FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 55 No. 6 *For Everyone Concerned with the Safety of Flight* June 1998

Operations and Maintenance Audit Failures Cited as Factors in Two Fatal Accidents

The New Zealand Transport Accident Investigation Commission said that Civil Aviation Authority audits of two commercial operators failed to detect and/or correct conditions that might have contributed to a de Havilland Canada Dash 8 controlled-flight-into-terrain accident and a Beechcraft Baron 58 loss-of-control accident.

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FSF Editorial Staff

The de Havilland Canada Dash 8-102 was on a nonprecision instrument approach to Palmerston North (New Zealand) Aerodrome in day, instrument meteorological conditions (IMC) on June 9, 1995. The flight crew attempted to correct a landing-gear-unsafe condition during the approach. The aircraft descended below published approach minima and struck a mountain. Four occupants were killed, and 14 occupants were injured seriously.

The New Zealand Transport Accident Investigation Commission (TAIC) said, in its final report on the accident, that the causal factors were:

- "The captain not ensuring [that] the aircraft intercepted and maintained the approach profile during the … nonprecision instrument approach;
- "The captain's perseverance with his decision to get the undercarriage lowered [while continuing] the instrument approach;
- "The captain's distraction from the primary task of flying the aircraft safely during the first officer's endeavors to correct [the] undercarriage malfunction;
- "The first officer not executing a quick-reference-handbook [QRH] procedure in the correct sequence; [and,]
- "The [inadequacy] of the ground-proximity-warning-system [GPWS] warning." (The warning occurred about 4.5 seconds before impact.)

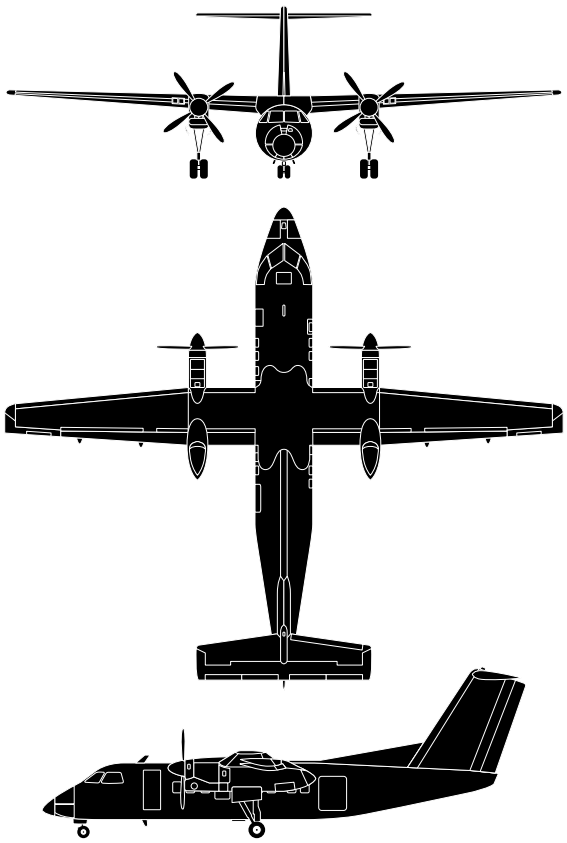
The TAIC said that a contributing factor was the shortage of New Zealand Civil Aviation Authority (CAA) audit staff available to detect weaknesses in the aircraft operator's standard operating procedures.

Approximately two years after the Dash 8 accident — on June 11, 1997 — the Beech Baron was cruising in night IMC during a cargo flight when it entered a steep spiral dive and struck a wooded slope near Paraparaumu, New Zealand. The pilot was killed.

In its report, the TAIC said that the pilot probably lost control of the airplane while suffering carbon-monoxide poisoning and while encountering severe icing conditions in the vicinity of a convective cell.

"Factors contributing to the accident included a flawed operational environment, inadequate flight planning by the pilot to minimize the exposure to icing conditions and the lack of an appropriate safety culture within the operating company," said the TAIC.

Before the accident occurred, CAA audits of the operator disclosed several noncompliances (failures to comply with



De Havilland Canada Dash 8

The DHC-8 is a twin-turboprop, short-range transport. Deliveries began in 1984. The DHC-8-100 series is powered by two Pratt & Whitney PW-120A engines rated at 2,000 shaft horsepower (1,491 kilowatts) and Hamilton Standard 14SF-7 four-bladed propellers. The Dowty Aerospace landing gear have two wheels on each strut. The nose gear retracts forward; the main gear retract into the engine nacelles. Standard accommodation is for two flight crewmembers, one cabin crewmember and 36 passengers seated four-abreast with a center aisle. Maximum takeoff weight is 34,500 pounds (15,650 kilograms). Maximum payload is 8,400 pounds (3,810 kilograms). Maximum cruising speed is 265 knots. Maximum certified altitude is 25,000 feet.♦

Source: *Jane's All the World's Aircraft*

CAA regulations) and several nonconformances (failures to comply with company procedures). The CAA, however, did not take appropriate action to ensure that the operational deficiencies and maintenance deficiencies identified by the audits were remedied, said the TAIC.

The Dash 8 had a history of landing-gear-extension malfunctions. The Dash 8 involved in the approach accident was operated by Ansett New Zealand.

"The operational history of the Dash 8 involved instances of a failure of a main undercarriage leg to extend, or a significant delay in its extension, after the undercarriage had been selected down," said the TAIC.

Records on the accident aircraft from 1986 through April 1995 include one report that the right main landing gear was slow to release, five reports that the left main landing gear was slow to release and one report (three months before the accident) that the alternate gear-extension system was used after the left main landing gear failed to extend normally.

Another Dash 8 in service with Ansett New Zealand during this period had four reports of use of the alternate gear-extension system following failures of the left main landing gear to extend normally and two reports of use of the alternate gear-extension system after the right main landing gear failed to extend normally.

Ansett New Zealand performed several modifications to the landing-gear system that were recommended by de Havilland Canada service bulletins (SBs). The modifications included installation of reshaped and hardened uplock latches (SB8-32-58), new uplock rollers and uplock-roller seals (SB8-32-74), and reshaped actuators (SBA8-32-79).

The modifications did not solve the landing-gear-extension problems. In 1992, SB8-32-98 introduced a new uplock-actuator assembly.

