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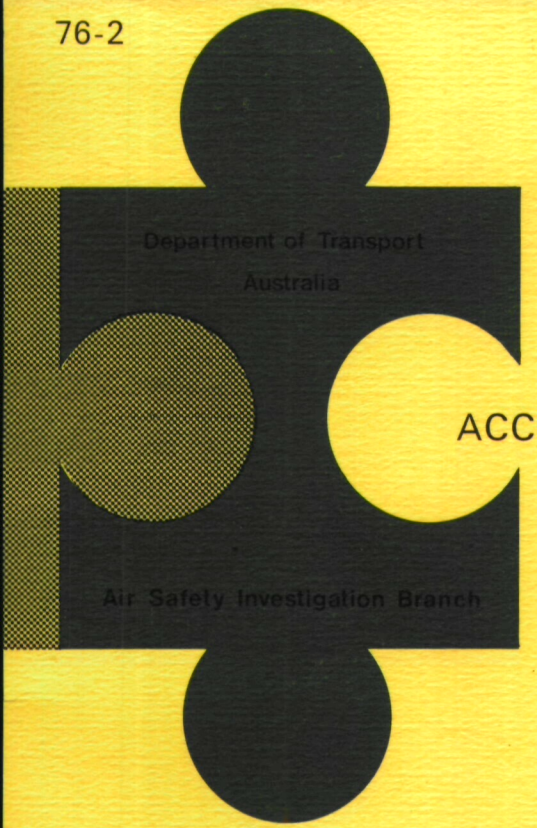
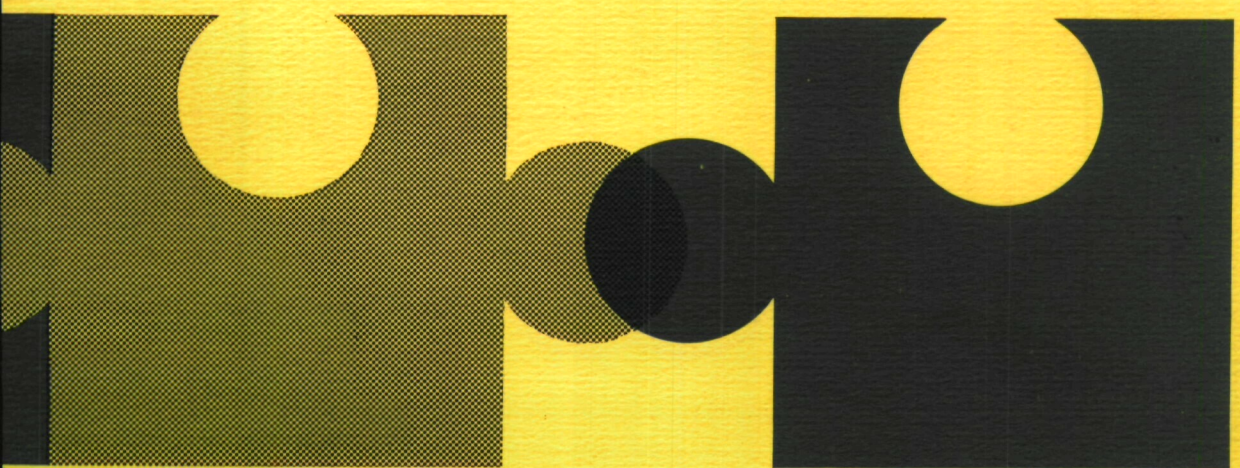


DEPARTMENT OF TRANSPORT · AUSTRALIA ·

ACCIDENT INVESTIGATION REPORT

Fokker Friendship F-27-100
Aircraft VH-EWL,
at Bathurst,
New South Wales,
on 31 May 1974



Special Investigation Report 76-2

AIR SAFETY INVESTIGATION BRANCH

Accident Investigation Report

Fokker Friendship F-27-100 Aircraft VH-EWL at Bathurst, New South Wales, on 31 May 1974

The Secretary to the Department of Transport authorised the investigation of this accident and the publication of this report pursuant to the powers conferred by Air Navigation Regulations 278 and 283 respectively.

Prepared by: Air Safety Investigation Branch

October 1976

AUSTRALIAN GOVERNMENT PUBLISHING SERVICE
CANBERRA 1977

Contents

Note 1: All times are Eastern Standard Time and are based on the 24 hour clock. Where applicable, seconds are shown using a six figure group.

Note 2: Metric units are used except for airspeed and wind speed which are given in knots; and for elevation, height and altitude which are given in feet.

THE ACCIDENT

At approximately 1822 hours Eastern Standard Time (EST) on 31 May 1974 Fokker Friendship F-27-100 aircraft, registered VH-EWL, crashed adjacent to Runway 35 at Bathurst aerodrome, New South Wales, during an attempted go-around from a landing approach. The aircraft came to rest after sliding 625 metres from the impact point, and sustained substantial damage.

VH-EWL was engaged in operating a regular public transport flight with a crew of four and was carrying thirty passengers. Both members of the flight crew, and six passengers, received minor injuries; no other persons were injured.

1. FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHT

Fokker Friendship F-27-100 aircraft, registered VH-EWL, was operating under a current certificate of registration, the holder of which was East-West Airlines Ltd (EWA). The aircraft was operated by EWA and, at the time of the accident, it was engaged on a regular public transport service operated under the terms of a current airline licence. The service, designated Flight 752/753, is operated from Sydney to Orange, Bathurst and thence to Sydney.

The flight plan submitted to Air Traffic Control indicated that it would be an instrument flight rule (IFR) category flight with estimated time intervals between Sydney and Orange of 33 minutes, Orange and Bathurst 8 minutes, and Bathurst to Sydney 25 or 33 minutes, depending on which of two alternative routes was flown. The flight departed from Sydney at 1706 hours and proceeded to Orange without incident. The aircraft cruised at 10 000 feet in clear conditions with a layer of alto-stratus cloud at about 12 000 feet but, when overflying the area some 55 km south-east of Bathurst, the Captain diverted slightly south of track to avoid some cumulus clouds; for the remainder of the flight to Orange there were only occasional patches of cloud below the aircraft. During the flight to Orange, the weather radar was operated through the full range of tilt, through various ranges, and through all three modes, but no adverse weather returns were observed.

The flight departed from Orange at 1810 hours and, flown by the First Officer from the right-hand pilot seat, the aircraft cruised at an altitude of 5250 feet which is the lowest safe altitude for the route. There was no cloud below the aircraft and the visibility was unrestricted: the aircraft weather radar was selected to 'standby' but it was not used.

When the aircraft was about 18 km west of Bathurst aerodrome, radio contact was made on the EWA Company frequency with a Company representative in the aerodrome terminal building who, after observing the illuminated windsock on the aerodrome, advised the flight that the wind was from the north-east at five knots, and that the altimeter setting was 1021 millibars. The crew commenced the descent from a position about 5.5 km west of the aerodrome, in visual conditions, with the lights of the city of Bathurst and the runway lights clearly visible.

Initially, it was intended to overfly the aerodrome and then make a left-hand circuit preparatory to landing on Runway 17, but when the Captain saw what appeared to be a light rain shower slightly east of the Runway 35 threshold, and which might have involved penetration during a left-hand circuit to Runway 17, he decided to land on Runway 35 instead. At 1817:30 hours the Captain called Sydney Flight Service on the frequency of 125.0 MHz reporting that the aircraft had arrived in the Bathurst circuit area, and requesting that the search-and-rescue watch be terminated. The aircraft,

which was still being flown by the First Officer, was turned some 90 degrees to the right and it joined the left downwind leg of the traffic circuit for a landing on Runway 35. The aircraft proceeded downwind a little further than is usual then turned onto base leg of the circuit by which time, the flight crew state, all cockpit checks had been completed except for setting the engine fuel trims to 'full increase'. The Captain states that whilst the aircraft was on the base leg he checked that the water methanol lights were on, and that the fuel trim indicators were at 'full increase'.

