NO. 91-007

BOEING 767-219

ZK-NBC

Runway 03, Nandi Airport, Fiji

9 March 1991

V8:12/09/91

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

AIRCRAFT ACCIDENT REPORT NO. 91-007

Aircraft Type, Serial Number and Registration:	Boeing 767-219, 23328, ZK-NBC
Number and Type of Engines:	2 General Electric CF6 80A2
Year of Manufacture:	1986
Date and Time (UTC):	8 March 1991, 1747 hours (0547 local time, 9 March 1991)
Location:	Runway 03, Nandi Airport, Fiji
Type of Flight:	International Scheduled Airline
Persons on Board:	Crew: 12 Passengers: 151
Injuries:	Crew: Nil Passengers: Nil
Nature of Damage:	Substantial to front fuselage and overhead stowage bin restraint
Pilot in Command's Licence:	Airline Transport Pilot
Pilot in Command's Age:	51
Pilot in Command's Total Flying Experience:	13,607 hours (785 of which was on type)
Information Sources:	Transport Accident Investigation Commission on site investigation and UFDR analysis
Investigator in Charge:	Mr R Chippindale

This accident was investigated by the New Zealand Transport Accident Investigation Commission at the request of the Fiji Government which delegated the investigation of the accident to the New Zealand authorities in accordance with Chapter 5 paragraph 5.1 of Annex 13 to the Convention on International Civil Aviation.

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Prior to departure the weather forecast for Nandi was for variable winds up to 8 knots, visibility in excess of 9 km but reducing at times to 5000 m in rain and extensive cloud cover with isolated cumulonimbus cloud.

1.1.2 The aircraft departed from Honolulu at 1131 hours UTC (0131 local) on a flight scheduled to Nandi and thence to Auckland and Melbourne. Prior to descent into Nandi, the Captain briefed the First Officer for a Category 1* (Cat 1), instrument landing system (ILS) procedure for runway 03. The flight crew consisted of two Captains and a First Officer. The Captain nominated as pilot in command, flew the aircraft. The second Captain occupied the centre observer's seat during the approach and landing.

* A Category 1 landing was one made using ILS and visual aids intended for operations down to a 200 foot decision height and down to a runway visual range (RVR) of the order of 800 m.

1.1.3 Most of the approach was conducted in cloud using one of the autopilots to position the aircraft on the ILS at 2500 feet. An assessment of local cloud activity made prior to the approach, with the aircraft's radar showed no returns which indicated areas to be avoided near the aerodrome. The final approach was conducted with the autoflight system in the approach mode and the autothrottles engaged.

1.1.4 At approximately 600 feet agl the aircraft entered very heavy rain, but the high intensity approach lights were sighted at approximately 500 feet agl and the first runway lights came into view at 300 feet agl.

1.1.5 At his decision height of 260 feet the Captain assessed the conditions as better than those required for a "Cat 1" landing so he disengaged the autopilots. The aircraft

crossed the runway threshold at 50 feet on the ILS centreline but then it commenced to drift to the right until its left main wheels touched down well to the right of the runway centreline.

1.1.6 During the initial rollout, the aircraft continued to track to the right. Although the aircraft subsequently paralleled the runway for some distance it later slowed to a stop alongside the runway, with all of its wheels in the soft ground, slewed 25° to the right of the runway heading.

1.1.7 The passengers and crew were disembarked, some 40 minutes after the aircraft came to rest, via mobile steps.

1.1.8 The accident occurred at night, at 1747 hours UTC (0546 local) at latitude 17°45'30"S, longitude 177°26'30"E, 26 feet amsl, 1535 m from the runway 03 threshold.

1.2 Injuries to persons

1.2.1 There were no injuries to any passenger or crew member.

1.3 Damage to aircraft

1.3.1 There was damage to several of the fan blades on each engine, due to ingestion of debris which was thrown into the engines' path during the runway excursion.

1.3.2 Minor damage also occurred to panels, aerials and light fittings beneath the fuselage and to the braking system at each main wheel.

1.3.3 The nose undercarriage box structure sustained substantial damage.

1.3.4 Failures and damage to overhead stowage bin lateral restraint tension tie rods occurred in zones 43 and 46 in the centre of the rear cabin. However the bins remained in place

1.4 Other damage

1.4.1 Six runway lights, with the associated, buried power-supply cabling and extensive areas of grass to the right of runway 03 were damaged.

1.5 Personnel information

1.5.1 The handling pilot and Captain, Ronald Thorne, age 51, had been flying with the company for 26 years. He had 12½ years' experience as an aircraft Captain. His last sixteen months' flying was as a Captain on Boeing 767 aircraft. He had a total of 13 607 hours flying experience and 785 hours on type. His flying time in the last 90 days was 135 hours all of which was on the Boeing 767 aircraft.

1.5.2 The co-pilot was the First Officer, Frank Henry Parker, age 39, had a total of 7660 hours flying experience and 823 hours on type. His flying time in the last 90 days was 180 hours of which 167 hours was on the Boeing 767.

1.5.3 The third pilot, age 45, a Captain seated in the centre observer's seat for the approach and landing, had a total of 14 240 hours flying experience and 302 hours on type.

1.6.4 Each of the crew members was well rested and fit for the flight.

1.6 Aircraft information

1.6.1 The aircraft was manufactured by the Boeing Airplane Company in 1986 and delivered to Air New Zealand.

1.6.2 It was allocated the New Zealand registration ZK-NBC and was operated by Air New Zealand at the time of the accident.