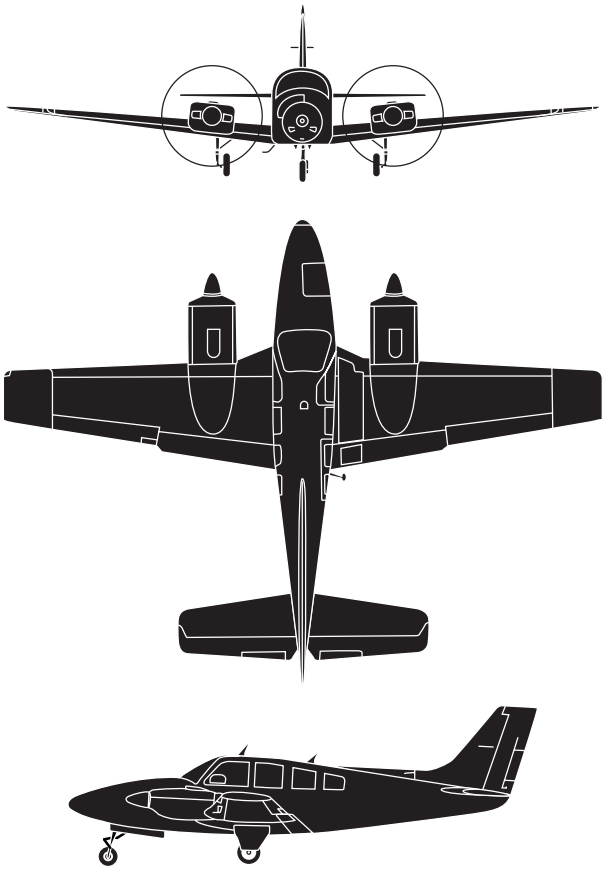
"The new uplock unit was designed to minimize the [landing-gear] hang-up problem and eliminate spurious indications that the main undercarriage had failed to lock down," said the TAIC.

Ansett New Zealand elected to perform periodic inspections of the current uplock assemblies in its Dash 8s, rather than install the new assemblies. The TAIC said that the company did not inform its Dash 8 flight crews of the decision to defer the modification and did not take steps to ensure that the crews could deal safely with malfunctions of the landing-gear system.

In October 1994, de Havilland Canada issued an all-operator message (AOM) that reported an incident in which the right main landing gear on a Dash 8 failed to extend normally and advised that uplock assemblies not replaced per SB8-32-98 tended to cause progressively more troublesome operational problems.

Two months after the AOM was issued, Ansett New Zealand decided to install the redesigned uplock assemblies in its Dash 8s. However, the company apparently was not able to obtain enough new assemblies to equip both airplanes fully.

"Stocks of the redesigned units were limited, and the aircraft manufacturer was unable to provide an immediate supply of the modification kits," said the TAIC. "The majority of events involving failures of the main undercarriage to lower normally [in the Ansett New Zealand Dash 8s] … had involved the left main undercarriage. Accordingly, the left undercarriage



Beech Baron 58

The Beech Baron 58, certificated in 1969, is 10 inches (25.4 centimeters) longer and has a gross weight that is 100 pounds (45 kilograms) higher than the Model 55 Baron. The Model 58 accommodates up to six occupants and has a passenger/cargo door on the rear, starboard fuselage. The aircraft is powered by two 285-horsepower (213-kilowatt) Teledyne Continental IO-520 six-cylinder piston engines. Later versions have 300-horsepower (224-kilowatt) Teledyne Continental IO-550 engines. Maximum gross weight is 5,400 pounds (2,430 kilograms). Cruising speed at 8,000 feet is 192 knots. Service ceiling is 20,680 feet. Single-engine service ceiling is 7,280 feet.♦

Source: *Jane's All the World's Aircraft*

assemblies received priority for embodying the modification as the redesigned units became available."

In April 1995, redesigned uplock assemblies were installed in the left main landing-gear systems in both Ansett New Zealand Dash 8s. The airline had not received modification kits for the right main gear systems when the accident occurred two months later.

"The CAA was aware of the various measures taken by Ansett New Zealand to investigate and rectify the problems experienced with the uplock-latch assembly and uplock roller, and was aware of the service bulletins and modification program recommended by the aircraft manufacturer," said the TAIC.

"CAA maintained a monitoring role," said the TAIC. "They saw no requirement for an airworthiness directive or other direct action concerning the undercarriage defects. … [Because] the [uplock-actuator-assembly] modification remained optional (compliance subject to operator's discretion), no external requirement existed in respect of an installation date."

On the day of the accident, the Dash 8 was on a scheduled flight from Auckland to Palmerston North. The destination airport had scattered clouds at 800 feet, a broken layer of clouds at 1,200 feet and visibility varying from three miles [five kilometers] in rain showers to 12 miles [20 kilometers]. Surface winds were from 300 degrees at 10 knots to 20 knots.

Both flight crewmembers had airline transport pilot licenses and Dash 8 type ratings. The captain, 40, had 7,765 hours of flight time, including 273 hours in type. The first officer, 33, had 6,460 hours of flight time, including 341 hours in type.

At 0858, the crew briefed for the Runway 07 VOR/DME (very high frequency omnidirectional radio range/distance-measuring equipment) approach. Because an aircraft was departing from Runway 25, however, Ohakea Approach Control instructed the crew to intercept the Palmerston North VOR 14-nautical-mile arc for the Runway 25 VOR/DME approach. The crew then briefed for the Runway 25 approach.

"The captain had experienced the Runway 25 VOR/DME approach to Palmerston North Aerodrome only once, and he was PNF [pilot not flying] at the time," said the TAIC. "The first officer had flown the procedure several times before."

The crew flew the 14-nautical-mile DME arc from the north and made a right turn to intercept the 250-degree inbound course. The captain, who was hand-flying the aircraft in accordance with company policy, brought the power levers to flight idle during the turn.

The crew attempted to fly a constant-descent profile, rather than descend in stages according to the step-down segments of the published instrument approach. The profile conformed with the International Civil Aviation Organization Procedures for Air Navigation Services — Operations (PANS-OPS) five-percent gradient. The formula for calculating the altitudes required to maintain the profile for the VOR/DME Runway 25 approach was to multiply the DME distance by 300 and then add 400 feet. For example, at 10 DME, the profile altitude would be 3,400 feet. Ansett New Zealand's procedure required the pilot not flying to calculate and announce the altitudes

that would be required to maintain the profile descent every one or two miles ahead of the aircraft, depending on the approach segment.

