that the warning system was faulty. It appears that this assumption was dictated, primarily, by the flickering behaviour of the warning light when the rear door and ramp were being checked and on a visual check of the latch bolts.

It seems improbable that the flickering of the warning light was associated with engagement of the latches. The micro switch is located in the door frame and is tripped by a latch bolt during the final 3/16″ of movement. If the bolt went in far enough to momentarily trip the switch it should have been safely engaged.

A visual inspection of the bolts is not always conclusive evidence that they are safely engaged because in this installation they can only be viewed across the gap between the door edge and the door frame and thus a safe depth of engagement cannot be verified by this means.

From checks carried out, the pilot concluded that the warning system was faulty, but subsequent events proved that his analysis was incorrect. This incident shows that the safest way to treat such a warning is to believe it until the defective component of the warning system is located. It would be impossible to predict all the combinations of faults and symptoms for the guidance of a pilot in analysing malfunctioning of the equipment and therefore the safe rule is—"If the door warning light is 'on', do not pressurize".

Unsafe Separation On A Controlled Air Route

(1746/53)

TWO DC.4s departed Melbourne for Sydney, via the direct route, with 20 minutes separation at Melbourne. Both pilots elected to cruise at the same altitude and, on flight plan times, the succeeding aircraft would make up four minutes on the leading aircraft at Sydney. Minimum safe longitudinal separation on this route is 10 minutes and on the position reports at the Murray River the separation was reduced to 17 minutes.

Gunnery exercises in the Canberra area had been notified by Notam and Sydney A.T.C. issued an instruction to the leading aircraft to track over 2CY broadcast station (i.e. 6 miles W.N.W. of Canberra) to avoid these exercises. The firing was cancelled because of weather before the following aircraft reached Murray River and no such diversion was required of this aircraft.

For reasons, which cannot now be determined, the pilot of the leading aircraft did not receive or understand the A.T.C. instruction regarding his diversion route and this aircraft avoided Canberra by some 25 miles to the south-east. The pilot reported his position as "Canberra", when in fact, he had only intercepted the south-eastern aural leg of the Canberra V.A.R. at some 25 miles from Canberra. The ambiguity of this report (see AIP/RAC 1-9-3) was not queried by the air traffic controller who assumed that the report was "over 2CY" broadcast station.

The leading aircraft then turned towards Marulan into an 80 knot wind, reduced airspeed because of turbulence and the pilot notified an E.T.A. Marulan devised simply by the addition of the flight planned time interval to his incorrect Canberra reporting time. This, of course, took no account of the longer route, reduced airspeed, greater head wind component or the incorrect position report, and led the air traffic controller to believe that the aircraft was complying with the route instructions he had issued.

Meanwhile, the following aircraft had not deviated from the normal route and had notified an E.T.A. Marulan 17 minutes later than the leading aircraft. The two aircraft reported at Marulan within two minutes of each other at the same altitude.

The investigation revealed that the pilot of the leading aircraft was not aware of the route instructions issued and in turn the air traffic controller was completely unaware of the actual diversion route flown. Certainly, every effort must be made by air traffic controllers to ensure that their instructions are received and understood, but, it is considered that this incident would still have been avoided if the pilot of the leading aircraft had notified A.T.C. of the nature of his diversion from the normal route, or had complied with standard position reporting procedures, or had re-calculated an E.T.A. for Marulan in the light of the changed route and ground speed. Similarly, the air traffic controller should have insisted upon the Canberra position report containing all the information required by the Aeronautical Information Publication.

Low Visibility Approaches at Nadi, Fiji

(6/855/15)

A CONSTELLATION 1049 aircraft arrived over Nadi Airport, Fiji, on 8th March, 1955, at 1210 hours with 210 minutes remaining endurance at holding power. The weather at this time consisted of heavy showers passing over the field reducing the visibility to one mile in some directions with a maximum of three miles. An instrument approach was carried out by reference to the twin locator aids aligned with the runway but, although the aircraft broke cloud at 800 feet, the pilot was unable to locate the runway and carried out the missed approach procedure returning to 6,000 feet, the stipulated lowest holding altitude.