The aircraft was turned onto final approach for landing, at which time the landing gear was down, 26.5 degrees of wing flap had been extended, it was aligned with the runway centre-line and no drift was evident. Flight conditions were smooth. Light rain was then encountered and the windscreen wipers were switched on to operate at slow speed. The flight path appeared to be normal and the flight data record indicates that the airspeed was 110 knots reducing to 100 knots with the rate of descent stabilised at some 700 ft/min. At about this time the aircraft passed over the Great Western Highway (730 metres south of the Runway 35 threshold) at a position described by witnesses as normal and at the normal height of about 300 feet above terrain; two or three noticeable turbulence bumps were then encountered and the aircraft commenced to drift to the left of the runway alignment.

The aircraft heading was altered a few degrees to the right and the approach was continued in light to moderate turbulence with the rain intensity increasing to heavy as the aircraft approached the runway threshold; the windscreen wipers were then selected to operate at high speed. The flight crew state that the full length of the runway lighting was visible to them and that, at approximately 200–250 feet above terrain and prior to reaching the runway threshold, on the command of the Captain, the First Officer initiated a go-around because the aircraft had drifted too far to the left of the runway centre-line to safely effect a landing.

The First Officer states that he placed the power levers in the position for maximum power and he rotated the aircraft, by reference to the flight instruments, to the normal body attitude of 8 to 9 degrees for initial climb. The response of the engines appeared normal to the crew and they believed that full 'wet' power was being developed. Immediately after the engine power increased the Captain raised the wing flaps from the setting of 26.5 degrees to 16.5 degrees, and he retracted the landing gear.

The flight crew state that at the commencement of the go-around the aircraft was still in conditions of turbulence and heavy rain and that, initially, the aircraft maintained its altitude; the indicated airspeed then decayed rapidly to 73 knots at which time, according to the Captain, the aircraft was estimated to be 80–100 feet above the runway. As the indicated airspeed decreased the First Officer lowered the nose of the aircraft slightly but still maintained a climbing attitude. At about this time the Captain took hold of his control wheel but the First Officer continued to fly the aircraft by reference to his flight instruments. The indicated airspeed remained at 73 knots for a few seconds then rapidly increased to about 80–85 knots; it was not fluctuating and the turbulence had ceased. The rear fuselage of the aircraft then impacted the ground heavily just outside the boundary of the flight strip, at a point 1240 metres north of the Runway 35 threshold, 48 metres to the right of the runway centre-line.

The aircraft slid along on the fuselage for a distance of 625 metres during which the starboard engine was torn out of the wing. Cockpit impact drill was initiated by the flight crew during the ground slide and completed when the aircraft came to rest. The crew and passengers evacuated the aircraft at which time there was little or no rain at their location and there was a light breeze from a southerly direction.

Passenger evidence indicates that during the landing approach the rain intensity and turbulence increased after the aircraft crossed the Great Western Highway and, as the aircraft approached the runway threshold, there were various changes in the engine

noise consistent with their expectations during an approach in gusty conditions. In the immediate vicinity of the runway threshold area the rain became very heavy and the aircraft was buffetted extensively by wind gusts. According to passenger evidence, after one or two of the runway lights had been overflown, with the taxiway lights to the right of the aircraft being seen by some passengers, and when passengers thought the wheels were almost on the ground, there was a substantial sustained increase in engine noise and there was a noticeable change in the aircraft attitude to an apparent climb attitude. Passengers observed that the aircraft turned slightly to the right at about this time and some seconds later the aircraft contacted the ground, there having been no further noticeable change in engine noise.

Some passengers indicated that the aircraft was to the left of the runway at the time the substantial increase in engine noise was heard. One passenger was a pilot familiar with Bathurst aerodrome. He indicated, from reference to land marks that, at that time, the position of the aircraft was 197 metres north of the Runway 35 threshold, in the general area of the western edge of the flight strip, at a height he estimated to be no more than 50 feet and, that subsequently, it was heading and tracking at an oblique angle across the runway. Other passengers observed the undercarriage retracting at about the time of the substantial increase in engine noise and/or change of aircraft attitude, and one passenger observed the undercarriage retracting when the aircraft was 'close by the windsock', which is located some 335 metres north of the threshold of Runway 35. Another passenger observed the windsock pointing towards him as the aircraft passed abeam of the windsock.

A ground witness located some 700 metres south-west of the Runway 35 threshold described the landing approach of the aircraft as being consistent with many other F-27 landings which he had observed on this runway, and that it was continued to a normal landing height at a normal distance along the runway, except that it appeared to be slightly to the left of the runway. Additionally, he indicated that there was an area of heavy rain over the Runway 35 threshold and the terminal buildings; with the area of rain extending a few metres to the west of Runway 35 and some 500 metres north of the runway threshold. In his opinion, the aircraft was flying along the edge of the rain.

Witnesses who were located in the aerodrome terminal building, some 400 metres north-east of the Runway 35 threshold, saw the aircraft apparently climbing away from the normal touchdown area of the runway; their estimates of height varied from 10 to 100 feet. One witness, with light aircraft pilot experience, was familiar with F-27 operations. After hearing engine noise consistent with a landing approach, he heard a substantial increase in engine noise which attracted his attention; he then saw the aircraft at a position about 320 metres north of the Runway 35 threshold, at a height he estimated to be 10–15 feet, and apparently going-around.

None of the ground witnesses saw the aircraft strike the ground.

The accident occurred at night, at approximately 1822 hours, at an elevation of 2395 feet above mean sea level.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others
Fatal	—	—	—
Serious	—	—	—
Minor/None	2/2	6/24	—

1.3 DAMAGE TO AIRCRAFT

The aircraft was substantially damaged.

1.4 OTHER DAMAGE

While sliding along the ground, the aircraft passed through and damaged five fences.

1.5 PERSONNEL INFORMATION

The pilot in command of the aircraft, Frank Henry OWEN, aged 40 years, was the holder of a first class airline transport pilot licence which was current until 31 October 1974. His licence endorsements authorised him to fly Fokker Friendship F-27 aircraft and he held a first class instrument rating endorsed for appropriate radio navigation aids. Captain Owen's total flying experience at the time of this accident was 8067 hours of which approximately 6000 hours had been gained in F-27 aircraft, including 1102 hours as pilot in command. His most recent proficiency check had been satisfactorily completed on 27 March 1974 and his most recent medical examination had been passed on 21 March 1974. In the 90 days preceding this accident he had flown 154 hours, all in Fokker F-27 aircraft. He had not flown for four days prior to commencing duty on the afternoon of 31 May 1974.

First Officer Philip Kevin POWER, aged 30 years, was the co-pilot of the aircraft and he held a second class airline transport pilot licence which was current until 30 June 1974. His licence endorsements authorised him to carry out the duties of co-pilot on Fokker Friendship F-27 aircraft, and he held a second class instrument rating endorsed for appropriate radio navigation aids. At the time of this accident his total flying experience amounted to 5420 hours of which 514 hours had been gained in Fokker F-27 aircraft. His most recent proficiency check had been satisfactorily carried out on 6 May 1974, and his most recent medical examination had been passed on 27 May 1974. In the 90 days preceding this accident he had flown 142 hours, all in Fokker F-27 aircraft. He had not flown for five days prior to commencing duty on the afternoon of 31 May 1974.

The cabin attendants on this flight were Michele Ann LOVES, the senior hostess, and Angela GREEN. Hostess Loves commenced employment with East-West Airlines Ltd on 8 November 1973, and Hostess Green on 7 February 1974. The most recent training in emergency procedures was carried out by Hostess Loves on 28 November 1973, and by Hostess Green on 21 February 1974.