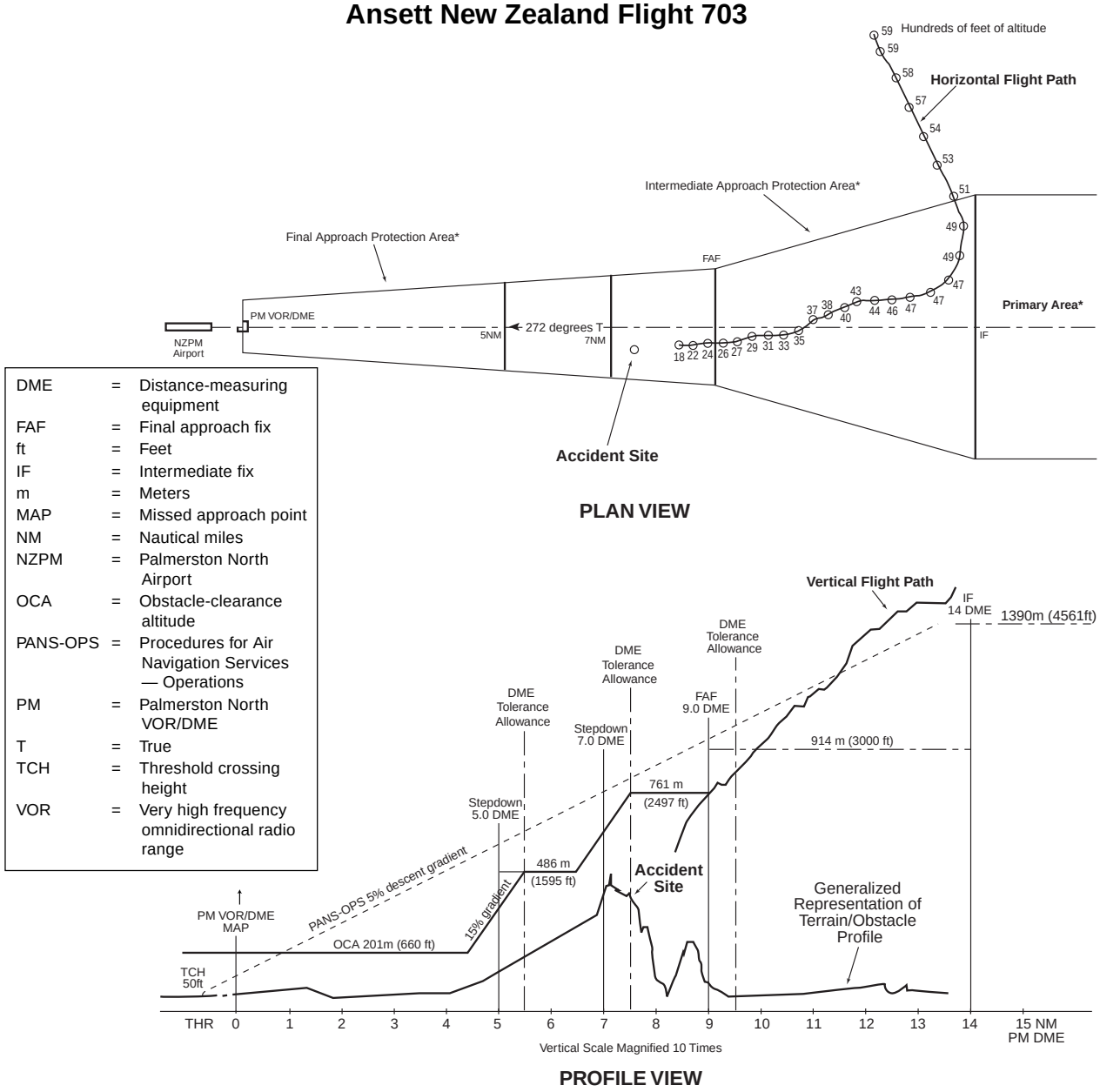
Company procedure also required the crew to set the altitude-alerting system to the minimum descent altitude after receiving approach clearance.

The aircraft was about 12 miles DME on the final approach course when the captain said, "Gear down."

The first officer said, "Selected," indicating that he had moved the landing gear switch to the DOWN position. He then said, "and on profile."

The descent rate was excessive. When the first officer said, "and on profile," the aircraft was slightly above the appropriate profile-descent altitude. The TAIC said, however, that the aircraft was descending at an excessive rate. Air traffic control radar showed that the steep descent continued until shortly before impact. Figure 1 shows the aircraft's descent path.

Simplified VOR/DME Runway 25 Approach and Radar Tracks of Ansett New Zealand Flight 703



DME	=	Distance-measuring equipment
FAF	=	Final approach fix
ft	=	Feet
IF	=	Intermediate fix
m	=	Meters
MAP	=	Missed approach point
NM	=	Nautical miles
NZPM	=	Palmerston North Airport
OCA	=	Obstacle-clearance altitude
PANS-OPS	=	Procedures for Air Navigation Services — Operations
PM	=	Palmerston North VOR/DME
T	=	True
TCH	=	Threshold crossing height
VOR	=	Very high frequency omnidirectional radio range

* Final Approach Protection Area, Intermediate Approach Protection Area and Primary Area are segments of the instrument-approach procedure defined by PANS-OPS.