The visibility deteriorated to 500 yards and the aircraft continued holding until

1315 hours when the visibility had improved to one mile again and a second approach was commenced. During the descent the visibility improved to 2 - 4 miles but as the descent from 6,000 feet occupied 14 minutes the visibility again deteriorated at the crucial stage and a second missed approach became necessary when the runway could not be sighted from the inner locator (distance to threshold—one mile).

The pilot then requested and obtained permission to hold at 3,000 feet and at 1354 hours (with 75 minutes endurance remaining and no suitable alternative field within range) a third approach was commenced. Nadi Airport Control had, meanwhile, stationed an officer at the runway threshold with a verey pistol and a supply of red flare cartridges. The visibility was still one mile but the pilot saw the red flares, located the runway and landed safely.

It is considered that the basic reason for the pilot being unable to see the runway from the inner locator (the missed approach limit) was the absence of approach lighting facilities between the inner locator and the runway threshold.

Arising from the incident it was agreed, at the 9th Meeting of the South Pacific Air Transport Council, to recommend to the Member Governments that a modified Calvert medium intensity approach lighting system be installed. This is anticipated to provide adequate guidance from the inner marker in conditions down to half mile visibility. At the same time it was also agreed to install medium intensity runway lighting on Runway 03 integrated with the approach lighting, omni-directional low intensity lighting on Runway 09 and to replace the existing obsolete airport beacon. The circumstances of this incident were made known to attending delegates as an illustration of the need for improved facilities at Nadi.

This incident also illustrated the disadvantages of having a minimum holding altitude as high as 6,000 feet when a pilot is endeavouring to complete an approach during a temporary improvement in visibility at the field. Approaches from this altitude occupied too much time to be completed within the period of temporary improvement. The minimum holding altitude examined in relation to the local terrain at Nadi has now been lowered to 3,000 feet and the approach pattern is being further examined with a view to lowering it, if possible, to 2,000 feet.

A New Twist To The Overspeeding Propeller

(6/855/12)

A CONSTELLATION 749 was cruising at 11,500 feet in clear air between Karachi and Bombay when the propeller of No. 4 engine oversped to 3,100 r.p.m. and then stopped suddenly, remaining stationary in flat fine. The whole collapse took only 3 - 5 seconds and was accompanied by a most violent airframe shudder. The aircraft entered a diving turn to the right which was corrected with rudder and aileron.

Height could not be maintained at climbing power on the remaining three engines and the aircraft was forced to return to Karachi, descending at 200 - 300 feet per minute down to an altitude of 3,000 feet, where height could be maintained at climbing power.

An inspection of the No. 4 propeller pitch change motor revealed that the shaft splines had worn to the extent that they had failed under load. The operator has taken additional precautions to check for wear and for regular greasing of the spline.

An examination of the aircraft also revealed diagonal skin rippling on the side of the fuselage between the rear pressure bulkhead and the empennage. It is considered that this resulted from the twisting tresses set up in the fuselage when the pilot applied sudden and coarse but necessary, control corrections to keep the aircraft on an even keel when the No. 4 propeller oversped. Four sections of fuselage skin were replaced and an aft fuselage bulkhead ring straightened and reinforced. A complete rigging check revealed no further abnormalities and the aircraft was returned to service.

It is probable that when control over the propeller blade angles was lost, the inertia would carry the blades past the full fine position into the reverse range. Momentarily, the No. 4 engine would have been developing cruise power with the propeller blades in reverse pitch and this would account for the sharp diving turn. It also seems likely that the sudden reversal of propeller thrust stopped the engine before the blades had time to return to the full fine position.

Incident Report Leads Directly To Changes In Operational Control Procedures

(1051/54)

A CONSTELLATION 749 left Darwin shortly before midnight bound for Sydney. The terminal forecasts provided to the pilot before departure indicated that the weather at Sydney, for an E.T.A. of 0700 hours, would consist of 6/8 stratus cloud at 1,000 feet, 2/8 stratus at 600 feet and visibility 5 miles due showers, whilst for Dubbo, the inter-national alternative airport to Sydney, the weather was forecast to be at 8 a.m., $\frac{3}{8}$ middle level cloud and visibility 25 miles. The revised forecast passed to the pilot, some two hours after departure, suggested fog patches at Sydney with visibility down to 2 miles whilst that for Dubbo was changed to cloudless, visibility 10 miles.