1.6.3 The maintenance and airworthiness documentation was valid. There were no defects recorded and use of the Minimum Equipment List was not incurred.

1.6.4 At the time of the accident the aircraft had completed a total flying time of 19 557 hours and 6612 cycles.

1.7 Meteorological information

1.7.1 The weather at Nandi airport was recorded by the Fiji Meteorological Service for 1800 hours UTC as:

Surface Wind:	180°/05 knots
Visibility:	3000 metres
Cloud:	1 octa cumulonimbus at 1800 feet
	4 octas stratocumulus base 4500 feet
	8 octas altostratus at 10 000 feet

There was moderate rain falling at Nandi Airport, the temperature 25°C and the dew point 24°C with a QNH of 1000.3 Hpa and 14 mm of rain recorded in the last hour.

1.7.2 Through the night a broad cloud system, resulting from a "convergence zone" which covered an area of the tropical South Pacific between longitudes 165° east and 140° west was centred on Fiji. In this system were embedded isolated cumulonimbus clouds.

1.7.3 The crew had kept themselves informed of the actual weather at Nandi and the weather trend, by listening to Volmet broadcasts.

1.7.4 While the forecaster at Nandi had revised the forecast for local conditions at 0206 hours (Fiji time) for the period 0300 to midday (local), the deterioration which he forecast was not reflected in the Volmet information which the crew received. This forecast deterioration was for less visibility and a lower and more extensive cloud base during temporary fluctuations.

1.7.5 The delay in updating the Volmet information was due to delays in the transmission of the information from Nandi to Auckland, from where the Volmet was broadcast, due to "queuing" of messages.

1.7.6 When the aircraft crew requested clearance to descend from flight level 390, at 0515 hours, to commence their approach to Nandi, the actual weather conditions at Nandi were given as:

Wind:	Calm
Visibility:	"5000 m all round in moderate rain"
Cloud:	3 octas at 3000 feet
	3 octas at 5000 feet
	"The rest in medium cover"
Temperature:	25°C
QNH:	1000 Hpa

1.7.7 Two minutes later Nandi Tower confirmed the visibility as 5000 m towards the south, for the preceding aircraft but after a further two minutes that aircraft crew was advised by the Air Traffic Control Officer (ATCO), "visibility 4000 metres in heavy rain now".

1.7.8 At 0523 hours "Tower" advised ZK-NBC that the preceding aircraft "reported breaking visual at 300 feet", to which the crew of the preceding aircraft added "That rain was extremely heavy on finals and the vis is well down". This was acknowledged by ZK-NBC's First Officer.

1.7.9 At 0543 hours as ZK-NBC reported "MOMI (NDB) established on the ILS", Tower acknowledged "Roger visibility 5000 metres" and added "Wind calm", 30 seconds later. At 0544 hours Tower broadcast "Visibility now 3000 m in heavy rain" which ZK-NBC acknowledged. At 0546 hours Tower broadcast "Visibility 2000 metres".

1.7.10 As ZK-NBC approached Fiji a squall line was moving towards the threshold of runway 03 at Nandi. The trace from the recording of the mid-field anemometer, situated 2900 m to the north of the runway 03 threshold indicated a drift of insufficient strength for either direction or speed to be recorded until 0537 hours when a sharp edged gust ranging between 16 and 21 knots arrived from the south-west and lasted for some 15 minutes (See Figure 1).

1.7.11 This squall probably arrived at the threshold just ahead of the aircraft and persisted beyond the time of the aircraft's arrival.

1.7.12 Associated with the gust was a period of rain which was described as the heaviest rain many of the local staff had experienced.

1.7.13 Prior to the onset of the squall the surface wind was recorded and reported as calm. However, the crew had observed a tail wind reducing from 17 knots to less than 5, before they were overhead the approach lights, as they made their approach. The crew did not monitor the wind velocity during the final stage of the approach as the pilot flying had to concentrate his attention between external visual cues and the flight instruments and the pilot not flying was required to concentrate on the radio altimeter read out.