1.6 AIRCRAFT INFORMATION

1.6.1 History

VH-EWL was a Fokker Friendship F-27-100 aircraft manufactured in 1967 by the Royal Netherlands Aircraft Factories and allotted Serial Number 10344. It had flown a total of 17 694 hours since new. East-West Airlines Ltd was the holder of the certificate of registration and the aircraft was maintained and operated by that organisation. There was a current certificate of airworthiness for the aircraft. VH-EWL had flown some 8 hours since the last maintenance inspection and there was no record of any defects which could have been relevant to this accident.

1.6.2 Loading

The maximum permissible gross weight for landing in this aircraft, having regard to structural considerations, was 18 144 kg; however, having regard to operational considerations (climb limitations) applicable to landings on Runway 35 at Bathurst, the maximum permissible landing weight was 17 600 kg. It has been calculated that the landing weight of the aircraft at Bathurst was 15 629 kg, that the centre of gravity was within the permissible limits, and that there was sufficient fuel and water methanol for the flight.

The loading documentation for the flight contained errors in that the cargo weight and distribution was incorrectly stated, the number of passengers recorded was incorrect, and the landing weight at Bathurst had been estimated as 15 505 kg.

1.6.3 Approach speed calculations

Before commencing the landing approach the flight crew calculated approach speeds for landing, having regard to the expected landing weight. These speeds were 2 knots less than those appropriate to the landing weight which was calculated subsequent to the accident. The required figures were:

Minimum Target Threshold Speed (MTTS)	*Minimum Flap Up/ Approach Climb Speed*	*Best Climb Gradient Speed*
88 kn	103 kn	112 kn

Additionally the crew calculated a planned Target Threshold Speed (TTS); this may vary from 5 to 10 knots above the MTTS according to assessment by the crew of the landing conditions. For this approach a TTS of 95 knots was selected.

1.6.4 Operating procedures

The Company procedures prescribe that the wing flaps be fully extended (40 degrees) by the time the aircraft descends through a height of 300 feet above terrain, but Captains are permitted, at their discretion, to delay this extension of flap to suit the circumstances. During this landing approach the flap was not lowered beyond 26.5 degrees.

The procedures also prescribe that, before landing, the fuel trim controls for each engine be set in readiness should a go-around be necessary, such setting to take into account the aerodrome temperature and pressure altitude. For the conditions prevailing at Bathurst aerodrome on this occasion the appropriate fuel trim setting was 'full increase'. Additionally, to ensure that full 'wet' power was available from each engine in the event of a go-around the water methanol switches for each engine are required to be turned ON during the pre-landing checks.

The aircraft was equipped with ECKO Series X band weather radar. It is Company practice that this be operated at the discretion of the Captain, based on his assessment of the general weather conditions.

1.7 METEOROLOGICAL INFORMATION

An anti-cyclone near the Central Tasman Sea extended a ridge to Alice Springs; gradients on the northern side of the ridge were slack but a shallow thundery trough followed the coast 100–200 km to seaward and northwards from Taree. Upper wind flows were weak at levels up to 600 mbs but at 500 mbs and 300 mbs a trough was moving slowly eastwards over eastern Australia; in the vicinity of Bathurst the circulation about the trough was light and it is probable that the upper winds did not exceed 30 knots. It is also probable that the air at levels up to 700–600 mbs advected over the area from the Tasman Sea but that modification of the air occurred at the lower levels west of the Dividing Range.

The forecast of the en route conditions, available at the Sydney Weather Service Office and provided to the crew, predicted that the strength of the upper winds would be 10 knots; that there would be scattered cumulus cloud with tops to 10 000 feet but scattered tops to 20 000 feet near the coast and in the vicinity of the Dividing Range; and that there would be isolated cumulo-nimbus cloud, base 5000 feet with tops to 35 000 feet, near the coast.

Bathurst aerodrome is not equipped with an anemometer, or rainfall recording equipment, and no weather observations are received from the aerodrome by the

Meteorological Bureau. Aerodrome forecasts are based on an appraisal of the regional situation. The aerodrome forecast predicted that for the expected time of arrival of the aircraft at Bathurst, the surface wind would be from 030 degrees (True) at 5 knots, the surface visibility would be 30 kilometres, the cloud cover would comprise $\frac{2}{8}$ cumulus cloud at 3000 feet, and that the QNH altimeter setting would be 1023 millibars.

Witness information indicates that at the time the aircraft entered the Bathurst circuit area the weather appeared to be fine, and that the surface wind in the vicinity of the runway was either calm or a light north-easterly breeze. However, coincident with the aircraft being on final approach for landing, a strong northerly wind suddenly became apparent together with heavy rain. A number of witnesses observed the windsock at this time indicating a wind from the north; it was kicking upwards and approaching a position consistent with a windspeed of 30–40 knots. Shortly thereafter the aircraft was seen in the area slightly to the south of the windsock, apparently landing and apparently into wind. The aircraft was then seen to have abandoned the landing approach and, about the time it was abeam of the windsock, the windsock movements became erratic. As the aircraft disappeared from the sight of these witnesses the windsock was then observed to be indicating a wind from the south at almost the same strength as when it had been from the north.

1.8 AIDS TO NAVIGATION

The procedures followed by the aircraft did not require reference to radio navigation aids.

1.9 COMMUNICATIONS

The flight from Orange to Bathurst was conducted outside controlled airspace and communications were conducted between the aircraft and the Sydney Flight Service Unit (FSU). The Department of Transport does not maintain a communication facility at Bathurst aerodrome.

East-West Airlines Ltd maintain a VHF transceiver at Bathurst aerodrome to permit communications between Company personnel. Approved personnel are authorised to transmit the aerodrome altimeter setting to inbound Company aircraft.

1.10 AERODROME INFORMATION

Bathurst aerodrome is located at latitude 33° 24′ 40″ South, longitude 149° 39′ 10″ East and contains one sealed runway, Runway 17/35. Runway 35 is aligned 354° 42′ 19″ True (variation 11.1 degrees East) and is contained in a flight strip 1889 metres long and 91 metres wide. It is 1706 metres in length, 30 metres in width and has an average slope of 0.7 per cent down to the north. The first 30 metres of the runway is 45 metres wide and this provides a turning area for taxiing aircraft. The elevation at the Runway 35 threshold is 2434 feet above mean sea level, and the elevation at the northern end of the runway is 2391 feet. Standard runway markings were painted on the runway.

Runway 35 is equipped with standard omni-directional, fixed intensity, runway edge lighting. This includes fixed distance lighting located 320 metres north of the runway threshold to denote the aiming point during the approach for landing.

The runway threshold is delineated by eight green lights at intervals across the runway and three blue lights at intervals along each side of the first 50 metres of the runway.

The runway is serviced by one taxiway which enters Runway 35 at a position 320 metres north of the runway threshold on the eastern side of the runway, and it lies in a

general east-west direction. It is equipped with side lighting consisting of fixed blue lights.

An illuminated windsock is located 137 metres east of the fixed distance lighting on Runway 35.

1.11 FLIGHT RECORDERS

The aircraft was equipped with a United Data Control F-542 Flight Data Recorder which records the aircraft pressure altitude, indicated airspeed, heading, and vertical acceleration, against a time base by means of engravings made on a stainless steel tape. The recorder was installed towards the rear of the fuselage and was not damaged in the accident.

The section of the foil which recorded the behaviour of the aircraft during the flight from Orange to Bathurst has been examined, and a representation of the flight data record for the final 117 seconds is at Appendix A.

It is significant that the traces indicate that, initially, the aircraft heading was consistent with the runway heading, and that the descent and airspeed pattern were normal. In respect of the vertical acceleration trace, a characteristic long-term excursion consistent with a turbulence encounter occurred 52.5 seconds before impact, and this was followed by a change of aircraft heading of some 4 degrees to the right. Turbulence then continued for the remainder of the flight. The recording indicates that the descent of the aircraft continued in a normal manner until 34 seconds before impact at which time the descent was arrested and a further change of aircraft heading of 8 to 10 degrees to the right occurred. At 24 seconds before impact the altitude trace exhibits a 'dip' characteristic of that associated with rotation of F-27 aircraft during a landing or take-off. During the next 8 seconds the indicated airspeed increased slightly as did the altitude, the indicated airspeed then decreased steadily from a peak of 99 knots to 70.5 knots and the aircraft gradually descended. The indicated airspeed fluctuated about 71 knots for 4.5 seconds then rapidly increased during 0.5 seconds at which time the impact with the ground occurred.