Source: New Zealand Transport Accident Investigation Commission

Figure 1

Cockpit Voice Recorder Transcript, Ansett New Zealand Flight 703, June 9, 1995

Time	Source	Content
08:56:23	FO A703	Ohakea Control Ansett seven zero three maintaining flight level two two zero received Palmerston Echo one zero one two
08:56:59	ACC OH	Ansett seven zero three Ohakea good morning, when ready descend to flight level one three zero, Palmerston weather Echo confirmed, I'll advise if the zero seven approach is available
08:57:08	CAPT	one three zero
08:57:10	FO A703	wilco, flight level one three zero Ansett seven zero three, morning
08:57:14	CAPT	set and armed, ten thirteen still on the standby
08:57:16	FO	check
08:57:18	CAPT	I certainly hope it's available, I don't really want to do two five
08:57:24	FO	yeah
08:57:24	CAPT	I've done it once that was enough
08:57:27	FO	It's quite a long way around there, isn't it?
08:57:28	CAPT	yeah
08:57:36	CAPT	top of descent fifty four, visual or VOR depending on what we get, flap fifteen landing ninety five plus ten one oh five
08:57:48	FO	set
08:57:49	CAPT	that's landing runway two five, seeing as it's gusty, I'll stick with flap fifteen
08:57:55	FO	yep
08:58:04	CAPT	and if we have to do the VOR DME runway zero seven second of March ninety five very similar to what you briefed, anticipating radar vectors or tracking via Ohakea, thence a radar heading for the final approach and inbound zero six nine not below fifteen hundred at nine miles not below seven thirty at seven miles, the descent profile three times minus three hundred down to four hundred and eighty feet QNH and sixteen hundred meters of vis requirement, and missed approach point two point five miles and the missed approach climbing left hand turn outbound two two nine and then back right hand to overhead into the holding pattern at fifty six hundred or as instructed
08:58:47	FO	check
08:58:49	CAPT	elevation one forty nine feet
08:58:51	FO	check
08:58:55	CAPT	and I'll brief on the, other one if we actually have to do it

"The captain did not increase the engine thrust sufficiently … to maintain or thereafter to regain the appropriate flight path," said the TAIC. "That no comment was made by either pilot relating to altitude and no appropriate adjustment [was] made to the engine thrust by the pilot flying attest to the pilots' failure to appreciate their predicament."

The aircraft was on the lee of a mountain and in a downdraft of about 410 feet per minute. "This would have aggravated the consequences of the captain not setting sufficient engine thrust, by reducing the time available for him to correct the situation," said the TAIC.

About 20 seconds after commanding "gear down," the captain observed that the landing-gear-position indicators showed that the right main gear was not down and locked. He instructed the first officer to consult the QRH alternate-gear-extension checklist.

"Whip through that one," said the captain. "See if we can get it out of the way before it's too late … and I'll keep an eye on the aeroplane while you're doing that."

The first officer began reading the checklist items, and the captain said, "Oh, just skip her down to the actual applicable stuff."

While the first officer proceeded with the checklist, the captain informed Ohakea Approach that the aircraft was established on the final approach course. He did not advise the controller of the landing-gear malfunction.

The captain then observed that the first officer apparently had missed one checklist item that requires pulling a handle to release the landing gear uplocks. "You're supposed to pull the handle," said the captain with a laugh.

Shortly thereafter, the GPWS activated: "Terrain, whoop whoop pull up, whoop whoop pull up." The aircraft was descending at 2,100 feet per minute and struck the ground about 4.5 seconds after the GPWS warning. The accident occurred at approximately 0922.

[The TAIC determined that the GPWS should have provided a warning at least 12 seconds before impact, but was unable to explain why the system failed to activate sooner than 4.5 seconds before impact. "Research has shown that an average pilot reaction time from hearing the GPWS warning to initiating a pull-up maneuver is 5.4 seconds," said the TAIC.]

The flight-data recorder showed that the crew increased pitch to about eight degrees nose-up but did not increase power substantially before the aircraft struck the ground.

The initial impact was on a grassy knoll at 1,272 feet, eight nautical miles from the runway threshold. The aircraft then crossed a gully and struck two steep ridges. "The aircraft rocked

08:58:58	**FO**	yep
09:02:29	**CAPT**	and descent and approach checklist
09:02:31	**FO**	descent and approach checklist, cabin pressure
09:02:33	**CAPT**	set
09:02:34	**FO**	set, fuel panel
09:02:36	**CAPT**	is set
09:02:37	**FO**	set, check complete to altimeters
09:04:50	**CAPT**	leaving flight level two two zero on descent one three zero ten thirteen still on the standby
09:04:54	**FO**	check
09:06:57	**CAPT**	and MSA through here, in case I didn't mention it, is eleven three hundred DME steps of forty five miles down to forty eight hundred fifteen miles to thirty six hundred
09:07:04	**FO**	check
09:07:06	**ACC OH**	Ansett seven zero three descend to five thousand feet radar terrain Ohakea QNH one zero one two
09:07:11	**CAPT**	five thousand on one two
09:07:13	**FO A703**	five thousand one zero one two Ansett seven zero three
09:07:17	**FO**	five thousand's checked
09:08:55	**FO**	(yawn) oh gee, excuse me, I'm tired
09:09:08	**OA**	Ohakea good morning Airlink three one one flight level one eight zero copied Palmerston's Foxtrot one zero one one
09:09:15	**ACC OH**	Airlink three one one Ohakea good morning when ready descend to flight level one three zero Palmerston weather Foxtrot confirmed
09:09:40	**ACC OH**	Airlink zero four eight Ohakea descend to four thousand feet Foxtrot confirmed
09:10:37	**ATC OH**	Ansett seven zero three stop descent at six thousand feet intercept the one four DME arc for the VOR DME approach runway two five
09:10:44	**CAPT**	#
09:10:46	**FO A703**	stop descent at six thousand intercept the one four DME arc for an approach to two five Ansett seven zero three
09:10:53	**CAPT**	six thousand check
09:10:53	**ACC OH**	Ansett seven zero three that's correct, sorry the zero seven approach not available due departing traffic
09:10:58	**CAPT**	OK
09:11:00	**FO A703**	understood Ansett seven zero three
09:11:02	**CAPT**	OK six thousand
09:11:03	**FO**	check
09:11:05	**CAPT**	and the MSA on that part of the arc is fifty seven hundred, and
09:11:13	**FO**	did she say twelve or four, one four DME?

significantly during the impact sequence, causing many passengers to sustain substantial contacts between the fuselage, or other passengers, and their heads, shoulders, chests and arms," said the TAIC.

"Both of the pilots remained conscious but were incapacitated by serious head injuries. The flight attendant was leaning over the back of [a] seat … facing rearward … and was thrown to the floor, sustaining fatal injuries to her head. The other two immediate fatalities involved passengers seated in the rear mid-section of the aircraft. One was thrown, in his seat, onto another seat two rows forward, sustaining major chest injuries. The other died from chest injuries sustained while still restrained, due to additional localized impact loads from seat dislodgement.