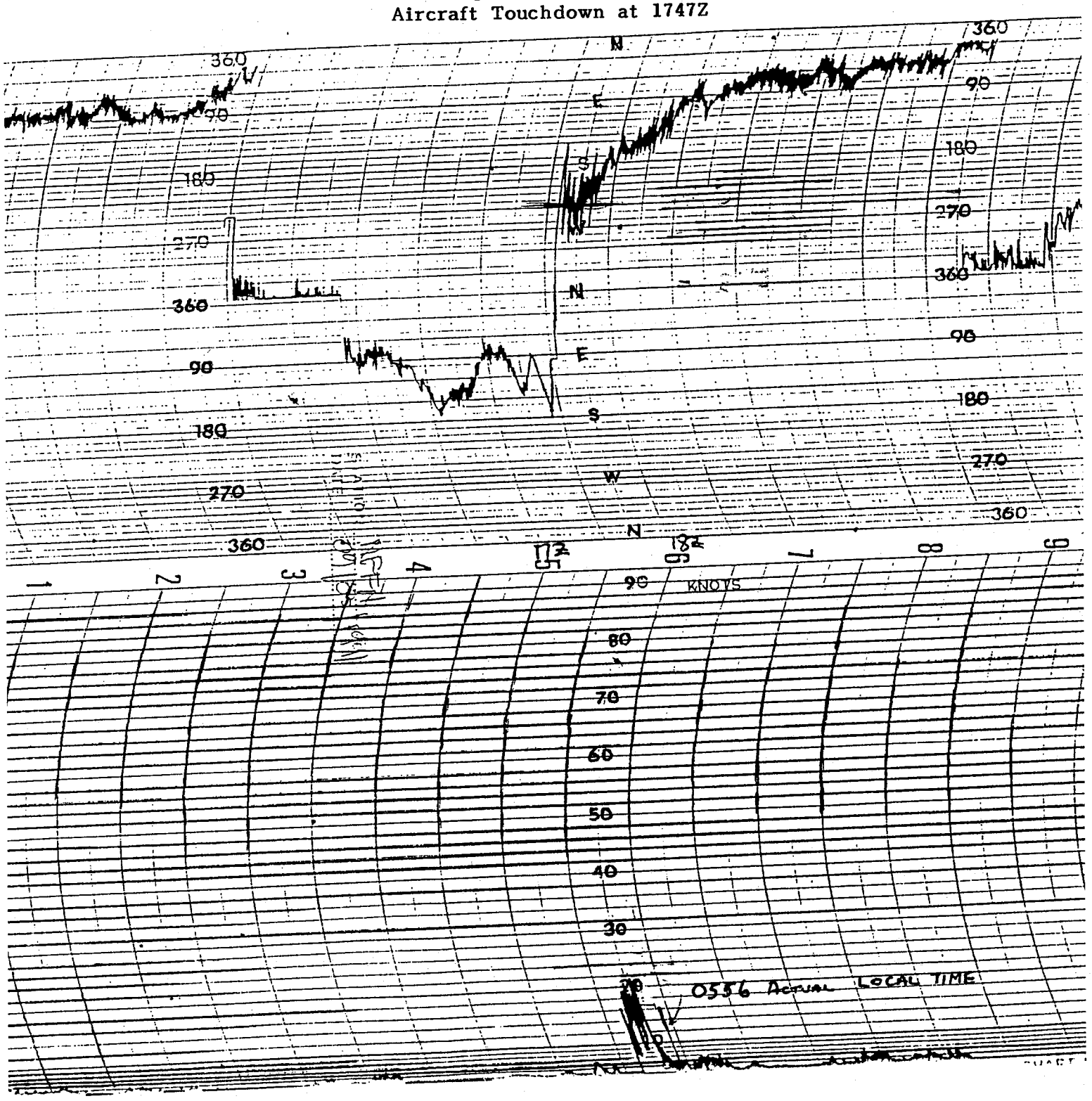
1.7.14 A witness living within a kilometre of the threshold, who was woken by the rain, claimed he was able to light a cigarette without difficulty and felt no wind in his location as ZK-NBC came to rest within his view. Another witness who was 5 kilometres away in an area beneath the approach path also stated that he was unaware of any significant wind at the time of the accident. Both were experienced pilots.

1.7.15 The Nandi Meteorological Office was equipped with a radar suitable for wind finding and limited weather surveillance. This radar was normally used for tracking balloon ascents for wind finding. It was used for weather surveillance at the forecaster's discretion but took some 30 minutes to warm up. Although there was no embargo on its use the radar was used more as a "forecasting tool" than for continuous monitoring of weather conditions except during extreme weather conditions such as hurricanes.

FIGURE 1

Centrefield Anemograph Trace, Nandi

Wind Direction True
Mag Variation 13°E
Aircraft Touchdown at 1747Z



1.8 Aids to navigation

1.8.1 All of the navigational aids used by the aircraft were serviceable at the time of the accident.

1.9 Communications

1.9.1 The VHF communications between the aircraft and Air Traffic Control were clear and audible until the aircraft came to rest after the runway excursion.

1.9.2 After the aircraft came to rest the Rescue Fire Service (RFS) Chief attempted to call the Tower to advise the ATCO that he was proceeding to the aircraft on his own initiative. He was unable to make contact as although the ATCO heard the transmission he accorded priority to a coincidental transmission from an inbound aircraft.

1.9.3 The crew of ZK-NBC asked the ATCO for the appropriate frequency on which to discuss the situation with the RFS Chief and were given 121.9 MHz which they attempted to use.

1.9.4 As the ATCO was attempting to monitor both the aerodrome control frequency of 119.1 MHz and the RFS frequency, and the RFS was using only 121.2 MHz, some confusion occurred. This was exacerbated because the aircraft crew were monitoring both frequencies and the RFS Chief left his vehicle from time to time, leaving the driver to monitor the radio.

1.10 Aerodrome information

1.10.1 Runway 03 at Nandi had an alignment of 024 degrees magnetic. It was 3200 m in length with a bitumen surface laid over concrete.

1.10.2 The night lighting consisted of high and low intensity approach lighting systems with a coded centreline; high intensity runway edge lighting with the first four fifths of the lights white and the remainder amber and a precision approach path indicator (PAPI) set at 3 degrees to give a threshold crossing height of 75 feet. There was also an illuminated wind indicator to the left of the threshold.

1.10.3 The runway and approach lights were set to 100% intensity. With the exception of two high intensity approach lights and one runway edge light all of the lights were working immediately prior to the accident.