The aircraft was also equipped with a United Data Incorporated Model V412 Cockpit Voice Recorder and this recorder maintains on a continuous loop of magnetic tape a record of the preceding 30 minutes of cockpit communications, radio communications, public address announcements, and other sounds audible in the cockpit. The recorder would have ceased operating when the flight crew switched off the electrical supply in the course of conducting the impact drill but when they restored electrical power to provide lighting during the evacuation (see sub-section 1.15.1) the recorder would have re-commenced operating and continued whilst power was available. Nevertheless, having regard to the recording capacity it would be expected that at least that portion of the audio record covering the flight from Orange to Bathurst would still remain.

When cockpit audio recorders were first installed in Australian airline aircraft the Australian Federation of Air Pilots (AFAP) insisted that the information they contained should not be used in the investigation of air safety incidents or of any accident which the flight crew survived. In the interests of having this source of information available, at least in those accidents where the flight crew did not survive, the then Department of Civil Aviation agreed to this restriction for the time being. Accordingly, the evidence contained in the cockpit audio record for VH-EWL did not become available for use in this investigation.

1.12 WRECKAGE AND IMPACT INFORMATION

The aircraft first struck the ground at a position 1240 metres north of the Runway 35 threshold, and 48 metres to the right of the runway centre-line. It then slid over the

ground for a distance of 625 metres. The ground marks indicated that at initial impact the aircraft was tracking 356 degrees magnetic, 12.5 degrees to the right of the runway heading; and abrasion marks on the aircraft fuselage, consistent with the initial impact, indicate that the aircraft heading was 011 degrees magnetic, 27.5 degrees to the right of the runway heading. The initial ground impact damage incurred by the aircraft fuselage indicated that the probable body pitch angle at that time was between 6 and 8 degrees nose-up; and examination of the ground marks suggest that at first impact the aircraft was substantially laterally level, but possibly slightly right wing down.

Structural damage to the fuselage was confined generally to the lower fuselage area, but there was some distortion of the fuselage structure caused by impact loads. Additional damage to the nose section, and to the fuselage sides above the floor line, was caused by contact with fencing through which the aircraft passed.

Propeller ground slash marks first occurred after the aircraft had travelled about 20 metres from initial impact. These had been made by the starboard propeller when the blades made light contact with a gravel surface leaving eleven cuts 50 to 80 mm in depth and extending over a distance of 7.06 metres with a uniform spacing of 0.706 metres. After passing over a depression in the ground the propeller again contacted the ground lightly with an initial spacing of about 0.67 metres between slashes. Subsequent ground contact of the propeller blades became increasingly more severe and the engine frame failed as a result of overloading. The starboard engine separated from the aircraft shortly after the starboard wing tip made a brief contact with the ground about 140 metres from initial impact. The propeller sustained extensive impact damage and the propeller and gear box had separated from the engine. It was established that all damage to the propeller mechanism was consistent with impact loads, and there was no evidence of any defects or abnormal wear.

When the starboard engine separated from its nacelle portion of the fire-wall was torn away resulting in separation of the fuel trim control actuator from the structure. The actuator was found to be extended 16 mm and it was established, by comparison, that this position is equivalent to a fuel trim setting of 60 per cent 'trim-up'.

The port propeller first contacted the ground 405 metres after the initial aircraft impact, the slash marks being spaced 1.01 metres apart; the propeller stopped rotating after a further 85 metres. Apart from the propeller, the port engine installation was not damaged: there was no evidence that either the engine or the propeller had not been operating normally. It was found that the port fuel trim control actuator was also extended a distance of 16 mm.

The electrically-operated valves which control the water methanol supply to the port and starboard engines were both found to be in the closed position. The First Officer states that the switches were selected OFF during the post-accident impact drill. The starboard water methanol tank had been ruptured by impact forces and was empty. The port tank was intact and contained only a small quantity of water methanol but there was evidence that fluid from this tank had escaped through the cross feed line to the broken starboard tank.

The flight instruments were functionally tested and no significant deficiencies or errors were found. The selector valves, at both pilot positions, for the static source were found selected to NORMAL. Although it was not possible to conduct a leak check in respect of the starboard pitot system, because the lines had been disrupted at impact, the check conducted on the port system and a general examination of both systems revealed no defects. Water drain checks were carried out on the normal static and pitot lines and no water was found.

Arising from impact damage the primary flight controls were restricted in their movement but there was no evidence of any pre-existing defect. The elevator trim indicator was showing slightly nose-up and the rudder trim indicator was showing neutral. The flap selector lever was found to be at the 16.5 degrees detent, and all four

flap segments were found at the 16.5 degrees position. There was evidence from the pattern of mud splashes on and around the flaps that they had been in that position at impact and during the ground slide. The undercarriage selector lever was found in the UP position and there was no evidence that the undercarriage had been in any other position during the ground slide.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

Examination of the flight crew activities prior to, and during this flight, did not reveal any information which might have been pertinent to the accident.

1.14 FIRE

There was no sustained fire as a result of this accident. However, during the ground slide there was a flash fire which occurred at the time the starboard engine was detached from the aircraft by impact forces.

The mechanical port and starboard fuel shut-off valve mechanisms in the cockpit were operated at about the time the aircraft came to rest. The port shut-off valve was found closed but the starboard valve, located at the engine firewall, was found in the open position. It had been displaced during the separation of the engine and it was no longer controllable from the cockpit. The electrically operated fuel isolation valves were in the open position—there was no requirement in the impact drill that these valves be closed. Nevertheless, fuel, other than that contained in the collector tank, did not flow into the starboard engine bay area because the aircraft came to rest tilted slightly to starboard with the fuel level in the tank lower than the fuel outlet.

The fuel type was Avtur.

At about the time the aircraft came to rest the flight crew operated the engine nacelle fire extinguisher bottles. The two bottles in the port nacelle operated, but only one of the bottles in the starboard nacelle operated as the electrical wiring to the remaining bottle had been broken during the separation of the starboard engine from the aircraft.

The Department of Transport does not maintain fire fighting services at Bathurst aerodrome; such services are provided by the civil fire brigade operating from the city of Bathurst.

1.15 SURVIVAL ASPECTS

1.15.1 Evacuation

The ground speed of the aircraft at initial impact was about 114 knots (see sub-section 1.16.3) and it is estimated that the maximum longitudinal deceleration was between 2G and 3G with an average value of less than 0.3 G. The cockpit area and the cabin area remained intact. There were no significant failures of seats, passenger seat belts, or flight crew seat harnesses, but many of the passenger seats sustained distortion associated with vertical loading estimated to have been about 4.5G.

The passageway forward of the passenger cabin was partially obstructed by a galley table which had jammed in a mid-down position. The flight crew opened the forward cargo door but they encountered some difficulty because of distortion of the door frame; the First Officer left the aircraft through this door and proceeded to attend to the passengers, all of whom vacated the aircraft through the four window exits. The Captain went into the passenger cabin to open the passenger door but, although the lock mechanisms operated, the door remained jammed in the closed position because of distortion of the door frame. No attempt was made to use the rear cargo door but subsequently it was found that it could not be opened more than half-way because of

interference from the toilet compartment wall which had been displaced by the impact. The aircraft was evacuated within approximately two minutes.

The aircraft was equipped with an emergency lighting system which, in addition to normal manual switching at each light, was designed to operate automatically should longitudinal deceleration in excess of 3G be experienced. The emergency lighting did not operate however, probably because the longitudinal deceleration forces present in this accident were less than 3G; and the individual manual switching was not operated by the cabin attendants. Consequently, when the aircraft electrical power was switched off by the flight crew during the impact drill the aircraft was in darkness. To assist in the evacuation, the Captain restored electrical power to the aircraft.