"One further fatality occurred involving a passenger who, while waiting outside the aircraft [for rescue], became enveloped in a small, short-lived fire which erupted from the rear of the right engine nacelle. He survived initially but died 12 days later in [a] hospital from extensive burns."

Audits did not detect deficiencies. The TAIC said that the CAA audits of Ansett New Zealand preceding the accident provided limited opportunity to detect deficiencies in the flight crew's ability to handle emergency and abnormal situations competently.

"At the time of the accident, the CAA audit team had … no auditors who were current on Dash 8 aircraft, no requirement for check flights … and a reluctance to spend time reviewing information about the operator," said the TAIC.

"[Flight crew] route checks made as part of the safety audits were infrequent and made only on scheduled flights," said the TAIC. "As no check flights were conducted, there was no opportunity to witness the degree to which [the pilots] retained their CRM [crew resource management] training or the efficacy of that training.

"Had CAA conducted check flights, rather than route checks, there would have been a greater potential for them to detect the efficacy of the company's training for dealing with abnormal and emergency procedures."

Company records showed that both the captain and the first officer had performed the full QRH alternate-gear-extension procedure during their Dash 8 transition training. "[However,] the captain and first officer each stated that at no time during their training did they execute the full QRH procedure," said the TAIC.

The pilots also had different conceptions of their responsibilities to monitor altitude. Guidance varied in the operating and procedures manuals:

- The Dash 8 operating manual said, "When conducting emergency or abnormal procedures, the captain will

09:11:15	**CAPT**	well it's a fourteen mile arc no matter what she said
09:11:16	**FO**	yeah it is isn't it, yeah
09:11:18	**CAPT**	and coming in the one four eight left turn right hand arc fifty seven hundred until we're through the zero five zero when it's forty nine hundred
09:11:35	**CAPT**	and round we come lead in radial of zero six one and not interested in that holding pattern out there
09:11:41	**FO**	no
09:11:42	**CAPT**	inbound two fifty down the approach not below forty six hundred to start off with and not below three thousand at nine miles, not below seven, twenty five hundred at seven miles, and
09:11:52	**FO**	yep
09:11:52	**CAPT**	sixteen hundred at five
09:11:54	**FO**	make it a three times plus four hundred will we?
09:11:56	**CAPT**	eh?
09:11:57	**FO**	three times plus four hundred profile?
09:11:58	**CAPT**	that's it
09:11:59	**FO**	yep
09:12:00	**CAPT**	and it's right on the limits so we gotta stick to that
09:12:03	**FO**	yeah OK
09:12:04	**CAPT**	and nonstandard procedure gear down flap fifteen at ten miles
09:12:10	**FO**	yeah
09:12:12	**CAPT**	I think that's about all down, oh, minimums of six hundred and sixty feet
09:12:15	**FO**	yep
09:12:17	**CAPT**	and we're through thirteen cleared to six, one zero one two twelve thousand three hundred sorry eleven thousand, two hundred and two oh fourteen knots
09:12:29	**FO**	checked, and transition level, altimeters
09:12:32	**CAPT**	check
09:12:33	**FO**	check, landing data
09:12:34	**CAPT**	checked and set
09:12:35	**FO**	checked and set, external lights (one chime)
09:12:40	**FO**	set and, anti-ice
09:12:43	**CAPT**	might as well have it on
09:12:45	**FO**	take it on
09:12:49	**FO**	anti-ice on and ignition normal ECU selected top check complete
09:12:52	**CAPT**	OK, both the ADFs on Palmerston North
09:12:55	**FO**	and approaching the arc
09:12:56	**CAPT**	check, sixteen around we go left hand
09:12:58	**IDENT PM**	dot dash dash dot, dash dash

assume manipulative control and positively monitor the aircraft's flight path, while the first officer reads the appropriate checklist."

- The airline's procedures manual said, "When handling emergencies or abnormal procedures, the captain should assume, or specifically assign to the first officer, responsibility for monitoring the flight path of the aircraft."

The TAIC said that although the captain expected the first officer to continue monitoring the aircraft's altitude, the first officer was "entitled" to assume that he was relieved of that responsibility when the captain said, "I'll look after the aeroplane."

Other pilots for the airline also had varying interpretations of the responsibility for altitude monitoring during an abnormal or emergency situation. The TAIC said that these CRM deficiencies might have been detected and corrected through adequate audit check flights.

Based on its investigation of the Dash 8 accident, the TAIC recommended that the CAA director:

- "Take urgent steps to complete his review of the adequacy of CAA audit staff numbers for carrying out safety audits on operators in accordance with their stated policy;

- "Expedite the implementation of his plans for obtaining the appropriate staff numbers to achieve their planned safety audits in the appropriate time scales; [and,]

- "Explore the practicability of instituting check flights to supplement the audit process on approved operators."

Baron operator had a history of noncompliances. The TAIC said that although the CAA significantly improved its capability to detect noncompliances and nonconformances after the Dash 8 accident, the agency's failure to take effective follow-up action against the Baron operator contributed to the accident two years later.

The Baron was operated by United Aviation. The TAIC's review of CAA audit reports on the company revealed the following:

- In January 1994, five noncompliances and one nonconformance were detected. The audit report said, "The findings relating to operational aspects give cause for concern, as they appear to indicate a lack of awareness of basic CAA requirements."

- In March 1994, a special audit was performed after an accident involving a gear-up landing in a Piper Navajo by the chief pilot. [The TAIC's investigation of the accident revealed that the pilot's medical certificate had expired; the aircraft probably was loaded in excess of