These last mentioned forecasts remained unaltered during the remainder of the flight to Sydney but at 0400 hours a fog was first reported at Dubbo which persisted until 0845 hours with visibility down to 300 yards at times. By 0450 hours fog had also appeared at Sydney airport and this persisted either on the ground with visibility down to 220 yards or as raised fog, base 300 feet, until about 1125 hours. The reports of observed weather at both Sydney and Dubbo were regularly transmitted to the captain of the aircraft during the flight.

Some 20 minutes before the aircraft reached Sydney the fog began to lift from the ground and the horizontal visibility improved to two miles. The aircraft was cleared for an instrument approach utilizing the two locator aids but, before the aircraft had reached the minimum altitude, the lifting fog had formed a base of stratus at 300 feet. The aircraft missed the runway and returned to the holding point. At this stage the alternative airport, Dubbo, was still reporting fog conditions, and the nearest airport known to be suitable was Brisbane which the pilot estimated was two hours distant at minimum consumption cruise settings. His total fuel endurance remaining was 2 hours 19 minutes and the pilot set course for Brisbane.

Some $2\frac{1}{2}$ minutes later the pilot reported that he was "contact" just north of Sydney airport and requested permission for an approach from that direction. This was granted in view of the emergency situation but the pilot again was unable to locate the runway in time to effect a landing and carried out the missed approach procedure. By this time the remaining endurance of the aircraft was little, if any, in excess of two hours with Brisbane still the nearest suitable alternative. Before any further action could be taken the Sydney Control Centre received a report that the fog had suddenly cleared at R.A.A.F. Station Williamtown (some 75 miles north of Sydney) and the aircraft landed there at 0810 hours.

Because of the obvious hazards to the safety of this aircraft contained in the circumstances of this incident it was investigated in considerable detail and it became apparent that:—

(a) the pilot had taken all proper precautions to inform himself of weather trends during the flight and had acted reasonably in the light of that information;

(b) the meteorological forecaster had acted with all care and the contents of his forecasts, although in error, particularly in respect of Dubbo, were within acceptable limits having regard to the inescapable limitations of forecasting and the limits of the data available to him; and

(c) the A.T.C. officers providing operational control had acted in accordance with their instructions except that the aircraft was not diverted to

Dubbo and, in these circumstances, their action was reasonable having regard to the safety of the aircraft.

Referring to (c) above it was noted that the written instructions to A.T.C. officers required that any diversion action by him must be based upon forecast weather conditions or where doubt exists as to the fulfilment of the forecast he must inform the pilot of the circumstances giving rise to this doubt. Since the terminal forecasts for both Sydney and Dubbo indicated that conditions would be above minima on arrival of the aircraft, the A.T.C. officer had no authority to divert the aircraft and his action in keeping the pilot informed of the weather development at both airports was consistent with his own personal doubts and his instructions.

Despite the conclusions described in (a), (b) and (c) above, the fact remained that an aircraft had been caught in a most unsafe situation. On considering how this might be avoided in the future, the instructions to A.T.C. officers providing operational control were examined. These instructions appeared to place greater reliance upon the fulfilment of a weather forecast than experience had justified or even the forecaster himself would claim to be due. There are many conditions of weather which are notoriously difficult to forecast. The dispersal of fog certainly falls within this category. Then again, the consideration of forecast weather against observed weather separated by a short interval of time may also raise some doubts regarding the accuracy of the forecast.

Recognizing these uncertainties, particularly as underlined by this incident, it was decided to allow to the officer providing operational control, greater freedom to recommend or require aircraft to carry additional fuel reserves whenever some doubt exists concerning the accuracy of the weather forecast. Naturally this officer, in the exercise of this discretion, will only recommend or require action which will increase the safety assurance but he must endeavour to strike a nice balance between safety and the economy of operations. The new provisions are described in paragraphs 10.2 and 16.1 of AIP/RAC 1-7.

It is anticipated that, by close co-operation between air traffic controllers and pilots, pooling information and exchanging ideas, the potential dangers highlighted in this incident can be avoided and if, in the future, this prevents an accident it is no more than we can ask of the incident reporting system.