The crew ensured that no persons remained in the aircraft but post-evacuation action was limited to those persons obviously affected by the accident. The crew and passengers waited at the aircraft for several minutes then, as there was no sign of assistance forthcoming, individually commenced to walk to the aerodrome terminal building area some 1370 metres distant.

1.15.2 Search and rescue

In accordance with prescribed procedures the Captain, after establishing in flight that the Company representative was in attendance at Bathurst aerodrome, and as the aircraft arrived in the circuit area, reported to the Sydney FSU and cancelled the search-and-rescue watch maintained by the Department of Transport. This exchange of communications was completed at 1817:41 hours. At about 1822 hours, the Company representative heard the sound of F-27 engine power increasing and he saw the aircraft apparently commencing a go-around. He then lost sight of the aircraft in heavy rain and he made several transmissions on the Company frequency to advise the crew of the strong wind and heavy rain which now prevailed.

During the next nine minutes he was unable to contact the aircraft and, at 1831:30 hours, he telephoned the Sydney FSU to ascertain if it had communication with the aircraft. Communication checks were initiated by Sydney and a Company aircraft and, as nothing had been heard by 1838 hours, the Distress Phase of the search-and-rescue procedures was instituted by the appropriate Air Traffic Control Unit of the Department.

Between 1840 and 1845 hours some of the people in the terminal building noticed torches in the direction of the northern end of Runway 35. The Company representative proceeded in a taxi along the runway where he met a passenger from the aircraft. He then used the taxi radio to arrange notification to the police, ambulance and fire brigade. In fact, the emergency procedures specified that the Company representative first notify the fire brigade which, in turn, would alert the police and ambulance services and co-ordinate all necessary emergency services.

The police and ambulance services received notification of the accident and proceeded promptly to the aerodrome. The fire brigade did not receive notification until approximately 1900 hours and consequently did not arrive at the accident until some 50 minutes after the accident occurred.

1.16 TESTS AND RESEARCH

1.16.1 Flight tests

Because portion of the go-around attempt was flown at indicated airspeeds less than those for which published performance data was available, it was arranged that flight tests be conducted at such airspeeds, using various combinations of engine power and flap settings, to examine the low-speed climb capability of the aircraft type. The weight and balance of the test aircraft was similar to that existing at the time of the accident.

It was established that the aircraft was controllable at such airspeeds and that a significant climb performance was available.

1.16.2 Flight data recorder

The flight data record shows the altitude of the aircraft 24 seconds before impact as 'dipping' to 40 feet above the elevation datum which, in this instance, was the northern end of Runway 35. Reconstruction of the flight path of VH-EWL indicates that 24 seconds before impact the aircraft was over terrain which is about 40 feet above the elevation datum; therefore, on this basis, the aircraft would have been on the ground but, in fact, it was clear of the ground at this time.

Research indicates that during take-offs and landings the altitude trace normally 'dips' to a value less than the elevation of the runway. On most take-offs the recorder stylus scribes consistently at runway elevation during the take-off roll until a few seconds before lift-off when the stylus 'dips' below the runway elevation for a short time; a few seconds after lift-off the stylus indicates a climb back to and then above the runway elevation. A similar but less marked 'dip' is recorded during most landings. Observation of the behaviour of altimeters in F-27 aircraft during the rotation for lift-off confirms this tendency of the altimeter system to read low for a short period, the amount of 'dip' apparently being directly related to the speed of rotation of the aircraft; that is, rapid or gradual rotation.

The recordings of a total of 100 flights made by VH-EWL were examined in respect of the take-offs and landings. On take-off the recorded 'dip' below runway elevation ranged from zero feet to 158 feet and averaged 65 feet. On landing the 'dip' ranged from zero feet to 53 feet and averaged 16 feet.

Using the foregoing information as a basis, a corrected height profile of the aircraft in relation to the terrain traversed during the final 40 seconds of flight was prepared. It is calculated that at 24 seconds before impact the wheel height of VH-EWL was probably between zero and some 50 feet above the terrain, the most probable height being about 10 feet (Appendix B).

1.16.3 Power plants

The flight crew state that full engine power had been selected from the time of the decision to conduct a go-around until the initial impact of the aircraft with the ground; therefore, as the first propeller marks occurred only 20 metres after the initial impact, it is reasonable to assume that the engines were operating at the maximum engine speed of 14 500 rev/min at that time. Using this assumed engine speed, the engine propeller gear ratio, and the distance between propeller slash marks, it has been calculated that the ground speed of VH-EWL was 114 knots.

In the conditions pertaining at the time of the accident it could be expected that each engine would develop approximately 1620 shaft horsepower at full 'wet' power, or approximately 1230 shaft horsepower at 60 per cent 'trim-up' 'dry' power.

The gravel score marks on the tips of the starboard propeller blades were on the front face and thus consistent with them having had some degree of negative angle of attack, relative to the ground through which they had passed. It is considered that the largest blade tip angle at which there would have been an absence of significant scoring on the rear faces of the blades, would have been that corresponding to a zero angle of attack relative to the ground. Assuming such a relative zero angle of attack, and using the ambient density, assumed propeller rotational speed, and calculated ground speed; the actual blade angle would have been 1.7 degrees above the flight-fine pitch stop, and the corresponding engine power would have been 1180 shaft horsepower. Nevertheless, having regard to the range of variability possible in such calculations, it cannot be concluded with confidence that this was, in fact, the shaft horsepower being developed at impact.

It is significant however, that if it is assumed full 'wet' power of 1620 shaft horsepower was being developed, the actual blade angle would have been 5.75 degrees above the flight-fine pitch stop, and the blade tip would then have had a positive angle of attack of 4.1 degrees relative to the ground. The score marking on the blade tips indicates that such a blade angle did not exist at or about the time of the initial impact. The blade angle, as determined by the investigation, is significantly less than that expected at full 'wet' power, and this is indicative of less than full 'wet' power being developed at the time of initial impact.

1.16.4 Meteorology

A post-accident analysis conducted by the Bureau of Meteorology indicates that cumulo-nimbus activity was not a factor in the change in the weather conditions at the time of the accident; it is probable, however, that an active cumulus cell generated a pseudo-anticyclonic downdraught outflow system. This system encompassed only a few hundred metres, possibly a diameter of 700-800 metres; it was limited to the aerodrome and immediate environs; and it had a brief but severe lifetime, probably in the order of five minutes. The analysis indicates that the cell originated in the north-east to eastern sector of the aerodrome and it generated localised wind squalls, heavy rain and some hail. It then moved in a south-westerly direction crossing Runway 35 some 500-700 metres north of the runway threshold.

To obtain an outflow in the order of 30–40 knots, from a system some 700–800 metres in diameter, would normally require cumulus type cloud to be developed to a height of about 20 000 feet. The post-analysis did not determine that such a cloud did exist, but it did establish that pilots had estimated the tops of isolated cumulus to be at least 11 000 feet, and the possibility of cloud to 20 000 feet was not inconsistent with the atmospheric conditions pertaining at the time. Witness evidence of heavy rain and some hail is consistent with such cloud development being present. Additionally, there was some evidence to suggest that an outflow system, once formed, might have been augmented by local orographic or katabatic effects, or both, to produce local conditions more severe than those appraised from the regional conditions.

2. ANALYSIS

Examination of the aircraft did not reveal any defect or malfunction which might have contributed to the accident.

The flight crew stated that, the go-around was initiated at a height of some 200–300 feet above the terrain when it became apparent that the aircraft was misaligned with the runway; the go-around was commenced before the aircraft had reached the runway threshold; full 'wet' engine power was developed during the go-around and that no malfunctioning of the aircraft was experienced.