09:13:04	**FO**	and nav two course selector going to two five zero
09:13:08	**CAPT**	check
09:13:24	**CAPT**	and on the arc fifty seven hundred's the minima
09:13:34	**FO**	yep
09:13:57	**CAPT**	and autopilot's disengaged
09:14:01	**FO**	yep
09:14:04	**CAPT**	you could set minimum descent altitude in the
09:14:13	**FO**	she hasn't cleared us for the approach yet though has she, only cleared us to six thousand?
09:14:16	**CAPT**	but once you are on the arc I think the procedure is to
09:14:18	**FO**	I'll just, I'll just confirm it with her, will I?
09:14:21	**CAPT**	what?, I know we're cleared to six
09:14:24	**FO**	yeah
09:14:31	**CAPT**	once you're on the arc though you just set that thing to your minima, as far as I know
09:14:35	**FO**	she didn't clear us for the approach though or anything, but
09:14:38	**CAPT**	no
09:14:39	**FO**	I'll just
09:14:40	**CAPT**	I see what you mean
09:14:41	**FO**	yeah
09:14:42	**FO A703**	Ansett seven zero three is established on the arc descending to six thousand
09:14:47	**ACC OH**	Ansett seven zero three
09:14:49	**CAPT**	oh well
09:14:50	**FO A703**	just confirm we are to maintain six thousand
09:14:53	**ACC OH**	Ansett seven zero three affirm minimum descent on the arc is six thousand
09:14:56	**CAPT**	we've got fifty seven hundred
09:14:58	**FO**	yeah
09:14:59	**CAPT**	whatever, don't argue
09:14:59	**FO A703**	understood Ansett seven zero three
09:15:00	**CAPT**	we won't argue
09:15:04	**ACC OH**	Ansett seven zero three just confirming your descent is to six thousand feet
09:15:05	**FO A703**	descending to six thousand Ansett seven zero three
09:15:10	**FO**	(that's not right is it), cause passing zero five zero we can go to forty nine, or fifty hundred it is actually on the arc here
09:15:18	**CAPT**	yeah, we won't argue
09:15:22	**FO**	No
09:15:32	**FO**	oh well I suppose we can be out there at fourteen DME at five thousand anyway

its maximum gross weight; the normal and emergency exits were obstructed by freight; the aircraft was not suitably equipped for freight operations; the freight was not secured; and an unapproved portable oxygen system was aboard the aircraft.] The CAA's special audit disclosed two noncompliances and one nonconformance. The report said, "During this audit, the team perceived a desire on the part of the management to maintain a safe operation. The findings … , however, reflect an absence of substance in this expressed desire."

- In May 1994, the CAA advised United Aviation that, because of the audit findings, the company's air service certificate (ASC) would be renewed for only six months, rather than the usual two years.

- In November 1994, CAA auditors detected seven noncompliances and three nonconformances, including three noncompliances and one nonconformance that were detected during previous audits. One month later, the CAA renewed the operator's ASC for 12 months.

- In March 1995, a check of one aircraft logbook (for a Piper Tomahawk trainer) disclosed two noncompliances and one nonconformance.

- In December 1995, seven noncompliances and three nonconformances were detected during an audit. The noncompliances included failures to comply with five airworthiness directives (ADs). Four of the noncompliances and three of the nonconformances had been revealed in previous audits.

  The TAIC said, "The [audit] report identified, among other issues, a lack of follow-up with defects, a lack of knowledge of many legislative requirements, insufficient attention to maintenance issues by management, inadequate manuals and scheduled passenger services being conducted without an application for amendment to the operations specifications."

  On the same day that the audit was performed (Dec. 7, 1995), United Aviation's ASC was renewed for two years.

- In December 1996, during a CAA audit involving the observation of one scheduled flight, eight noncompliances were detected. The report said, "Given the limited scope of the audit, the number of findings is cause for concern. Of further concern is the fact that some of the findings are repeats of findings made at previous audits."

- In March 1997, a spot check of one aircraft revealed three noncompliances.

- In May 1997, an audit of maintenance on four aircraft detected 14 noncompliances and one nonconformance.

09:15:38	**CAPT**	mmm
09:15:51	**ACC OH**	Ansett seven zero three cleared VOR DME approach runway two five Palmerston QNH one zero one one
09:15:56	**CAPT**	zero one one
09:15:57	**FO A703**	cleared approach one zero one one Ansett seven zero three
09:16:00	**FO**	yeah now we're right
09:16:01	**CAPT**	OK
09:16:02	**FO**	and I'll set the MDA for you
09:16:04	**CAPT**	yep, that's it, what ever it is, seven hundred
09:16:06	**FO**	six sixty, I'll set seven hundred
09:16:07	**CAPT**	that'll do
09:16:10	**FO**	and minimum descent altitude set
09:16:13	**CAPT**	check
09:16:32	**FO**	yep, and MSA here fifty seven hundred
09:16:35	**CAPT**	check
09:16:52	**CAPT**	oh of course we've got that strong south-westerly there
09:16:56	**FO**	say again?
09:16:57	**CAPT**	I'm just wondering why it tended to keep blowing out on the arc but of course there's quite a strong south-westerly there
09:17:02	**FO**	yeah, yeah
09:17:13	**CAPT**	and I'm aware of the a limit of fifty seven hundred, (chime), even though there is no alert (chime)
09:17:19	**FO**	no
09:17:35	**FO**	oh you haven't asked for those landing checks yet have you?, no
09:17:37	**CAPT**	no
09:18:05	**CAPT**	just about there
09:18:07	**FO**	fifty seven hundred until we cross the
09:18:10	**CAPT**	zero five zero
09:18:11	**FO**	zero five zero
09:18:12	**CAPT**	which is about almost
09:18:14	**FO**	just coming up to it
09:18:15	**CAPT**	that'll do us, forty nine hundred now
09:18:18	**FO**	yep
09:18:19	**CAPT**	and not below forty six hundred till established inbound
09:18:20	**FO**	forty, forty nine yea now's the MSA, commencing, and you can probably commence the approach at that out here
09:18:27	**CAPT**	yeah, yeah I guess so
09:18:30	**FO**	that's about it
09:18:35	**CAPT**	what have we got fifty three hundred ten eleven and landing checks
09:18:39	**FO**	landing checks, belts smoking
09:18:41	**CAPT**	on

> Four of the noncompliances were detected during previous audits. The report said, "Disregard for the amendments to civil aviation legislation and the necessity to develop the changes to their management systems indicates a serious cultural problem has developed within the management of United Aviation … This culture has now transcended through all levels of the maintenance organization [and is] reflected as an attitude deficiency which is apparent in the manner in which maintenance is planned, accomplished and recorded."

One of the nonconformances detected during the May 1997 audit was the operator's failure to obtain air-transport-operations approval for the Baron. United Aviation still had not obtained air-transport-operations approval for the Baron when the accident occurred 14 days after the audit.

The pilot had insufficient weather information. The pilot, 27, had a commercial pilot license and 1,024 hours of flight time, including 150 hours in type. The company called him at about 2300 on June 10, 1997, to conduct the cargo flight.