1.10.4 The 03 runway at Nandi was preceded by a 60 m level clearway at 30 feet amsl; from the threshold it sloped upwards at 0.27% for 1005 m then dipped at a slope of 0.72% for 629 m before sloping upward again to the end initially at 0.69% for 621 m and for the final 945 m it was essentially level.

1.10.5 The runway measured 27 m from the centreline to the runway edge lights and sloped laterally at less than 1° to a point 5 m inside these lights at which point a white edge line was painted. From this edge line, the edge of the concrete was 8 m distant at a slope of 3° down. (See Figure 2)

1.11 Flight recorders

1.11.1 The aircraft was equipped with a cockpit voice recorder (CVR) which recorded cockpit area sounds on a continuous 30 minute tape. The Air New Zealand Flight Operations Manual Part A Administration required, on page 2-2-3,

> "After an aircraft incident or accident which occurred within 30 minutes before landing, the cockpit voice recorder (CVR) is to be deactivated by pulling the circuit breaker after completion of the parking checklist of the flight involved."

1.11.2 This item was not included in the parking checklist or the "Post Flight Procedures" of the B767-200 Operations Manual.

1.11.3 No consideration was given to pulling the CVR circuit breaker. However the record of the crew's post accident actions and R/T transmission for the 30 minutes prior to final shut down was preserved.

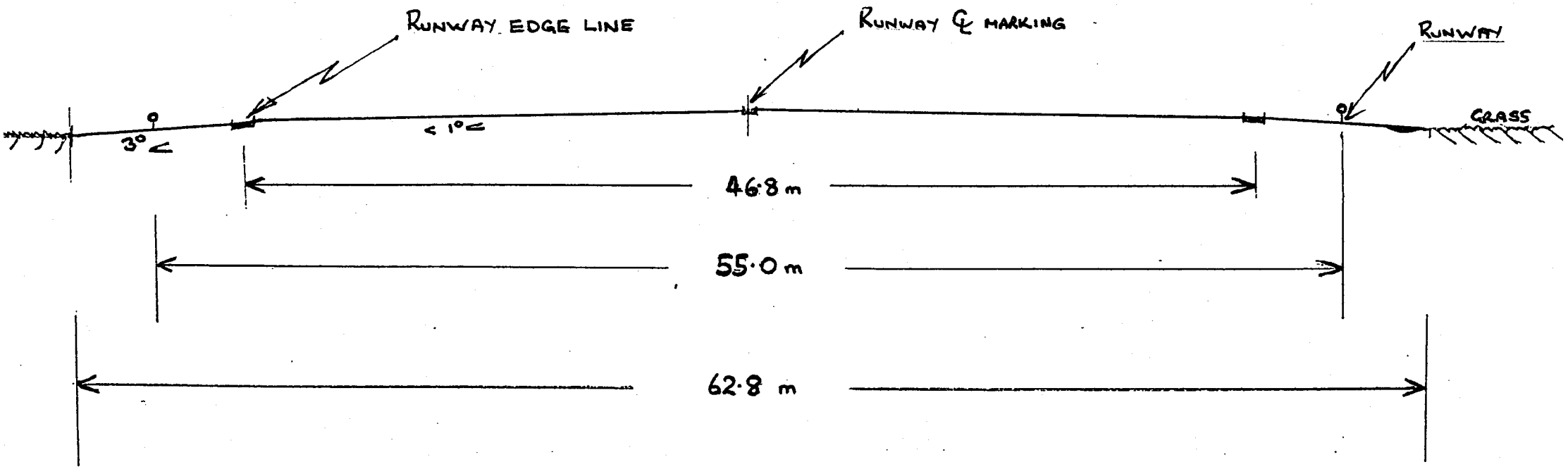
1.11.4 The CVR did not have the advantage of a "hot mike" system in which the crews' headset microphones were always live to the CVR.

1.11.5 The aircraft was equipped with a Sundstrand Data Control universal flight data recorder (UFDR) which recorded parameters on a 25 hour tape.

1.11.6 The recorder was read out for the four minutes prior to touchdown and the subsequent one minute after touchdown, in the Australian Bureau of Air Safety's laboratory in Canberra. This record confirmed, in general terms, the crew's recollection of events.

FIGURE 2

Cross Section of Runway 03, Nandi



1.11.7 The aircraft had conformed to the flight path expected for a "Flap 30, fully coupled, ILS approach".

1.11.8 The record showed that the aircraft followed the localiser and glideslope signals smoothly and the indicated airspeed was appropriate throughout the approach.

1.11.9 Just prior to decision height at 260 feet agl, the Captain disengaged the autopilots and flew the aircraft manually to touchdown.

1.11.10 In the 12 seconds prior to the autopilots being disconnected the aircraft rolled six degrees to the left and was rolling to the right as the Captain took control.

1.11.11 The aircraft then rolled through level to 5° left before resuming 4° of right bank, for some seven seconds despite the application of opposite aileron. The aircraft maintained the localiser centre line track until it was over the threshold 3 seconds after the roll to the right occurred. After this the aircraft drifted to the right of the centre line. The pilot applied some 9° of left rudder for 5 seconds prior to touchdown which failed to slow the rate of the drift to the right. (See Figure 3)

1.11.12 The aircraft was tracking along the centreline as it crossed the threshold but drifted 27 m to the right from that alignment in the eight seconds prior to touchdown despite the Captain's corrections.