In addition, the flight crew stated that all pre-landing actions had been completed prior to the go-around being initiated, in particular that the engine fuel trim indicators had been selected to the 'full increase' position, and the two water methanol switches had been selected ON. The fact that both the engine fuel trim units were found in the 60 per cent 'trim up' position, even though the starboard engine was torn from the aircraft during the ground slide, indicates that this was their position during the ground slide. Because of the damage sustained by the aircraft it was not practicable to check the correlation between the cockpit indicators and the trim actuators; but examination of the aircraft maintenance records revealed no history of any such discrepancy, and the engine power developed during the two previous take-offs on this flight had caused no concern to the flight crew. It is concluded therefore, that the cockpit engine fuel trim indicators were not set at 'full increase' during the pre-landing checks at Bathurst. This

situation leads to the question as to whether or not the water methanol supply was switched ON. The Captain has stated that, whilst the aircraft was on the base leg of the traffic circuit he checked that the water methanol lights were on; and the First Officer has stated that before leaving the cockpit he switched off all electrical switches including the water methanol switches. However this later action, whilst possibly a natural action, is not specified in the impact actions prescribed in the Company Operations Manual. If the water methanol switches were ON during the go-around then the position of the fuel trim units was of no consequence, for the system is so designed that full 'wet' power would have been available. If the water methanol switches were OFF then only 60 per cent 'trim-up' 'dry' power would have been available. Nevertheless, in either event the engine power available was sufficient, under normal flying conditions, for the aircraft to have safely effected a go-around from 300 feet above the terrain or any lower height.

The evidence of ground witnesses, passengers, and crew clearly indicates that when the aircraft commenced the final approach, the approach was normal and the weather conditions along the approach and in the immediate vicinity of the runway were fine. Additionally, the evidence indicates that an unheralded intense localised meteorological disturbance with strong winds and heavy rain then moved from right to left across the runway threshold, becoming apparent at about the time the aircraft was descending through 300 feet approaching the runway threshold; that during the attempted go-around the aircraft was traversing the meteorological disturbance; and, that when the aircraft came to rest it was outside the influence of the disturbance. Accordingly, the matters of prime concern to the analysis are the procedures adopted by the flight crew, the position in relation to the runway and the height of the aircraft at the time the go-around was commenced, and the nature and structure of a meteorological disturbance which could produce the apparent degradation of aircraft performance.

Correlation of all of the evidence, including the information derived from the flight data recorder, indicates that the influence of the meteorological disturbance first became apparent 52.5 seconds before impact, at which time the aircraft was some 730 metres from the runway threshold descending through 300 feet, at a normal rate of descent, with the indicated airspeed fluctuating about the planned Target Threshold Speed of 95 knots. Turbulence was then experienced, the rain increased in intensity, and the aircraft commenced to drift to the left of the runway alignment resulting in a heading change of some 4 degrees being made to realign the aircraft.

The evidence of the passengers, ground witnesses, and the flight data recorder clearly indicates that the descent continued until 34 seconds before impact at which time it is calculated the aircraft would have been at a position some 125 metres before the threshold, with the wheels some 30 feet above terrain, the indicated airspeed having gradually reduced some seconds beforehand to 88 knots which was the Minimum Target Threshold Speed. Coincident with the descent being arrested at this time, various changes in the engine noise were heard by the passengers; the rain had increased further in intensity; gusty conditions were experienced, and the aircraft had drifted further to the left of the runway resulting in a heading correction of 8 to 10 degrees being made. During the turn to alter the heading, which was of some 8 to 9 seconds duration, the aircraft remained in horizontal flight and some passengers observed threshold lights, runway lights, and/or taxiway lights, in their immediate vicinity. It might also be significant that the evidence indicates that, at this time, the landing flap had not been lowered further than 26.5 degrees which would be consistent with a Captain exercising his discretion not to lower full flap at about 300 feet, in accordance with preferred company procedure, because he was not assured of completing a landing from the approach.

The evidence is indicative of the approach having been continued, under the

control of the flight crew, to a wheel height of less than 50 feet above terrain to a point just before the runway threshold, following which the aircraft proceeded essentially in horizontal flight for a period of some 10 seconds. The recollection of the flight crew that the go-around was commenced from a height of some 200 250 feet above terrain, and from a position well before the Runway 35 threshold, is not supported by other evidence.

Passenger evidence indicates that; there was a substantial increase in engine noise after the aircraft was north of the Runway 35 threshold; there was a noticeable change in the aircraft attitude at about that time; and, the undercarriage retracted at about that time. This evidence places the aircraft in an area 200 to 300 metres north of the threshold to the left of the runway centreline, and it is significant that this position is consistent with the general 'touchdown area' along the runway as described by ground witnesses located either side of the runway approximately abeam of the area. It is significant that the evidence of one passenger, with pilot experience, indicates that the go-around was initiated at a position 197 metres north of the runway threshold and that this is consistent with the evidence of a ground witness, with pilot experience, which placed the position of origin of the sustained increase in engine noise about 275 metres north of the runway threshold. Additionally, the passenger and ground witness evidence indicates that the height of the aircraft at the relevant time was less than 100 feet above terrain with the majority of the witness estimates being less than 50 feet above terrain.

Reconstruction of the probable flight path of the aircraft based on the flight data recorder information indicates that some 24 seconds before impact the aircraft was in an area some 200 metres north of the Runway 35 threshold and, it was at that time the flight data recorder altitude trace exhibited a 'dip', characteristic of that associated with rapid rotation of an F-27 aircraft during a take-off or landing. Calculations based upon the flight data recorder information indicate that the wheel height was probably between zero and 50 feet above the terrain, and the most probable height was about 10 feet.

Therefore, having regard to all the available evidence, including the flight crew evidence that the undercarriage was selected UP immediately after go-around power was applied and a climb attitude adopted, it is concluded that the go-around was commenced some 24 seconds before impact, from a position some 200 metres north of the threshold of Runway 35 and some 45 metres to the left of the runway centre-line, from a wheel height above terrain of less than 50 feet, the indicated airspeed being 88–90 knots. It is probable that the go-around was initiated for the reason stated by the Captain, namely the misalignment of the aircraft with the runway. Additionally, it is probable that the flight crew had the runway lights in sight throughout, or for the majority of the approach as they have stated, for the evidence suggests that the aircraft was flying in the vicinity of the western periphery of the disturbance and consequently most of the runway could have been visible.

The ground witness evidence clearly indicates that coincident with the aircraft being on short final approach for landing, a strong northerly wind became apparent together with heavy rain and that this wind, which was in the order of 30 40 knots, existed at the time the go-around was initiated. Additionally, it clearly indicates that a few seconds after the go-around was initiated the wind direction commenced to change and that shortly before impact the wind was southerly in the order of 30–40 knots. The ground speed of the aircraft at impact was calculated to be 114 knots, and from correlation of the recorded indicated airspeed, heading and track at the moment of impact, it can be calculated that the wind was of a speed of 40 knots from a direction of 144 degrees magnetic, with the aircraft experiencing a tailwind component of 28 knots at that time. Similarly, calculations based on the flight data recorder information, when correlated with the witness evidence concerning the track of the aircraft, indicate

that the probable wind at the time the go-around was initiated was from a direction of 030 degrees magnetic at 32 knots, the headwind component at that time being 27 knots. These calculated wind velocities are entirely consistent with the witness observations of the wind behaviour.

It is concluded, therefore, that when the go-around was commenced the aircraft was experiencing a headwind component in the order of 30 knots; this headwind component became variable some 16 to 10 seconds before impact, and the aircraft experienced a tailwind component in the order of 30 knots during the final seconds of flight.

Performance calculations using rates of climb derived from the flight test data for 16.5 degrees of flap and indicated airspeeds as flown by VH-EWL, indicate that, even with such a wind change, the aircraft could have sustained a safe rate of climb at either full 'wet' power, or 'dry' power with a fuel trim setting of 60 per cent 'trim-up'. However, on the basis that the go-around was initiated 24 seconds before impact, the climb performance capability of the aircraft would have been negated if the aircraft, in addition to the horizontal wind changes, had also encountered an average downdraught in the order of 5 metres per second for the 'wet' power condition, or about 2.5 metres per second for the 60 per cent 'trim-up' 'dry' power condition.