The pilot telephoned the Airways Corp. National Briefing Office in Christchurch at 0017 and activated an IFR (instrument flight rules) flight plan for a planned 0045 departure from Palmerston North, direct to Christchurch, via the Otaki reporting point and the Wellington VOR. The pilot requested a cruising altitude of 8,000 feet, the minimum en route altitude.

The pilot also requested that area weather forecasts, terminal forecasts and surface observations be sent via facsimile to him at the United Aviation office in Palmerston North.

Airways Corp. had area forecasts that were valid only until midnight and, therefore, sent only terminal forecasts and surface observations to United Aviation.

Area forecasts for flights between midnight and 0500 hours were available only from the Meteorological Service of New Zealand (MetService). The pilot did not request or receive any information from MetService. The TAIC said that United Aviation did not use MetService or train its pilots on how to obtain information from MetService.

Thus, the pilot did not know that the area forecast called for a cold front to pass over the route after midnight, causing isolated thunderstorms embedded in clouds from 2,000 feet to 35,000 feet and moderate icing conditions from 8,000 feet to 18,000 feet.

The Baron did not have weather radar or deicing/anti-icing equipment, other than a heated pitot tube.

The TAIC said that it believed the pilot's decision to fly the route requested on his flight plan might have been influenced by a brief conversation with another company pilot who had just landed a Piper Chieftain after a flight from Christchurch.

09:18:42	**FO**	synchrophasers off hydraulics chamber pumps check on check complete to bleed air
09:18:45	**CAPT**	check
09:18:51	**CAPT**	there's the lead in radial
09:18:53	**FO**	yep
09:18:54	**CAPT**	right hand on the inbound
09:18:55	**FO**	and course bar's active
09:18:57	**CAPT**	check
09:18:59	**CAPT**	and going down to forty six hundred now
09:19:20	**FO**	thirty six, and twelve DME looking for four thousand
09:19:26	**CAPT**	check
09:19:33	**CAPT**	inbound no flags, no nav flags missed approach heading is, set, and that's two fifty of course
09:19:41	**FO**	check
09:19:42	**CAPT**	and minimum descent altitude's set
09:19:47	**FO A703**	Ansett seven zero three established inbound
09:19:50	**ACC OH**	Ansett seven zero three roger ten miles contact Palmerston Tower one two zero decimal six
09:19:54	**FO A703**	one two zero six at ten DME Ansett seven zero three
09:20:06	**CAPT**	gear down
09:20:08	**FO**	say again
09:20:09	**CAPT**	gear down
09:20:10	**FO**	oh, OK, selected
09:20:14	**FO**	and on profile, ten sorry hang on ten DME we're looking for four thousand aren't we, so a fraction low
09:20:21	**CAPT**	check
09:20:25	**CAPT**	and flap fifteen
09:20:30	**CAPT**	oh #
09:20:32	**FO**	actually no we're not, ten DME we're
09:20:33	**CAPT**	(whistle)
09:20:34	**FO**	# look at that
09:20:35	**CAPT**	I don't want that
09:20:36	**FO**	no, # yeah that's not good is it, so she's not locked, so alternate landing gear
09:20:42	**CAPT**	alternate extension, you want to grab the QRH
09:20:44	**FO**	yep
09:20:45	**CAPT**	whip through that one, see if we can get it out of the way before it's too late
09:20:48	**FO**	yeah, right
09:20:52	**CAPT**	and I'll keep an eye on the aeroplane while you're doing that
09:20:54	**FO**	yeah OK
09:20:57	**FA**	—

"The Chieftain pilot believed he suggested to the pilot of [the Baron] to go high, as there might be a tail wind to Christchurch," said the TAIC. "The Chieftain pilot thought he might have said that the weather was 'sweet' going to Christchurch."

However, the Chieftain pilot had flown a coastal route to Palmerston North. The more-direct route requested by the Baron pilot was over mountainous terrain with higher minimum cruising altitudes.

"Weather conditions can vary greatly, even over short distances, between mountainous and coastal areas, so the pilot should not have placed undue reliance on the Chieftain pilot's report," said the TAIC.

Three other pilots said that they encountered icing conditions during flights in the area that night. "An experienced senior flying instructor and IFR pilot … reported that the weather at Paraparaumu on the night of the accident was 'very nasty,' with heavy rain," said the TAIC. "He said he would not have flown in the vicinity of the Tararua Ranges that night because of the weather."

The TAIC said that the Baron was loaded within weight-and-balance limits when it took off at about 0110 with 935 pounds of cargo, consisting mostly of mail and documents, and 650 pounds of fuel.

The aircraft was climbing through 7,400 feet when the pilot requested and received clearance to climb to 10,000 feet. The pilot gave no reason for requesting the higher cruising altitude, and he made no further radio calls.

The aircraft leveled at 10,000 feet at 0123 and crossed the Otaki reporting point two minutes later. The aircraft then began to veer left of course. Groundspeed increased by about 20 knots. Altitude fluctuated 100 feet up and then 100 feet down.

The aircraft then began a right turn. "The altitude and groundspeed began to decrease, and the turn steepened," said the TAIC. "Shortly afterwards, [the aircraft] spiraled to the ground at a high rate of descent, in excess of 8,000 feet per minute."

Impact occurred at an elevation of about 2,500 feet in the Tararua Ranges, 13 miles (21 kilometers) southeast of Paraparaumu at approximately 0130.

During an autopsy on the pilot, toxicology tests of blood leached from muscle tissue revealed 14 percent saturation by carbon monoxide. "The expected level for a person not exposed to carbon monoxide is significantly less than one percent," said the TAIC. "Independent expert medical opinion suggests a rapidly rising inspired carbon monoxide level with concomitant hypobaric hypoxia, due to the cabin altitude of 10,000 feet, would have caused significant pilot mental impairment."