1.11.13 An analysis was made by the manufacturer's, of the information recorded by the UFDR and the lateral displacements which occurred after the aircraft crossed the threshold. This study established that the aircraft had encountered a sharp edged gust similar to that recorded on the mid-field anemograph, as it crossed the threshold.

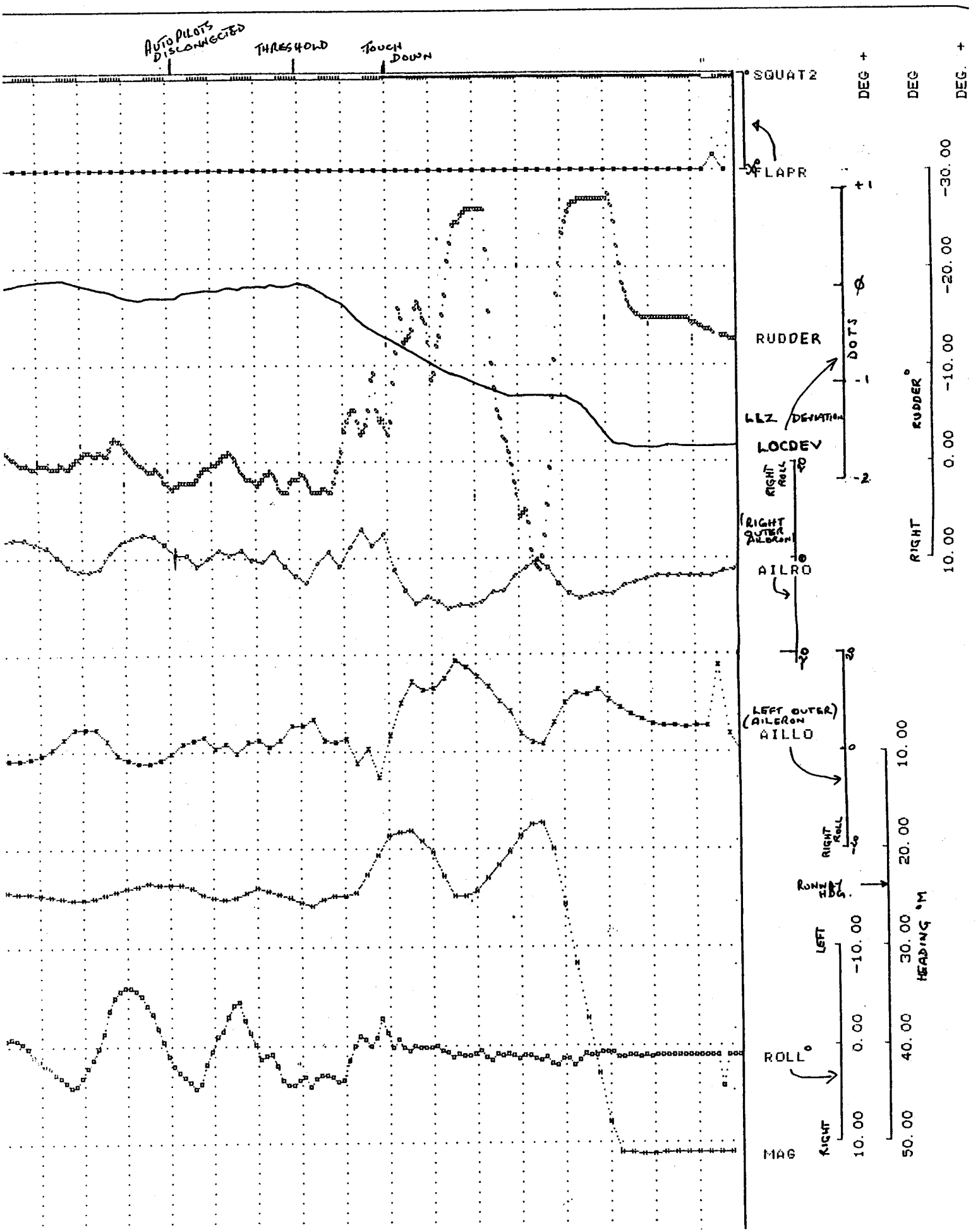
1.12 Wreckage and impact information

1.12.1 The wheels on the aircraft's right main undercarriage touched down outside the line of the runway lights on the edge of the concrete some 630 m from the runway threshold and 31 m from the centreline.

1.12.2 The aircraft continued to track off the runway until at 820 m a runway light was hit by the left front wheel of the left main undercarriage. Thereafter the left main wheels straddled the runway's right edge lights for 230 m after which point the left mainwheels left the runway a total of 1300 m from the threshold and some 700 m after touchdown.

FIGURE 3

UFDR Record



1.12.3 The aircraft then slewed to the left, as the captain attempted to guide the aircraft back onto the runway until the nosewheels were "edging" against the side of the runway but were prevented from climbing onto the concrete edge drain by the lip between the soft ground and the hard surface.

1.12.4 The aircraft's track continued to parallel the runway until the right mainwheels encountered deeper soft ground alongside the dip in the runway at 1500 m from the threshold. At this point the aircraft yawed to the right and travelled in that direction before it stopped 1550 m from the threshold with half of the left wing and the left tailplane protruding over the runway.

1.13 Medical and pathological information

1.13.1 There were no injuries to passengers, crew members or persons on the ground.

1.14 Fire

1.14.1 There was no fire.

1.15 Survival aspects

1.15.1 The accident was fully survivable and no emergency egress was involved.

1.15.2 After the aircraft had come to rest the crew shut down the engines and the aircraft's power supply was interrupted. The emergency lighting operated normally.