To achieve a downflow of some 5 metres per second it is considered that cumulus cloud would need to have developed to a height of about 20 000 feet. Post-analysis of the atmospheric structure indicates that such cloud was possible at the time of the accident and the evidence of heavy rain and some hail associated with the disturbance is consistent with such cloud being present. A horizontal outflow of air at some 30 knots is not inconsistent with an average downflow of 5 metres per second in free air over the apparent diameter of the disturbance. Therefore, during the attempted go-around, it is possible the aircraft encountered an average downdraught in the order of 5 metres per second, or at least of 2.5 metres per second, the relationship between headwind/downdraught/tailwind components at any given time varying according to the height of the aircraft above the terrain, its longitudinal location within the perimeters of the disturbance, and the actual engine power being developed.

The significance of the difference in engine power actually being developed, that is 'wet' power or 60 per cent 'trim-up' 'dry' power, relates solely to the determination of the degree of severity of the meteorological disturbance necessary to negate the climb performance of the aircraft. The investigation has not determined which of these two engine powers was being developed at impact but, overall, the evidence suggests that it might have been 60 per cent 'trim-up' 'dry' power.

The cause of the accident, on the basis of the evidence available to the investigation, was that during the go-around the climb performance of the aircraft was adversely affected by an unpredictable encounter with a large change in the horizontal wind component, and an associated downdraught, at a height too low to effect recovery.

A contributory factor was that the landing approach was continued to a very low height in rapidly deteriorating weather conditions.

There is no doubt that heavy rain and some hail was associated with the meteorological disturbance, therefore it is reasonable to assume that the disturbance could have been discernible on the aircraft weather radar had it been operated. The weather radar was not operated during the flight from Orange to Bathurst, and it was not mandatory that it be operated, but it was placed on 'standby' so that it could be used if deemed necessary. Considering that the crew had, some 50 minutes beforehand, overflown the general area whilst en route to Orange with no significant cloud being evident visually or on the radar and, considering the current good flight visibility for what was an 8 minute flight, this was a reasonable decision. However, with hindsight, it is likely that the disturbance present at Bathurst aerodrome would have given a significant return, in lieu of the actual visual assessment made by the Captain of light

rain, this visual observation having been made at night in an area offering no contrasting background. Accordingly, the use of the radar during the flight, and the sighting of a significant return, might have conditioned the flight crew to a more cautious approach with early consideration for go-around action once adverse conditions were encountered.

3. CONCLUSIONS

1. The flight crew were appropriately qualified and licensed.

2. At the time of the accident there was a current Certificate of Airworthiness for the aircraft. There was no evidence of any defect or malfunctioning which could have contributed to the accident.

3. The aircraft was loaded within safe limits.

4. At the time the aircraft commenced the approach for landing on Runway 35 the surface wind in the vicinity of the runway was from a north-easterly direction at about five knots, visibility was unrestricted, there was no cloud below the level of the aircraft, but rain was evident over the eastern sector of the aerodrome.

5. A severe but isolated meteorological disturbance, probably associated with an active cumulus cell generating a pseudo-anticyclonic downdraught outflow system, occurred in the east-north-east sector of the aerodrome. It encompassed some 700–800 metres and probably had a life of some five minutes. It moved in a general south-westerly direction passing in the vicinity of the threshold of Runway 35 coincident with the arrival of VH-EWL and the attempted go-around.

6. The weather at Bathurst aerodrome prior to, and subsequent to, the accident was essentially as predicted. However, the forecast of the aerodrome weather conditions did not envisage the possibility of a phenomenom such as was experienced at about 1822 hours.

7. The landing approach, which was flown by the First Officer from the right-hand pilot position, was normal until descending through 300 feet above terrain at which time the effects of the meteorological disturbance were first encountered. The landing approach was continued in heavy rain and with increasing drift, to a wheel height of less than 50 feet above terrain at which time the aircraft was in the vicinity of the runway threshold, but it was no longer aligned with the runway. It was then flown in controlled flight at essentially a constant height above terrain for several seconds.

8. The attempted go-around, which was initiated on the command of the Captain. was commenced approximately 24 seconds before impact, from a wheel height of less than 50 feet above terrain from a position some 200 metres north of the Runway 35 threshold and some 45 metres to the left of the runway centre-line. Initially, the aircraft was subjected to a headwind component in the order of 30 knots which had changed to a tailwind component in the order of 30 knots at the time of impact; coincident with the change of wind direction it is probable that the aircraft was subjected to an average downdraught of at least 2.5 metres per second, possibly of the order of 5 metres per second.

9. During the go-around the landing gear was retracted, and the wing flaps were retracted from 26.5 degrees to 16.5 degrees. The operating procedures specified that the engine fuel trim units be selected to 'full increase' for this go-around: they were found at the 60 per cent 'trim-up' setting. It was not positively established whether or not water methanol was selected on and therefore available during the go-around.

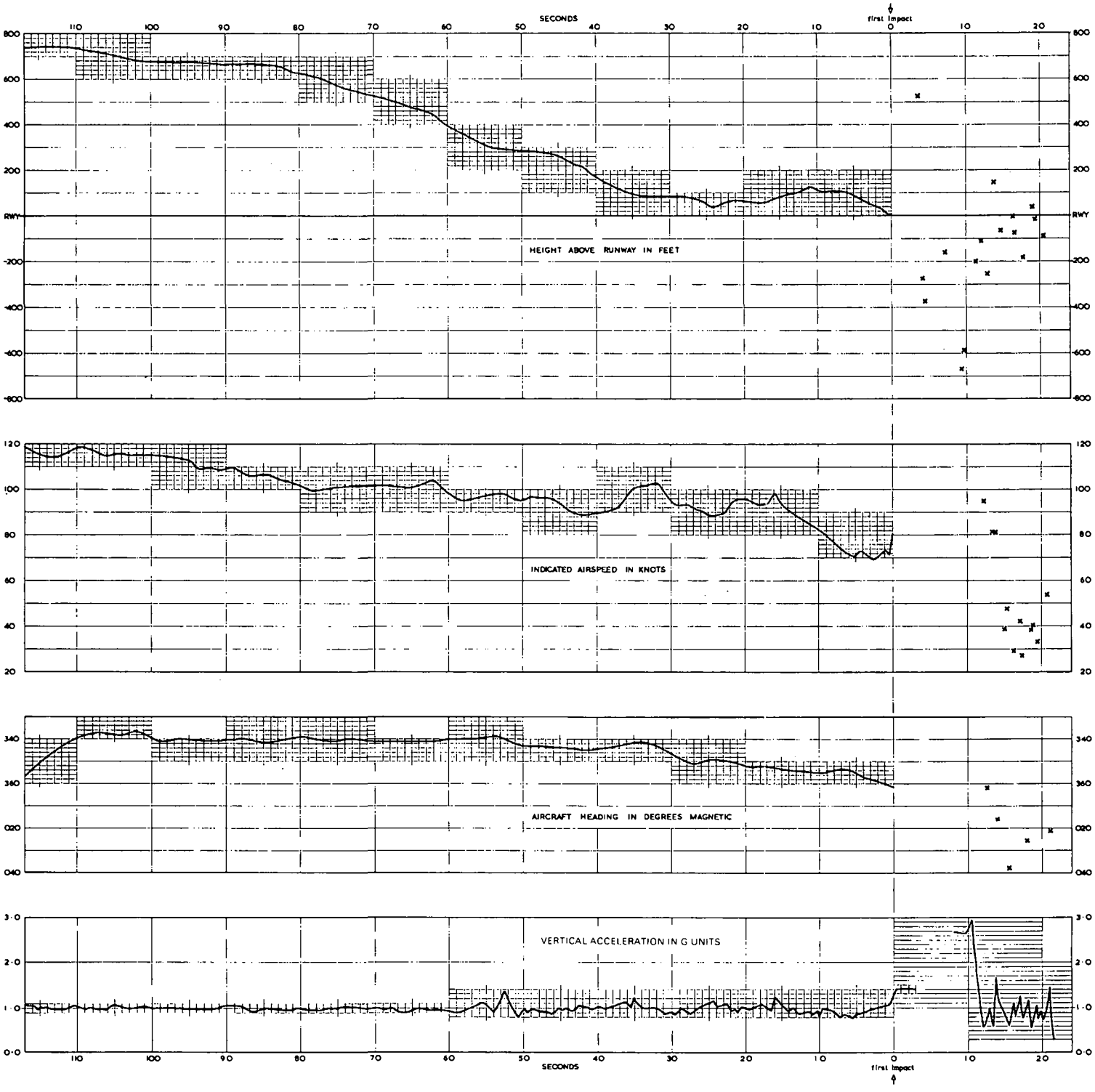
10. The evidence available suggests that the engine power being developed at or about initial impact was significantly less than that applicable to full 'wet' power.