09:21:01	**FO**	yeah, we know
09:21:02	**FA**	thank you
09:21:04	**FO**	landing gear inop, landing gear malfunction, alternate gear eighteen, oh right, alternate gear extension, approach and landing checklist, pressurization
09:21:19	**CAPT**	oh, just skip her down to the actual applicable stuff
09:21:20	**FO**	yeah, landing data altimeters tanks belt smoking OK airspeed below a hundred and forty knots
09:21:26	**FO**	and landing gear inhibit switch inhibit
09:21:28	**CAPT**	OK, and it's one forty
09:21:31	**FO**	landing gear selector is down
09:21:33	**CAPT**	yep
09:21:34	**FO**	landing gear alternate release door fully open, which it is
09:21:38	**CAPT A703**	and Ansett seven zero three established finals at Palmerston North
09:21:41	**FO**	yeah thanks, and insert
09:21:46	**ACC OH**	Ansett seven zero three that's understood, and contact Palmerston Tower one two zero six
09:21:49	**CAPT A703**	one two zero six, thanks
09:21:56	**FO**	insert this handle, (horn)
09:22:00	**CAPT**	it's noted
09:22:01	**FO**	insert handle at, till, oh yeah and operate until main gear locks, actually, nose gear
09:22:15	**CAPT**	you're supposed to pull the handle, … (laugh)
09:22:16	**FO**	yeah, it's got it actually after that, yeah that's pulled, here we go
09:22:25	**AEV**	terrain, whoop whoop pull-up, whoop whoop pull-up
		(Sound of impact)
09:22:30		END OF RECORDING

AA	=	Auckland
ACC	=	Area Control
AEV	=	Aircraft's "electronic voice"
APP	=	Approach Control
A703	=	Ansett 703
CAPT	=	Voice of Captain
FA	=	Voice of Flight Attendant
FO	=	Voice of First Officer
INDENT	=	Morse code identification of radio navigation aid
NP	=	New Plymouth
OA	=	Radio transmission from another aircraft
OH	=	Ohakea
PM	=	Palmerston North
#	=	Expletive
—	=	Unintelligible word/words

Source: New Zealand Transport Accident Investigation Commission

The TAIC said that the likely source of the carbon monoxide was the aircraft cabin heater — a Janitrol model B4050. An AD issued in November 1996 required pressure tests of certain Janitrol B4050 cabin heaters to detect cracks that could allow exhaust gases to enter the aircraft cabin.

"The records for [the accident aircraft] did not show the AD as having been complied with or being nonapplicable," said the TAIC. The records, however, included a report about one month before the accident that the cabin heater exhaust tube was eroded.

"The heater was cleared by the chief engineer as being satisfactory for operation," said the TAIC. "He said he visually checked the heater system, including the combustion chamber, and was satisfied it was serviceable and safe for use."

The TAIC said that, because of incomplete maintenance records and impact damage, determining whether the AD applied to the accident aircraft's cabin heater was impossible.

"The probability exists, however, that the AD did apply," said the TAIC.

"The audits in November 1994 and December 1995 had identified that United Aviation was not recording and complying with some ADs correctly," said the TAIC. "As the CAA did not ensure United Aviation had a procedure to identify and comply with all relevant ADs, there was significant potential for noncompliance with ADs such as that probably relating to [the accident aircraft's] cabin heater."

The CAA revoked United Aviation's ASC soon after the accident. "Given the number of new and repeat noncompliances and nonconformances detected during each audit [in the three years preceding the accident], the CAA should have taken firmer action — if necessary, suspending United Aviation's [ASC] — well before it did," said the TAIC.

Based on its investigation of the Baron accident, the TAIC made the following recommendation to the New Zealand minister of transport:

- "Require the CAA to implement, as soon as practicable, a system [that] will ensure any instances of operator noncompliance and nonconformance which are identified by, or to, the [CAA] are corrected promptly or sanctions automatically follow."♦

Editorial note: This article was based on TAIC Aviation Occurrence Report 95-011, *De Havilland DHC-8, ZK-NEY, Controlled Flight into Terrain Near Palmerston North, 9 June 1995*. The 138-page report contains color photographs, diagrams, tables and appendixes. This article also was based on TAIC Aviation Occurrence Report 97-012, *Beechcraft BE58 Baron, ZK-KVL, In-flight Loss of Control, Tararua Ranges, 21 KM South-east of Paraparaumu, 11 June 1997*. The 50-page report contains a black-and-white photograph and appendixes.

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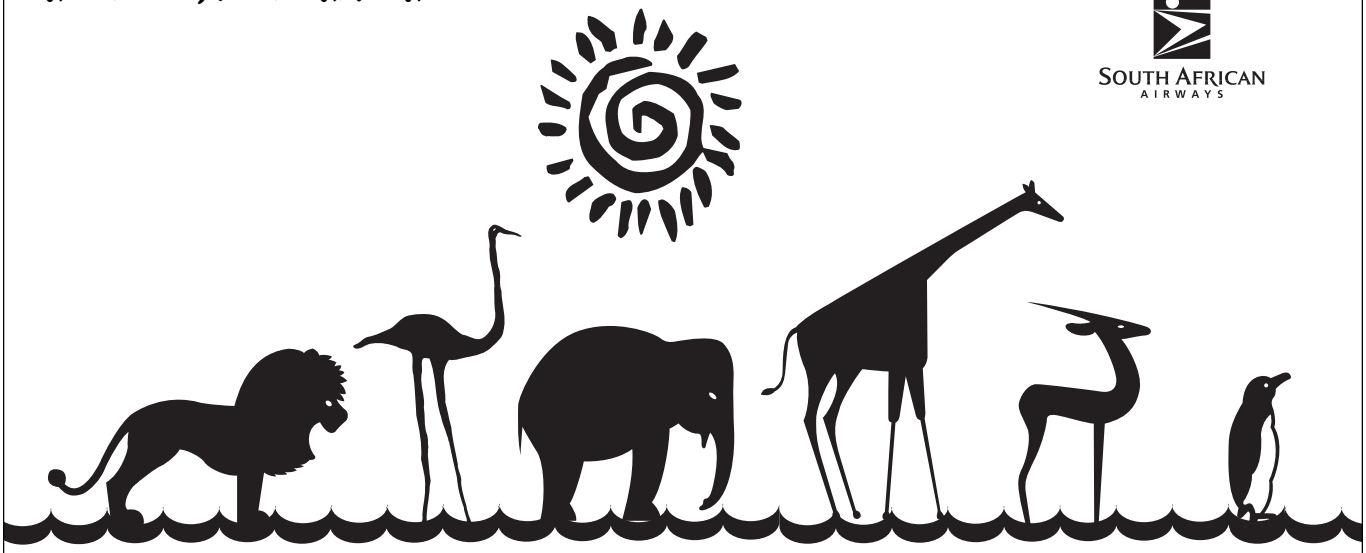

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