1.15.3 Senior members of the cabin crew said they had not seen the emergency lighting operate previously but had expected strip lighting on the floor to appear.

1.15.4 The Captain and First Officer leaned out of their adjacent side windows to check for any signs of fire. Seeing none and receiving advice from the cabin crew that no sign of fire was evident the Captain instructed them not to conduct an emergency evacuation.

1.15.6 The damage to the overhead luggage locker restraints did not threaten any passenger's safety.

1.15.7 After the aircraft came to rest the RFS Chief asked the ATCO to instruct the Captain to order an emergency evacuation. "Tower" in reply advised the RFS Chief that he

could speak to the Captain direct on the "Surface Movement" frequency. The RFS Chief then asked the Captain for an immediate evacuation.

1.15.8 The Captain having assessed the situation from inside the aircraft as well as he was able and confirmed with the Fire Chief that no fire existed, decided against an evacuation. The RFS Chief felt there was still a potential for a fire and repeated his advice to evacuate which was declined again.

1.15.9 Five or ten minutes after the aircraft came to rest the third pilot made his way to the ground through the "E and E" bay and confirmed there was no apparent risk involved in retaining the passengers on board.

1.16 Tests and research

1.16.1 A wind gust similar to that recorded at the remote anemometer was applied in the company's simulator, with and without warning, to pilots completing a simulated Category 1 landing.

1.16.2 Each of the pilots found difficulty in countering the wind's effects and none were able to stay on the runway unless they knew the gust was going to occur.

1.16.3 Similar tests and an analysis of the information recorded by the UFDR, conducted by the manufacturer, resulted in the conclusion that a sharp edged gust of the severity recorded was unlikely to be countered successfully by the most experienced of crews.

1.16.5 The operator and the manufacturer each conducted tests in their respective simulator facilities to establish if a "go around" could be completed successfully in the circumstances which were believed to have existed in the vicinity of the runway threshold at the time of the accident.

1.16.6 The manufacturer reported:

> "A go-around can always be made prior to touchdown, even when only inches above the runway. Depending on the rate of descent, airspeed, power setting, etc, a momentary touchdown (skip) may occur in the process of a go-around from a very low altitude; however, in most cases a touchdown can be avoided. In any event, a momentary touchdown would be preferable to going off the runway. Additionally, Boeing conducted simulator tests which duplicated the subject event and satisfactory autopilot

go-arounds were accomplished from as low as 11 feet. manually flown go-arounds were also accomplished from even lower altitudes."

1.16.7 The operator stated:

"Numerous go-arounds were attempted from a position at which drift away from the runway centreline was recognised. This position coincided with an altitude of approximately 30 feet. All of these go-around attempts except one failed. The one successful go-around resulted in the aircraft striking the ground so violently that it could not be considered to have been successful in actual conditions."

1.17 Additional information

1.17.1 While not a standard requirement, the International Civil Aviation Organisation recommended that runway centreline lights should be provided on a precision approach runway Category 1, particularly when the runway was used by aircraft with high landing speeds or where the width between the edge lights was greater than 50 metres. The width between the runway lights on runway 03 at Nandi was 55 metres.

1.17.2 The B767 aircraft was fitted with a rain repellant system to optimise the removal of rain from the aircraft's windscreens. No guidance on the effect of the repellant or the conditions under which use of this system should be used was given to crews by the aircraft's manufacturer or by the operator.

1.17.3 The crosswind component required to drift the aircraft from the runway centreline to its touchdown position was some 7 knots. The correction applied by the pilot just prior to touchdown was estimated as sufficient to offset some 50% of the component. The wind recorded at the centrefield anemometer indicated that a sharp edged gust of at least this magnitude could have existed in the runway threshold area as ZK-NBC was landing.

1.18 Air traffic control

1.18.1 On the night in question the air traffic control tower was manned by an air traffic control officer on his own.

1.18.2 The ATCO started his shift at midnight and was responsible for "surface" control, Aerodrome Control, Approach Control and Area Control, between 50 and 150 miles from Nandi, for inbound aircraft approaching the top of descent position.

1.18.3 The ATCO's shift was a quiet one until 0445 hours when two Boeing 767 aircraft then two B747 aircraft were scheduled to arrive in sequence. ZK-NBC was the second in this sequence of four aircraft. The first of the B747 aircraft requested descent clearance as ZK-NBC was on its final approach.

1.18.4 After the mishap occurred the ATCO's workload increased significantly. At that time he had to advise the two incoming B747 aircraft on the situation and take the action associated with these aircraft diverting to an alternate airport while coordinating the RFS and other vehicles on the aerodrome and implementing the aerodrome accident response procedures.

1.18.5 During the last stage of the approach of ZK-NBC, the heavy rain blown onto the control cab windows facing the approach to runway 03 prevented the ATCO from observing the fixed marks by which he judged the surface visibility. He therefore leaned over his control panel to look through the angled glass pane at the corner of the cab to enable him to see conditions on the southern end of runway 03. He saw a "front" of much heavier rain approaching from that area towards the Tower and transmitted "2000 m" as the last of a series of reports of reducing surface visibilities, just after ZK-NBC had come to rest.