Cause

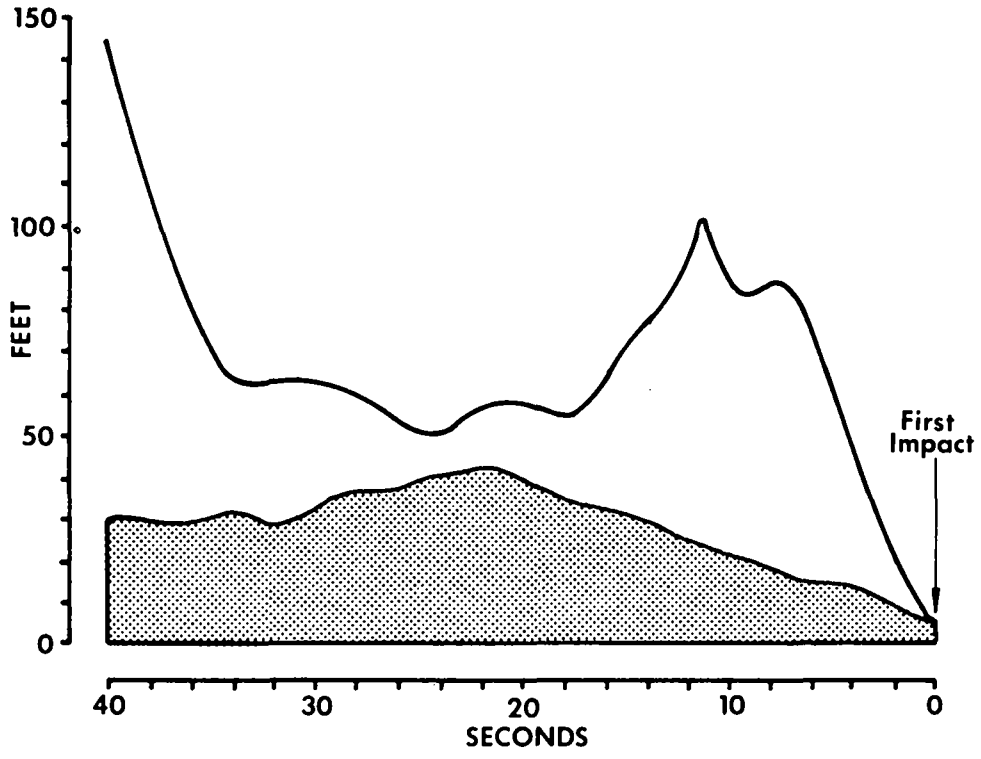
The cause of the accident was that during the go-around the climb performance of the aircraft was adversely affected by an unpredictable encounter with a large change in the horizontal wind component, and an associated downdraught, at a height too low to effect recovery.

APPENDIX A

REPRESENTATION OF THE FLIGHT DATA RECORD



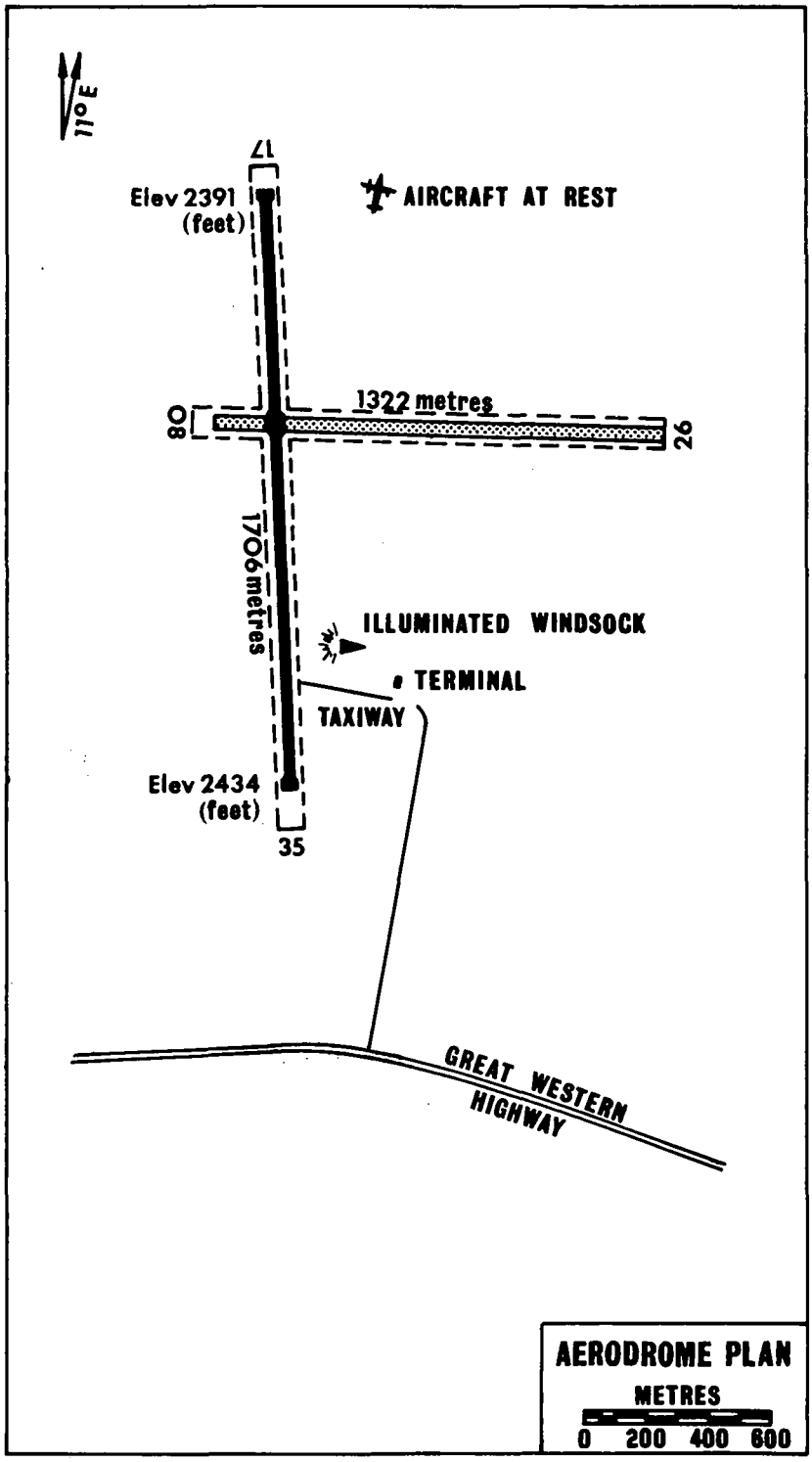
APPENDIX B



PROFILE SHOWING CALCULATED WHEEL HEIGHT

APPENDIX C

APPENDIX D



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