1.18.6 In the control cab there were two serviceable direct reading indicators for remote anemometers. The instrument for the readout from the anemometer located near the approach end of runway 03 was located directly in front of the ATCO's position. It had three display settings for windspeed and direction; instantaneous, the average for the last 2 minutes and the average for the last 10 minutes. On the night in question it was set to give the instaneous readout. A third anemometer installed at the inner marker, the Alpha Lima NDB, had a persistent defect, and had not therefore been commissioned. It was unserviceable on the night in question.

1.18.7 The ATCO did not look at the anemometers during the latter part of ZK-NBC's approach as he was devoting his time to providing information to the crew on the deteriorating surface visibility. He was however aware of a dramatic increase in the wind just as ZK-NBC was touching down as it blew the rain against the sloping windows of the Tower facing the approach to runway 03.

1.18.8 The ATCO believed the RFS would not proceed to an incident without his clearance but the RFS Chief had no doubts about his duty to turn out immediately. The Chief attempted to contact the ATCO to advise him of the mishap involving ZK-NBC, but when this failed he saw no need to delay his response.

2. ANALYSIS

2.1 The aircraft's crew took the normal prudent steps to keep themselves abreast of the weather trend at their destination, Nandi. On the advice obtained conditions were acceptable for them to continue to their destination and to attempt an approach and landing on arrival.

2.2 The crew's procedures were correct during the final stages of the ILS approach and the decision to disconnect the autopilots and land was appropriate from the visual indication available to the Captain who was flying the aircraft at the time.

2.3 While the ATCO showed initiative in endeavouring to provide comprehensive advice on the deteriorating visibility between himself and the runway threshold, as is normal practice, this was of limited value to the crew of the aircraft which was approaching in the heavy rain that was causing the visibility between the control tower and the aircraft to decrease.

2.4 The change in wind intensity was obvious from the rain striking the windows of the Tower located some 2300 m from the threshold of runway 03. The ATCO had not seen any indication of this wind change on the display of the wind strength and direction at the threshold, which was directly in front of him. Had this information been available to the crew it would have been of greater assistance to them than the reports of decreasing visibility as they were not in a position to monitor the aircraft's wind information display at that stage.

2.5 From the performance of experienced B767 pilots in separate simulators it was by no means certain that such information would have enabled the pilot to avoid the accident although it may have alerted him to the probability of a sudden crosswind from the left. It was not established whether the crosswind component had exceeded the company limit of 10 knots. This would have required the Captain to abort his attempt to land if he had been aware of such a crosswind.

2.6 There was no evidence to suggest that the crew's election not to use the rain dispersal system, provided in the aircraft to ensure the wipers performed to their optimum capability, lessened the clarity of the visual clues available to the Captain. However as the rain encountered was described as the heaviest to occur at Nandi for some time it would have been prudent to utilise the rain dispersal system's potential to improve the view.

2.7 The First Officer's last view of the runway lights before he concentrated on making the radio altimeter calls at 50, 30 and 20 feet was of the aircraft tracking down the centreline of the runway with more than the minimum number of runway lights in sight required for a Cat 1 landing. He was not required to attempt to monitor the aircraft's direction from that point on nor was it likely that had he been able to do so he could have influenced the outcome of the attempt to land.

2.8 The problem was caused by the suddenness of the onset of the crosswind, the late stage of the approach at which it occurred and the pilot's difficulty in seeing the runway edge lights to his right due to the build up of swept water from the windscreen wipers. Once he did detect the drift his application of 9° of rudder was insufficient to prevent the aircraft touchdown with its right mainwheels outside the runway edge lights.

2.9 Although it was evident to the pilots that a touchdown well to the right of the centreline was imminent this was detected at a stage which was too late to attempt a go-around in the circumstances. While the aircraft was capable of going around at this late stage of the approach it was apparent that the aircraft would leave the runway before it commenced a climb away. There was thus a clear potential for the situation to have been aggravated if go-around power had been applied as one set of main wheels started to track through the deep mud alongside the runway edge.

2.10 The witness marks on the runway and the grass alongside it, demonstrated that the Captain had held the aircraft to a straight track and almost regained the runway during the roll out.

2.11 Once the aircraft came to rest the cabin and flight deck crews ensured no passengers had been injured, then checked for any evidence of fire that would have dictated a need for an immediate evacuation. Although the cabin crew could not see through the right hand windows due to the mud spatter on them there was no "glow" of a fire evident on that side. The cockpit crew leaned out of their windows and saw no sign of fire then sought assurance from the RFS Chief that no potential for a fire existed. On the basis of this information they chose not to comply with the RFS Chief's repeated advice to conduct an emergency evacuation.

2.12 The ATCO was at a disadvantage with no readily available backup and two inbound aircraft needing sufficient information to prepare for a diversion while he co-ordinated the response to a landing accident involving a wide bodied aircraft. As a result important information for the crew of

ZK-NBC and to a lesser extent the crews of the inbound aircraft, was delayed. In the particular situation the delays did not have any serious consequences. The potential for the confusion to derogate from the performance of the RFS and cause an unnecessary hazard to life and property was present nevertheless.

2.13 The crew's failure to pull the CVR circuit breaker resulted in all of the pre-accident flight deck speech and sounds being erased. The consequential 30 minutes of activity prior to the occupants deplaning which was recorded in parts was of little value other than to illustrate the desirability of a "hot mike" modification to all aircraft not so fitted and the desirability of a longer period of recording than the current standard of 30 minutes.

2.14 The Duty Forecaster did not to use the weather radar to locate the position of local thunderstorms in the weather conditions conducive to such formations because it was "common practice" not to use the radar for this purpose. Such evidence might have been of assistance in determining the presence and position of storms which subsequently decayed but had the potential to leave areas of heavy precipitation and localised gusty wind conditions. The available evidence indicated that the wind which affected the aircraft was of a very localised nature.

2.15 The delays inherent in the method of transmitting updated forecasts for the Volmet system deprived the crew of one indication that the weather at Nandi might deteriorate but this had no effect on the crew's decision to attempt a landing.

2.16 Reconstruction of the probable wind acting on the aircraft from the information on the flight data recorder confirmed that the aircraft had encountered a sudden crosswind gust from the left after it had crossed the threshold on track to the localiser. There was some evidence that prior to the gust the aircraft was subject briefly to a quartering tailwind from the right before the sudden wind change which caused a significant aircraft drift to the right. This factor would have added to the pilot's difficulty in countering the drift to the right.

2.17 Although a localised wind change at the threshold was not seen by the ATCO on his anemometer read out the fact that a wind gust hit the tower just as ZK-NBC was touching down indicated that local sharp edged wind changes, of the type needed to deflect the aircraft to the extent experienced were present in the area at that time.

3. FINDINGS

3.1 The aircraft was airworthy prior to the touchdown at Nandi.

3.2 The crew were duly qualified, rested and competent to conduct the scheduled flight.

3.3 The aircraft encountered a localised weather situation after crossing the runway threshold and prior to touchdown which caused it to drift to the right unexpectedly.

3.4 The prevailing weather conditions were correctly forecast.

3.5 The wind gust encountered could not have been forecast in sufficiently specific terms for the crew to have avoided the accident.

3.6 Visibility in excess of the minimum for a Cat 1 landing existed throughout the approach below 300 feet agl.

3.7 The lateral visibility of the pilot flying was restricted by the heavy runoff of water from the windscreen wipers this delayed the Captain's appreciation of his proximity to the runway edge.

3.8 The decision not to attempt to go-around when the aircraft was about to drift off the runway was appropriate.

3.9 The use of the Nandi weather radar might have assisted in the detection of any slow moving cumulonimbus, in the vicinity of the aerodrome, which had decayed but still had the potential to cause significant rainfall and adverse wind effects.

3.10 It was not the accepted practice to use the weather radar at Nandi to monitor the progress of local thunderstorms.

3.11 While the decision not to order an emergency evacuation saved the occupants from a potential for serious injury and a wet and muddy experience, the decision not to comply with the RFS Chief's advice to leave the aircraft immediately was inappropriate.

3.12 The RFS Chief's order to evacuate the aircraft was appropriate in the circumstances as it appeared to him that there was a risk of a delayed outbreak of fire.

3.13 The ATCO should have had the support of an additional qualified controller in the tower during any period in which two or more wide bodied aircraft movements were scheduled.

3.14 The accident resulted from the occurrence of an unpredictable sharp edged wind gust which was beyond the ability of the pilot flying to assimilate and respond to in the time available to prevent the aircraft drifting away from the runway centreline prior to touchdown. The limited visual cues available to the pilot, the presence of torrential rain, the absence of a current surface wind report and absence of runway centreline lighting were contributory factors.

4. SAFETY RECOMMENDATIONS
(precis only)

4.1 The operator transfer the instruction to crews re pulling the CVR circuit breaker to the company's shutdown check list.

4.2 The operator remind all aircraft crews of the potential for a fire to occur at any time after an accident until the scene has been pronounced safe by the Chief RFS officer.

4.3 The operator promulgate guidelines to crews for responding to RFS Chief's instructions in an emergency.

4.4 The operator arrange for all cabin crew to witness the effect of emergency lighting in a dark aircraft and to ensure they are aware of which aircraft have strip lighting installed at floor level.

4.5 The operator consider incorporating the "hot mike" modification in each of their aircraft fitted with a CVR.

4.6 The CAAF ensure the ATCO is backed up by another ATCO during any period when more than one wide bodied aircraft movement occurs concurrently.

4.7 The CAAF ensure the runway centreline markings are maintained free of significant rubber deposits.

4.8 The CAAF investigate ways of improving the runway centreline definition in poor visibility, e.g. by installing lighting, reflective paint or "cat's eyes".

4.9 The CAAF endeavour to bring the anemometer at the Alpha Lima NDB site, and its associated cabling to a serviceable state and consider connecting it to the existing "Vaisala" wind measurement display system in the control tower.

4.10 The CAAF ensure that the Air Traffic Service staff and RFS staff are aware of each others duties and responsibilities in any situation where their actions overlap in an emergency response situation.

4.11 The Fiji Meteorological Service be equipped with a suitable radar facility to enable the duty forecaster to maintain a plot of local thunderstorms during weather patterns which promote local cumulonimbus activity.

4.12 The Manufacturer review the go-around limits and procedures for initiating go-arounds from low levels to ensure these are valid and adequately promulgated.

4.13 The Manufacturer consider promulgating a description of the appropriate use and advantages of the B767 rain dispersal system.

4.14 The Manufacturer redesign the overhead stowage bin lateral restraint tie rods and ensure in so doing they recognise the impracticability of ensuring the load in each locker is limited to 40 kg.

7 October 1991

M F DUNPHY
Chief Commissioner

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