Department of Transport and Regional Development

Bureau of Air Safety Investigation

INVESTIGATION REPORT
9402804

Rockwell Commander 690B VH-SVQ
en route Williamtown to Lord Howe Island
New South Wales
2 October 1994

BASI
Bureau of Air Safety Investigation

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Note 1. The Civil Aviation Authority was disbanded on 6 July 1995 and the Civil Aviation Safety Authority and Airservices Australia were formed. The former is the safety regulator and the latter the service provider.

Note 2. Due to the change of ownership of this line of aircraft, the common usage name has changed over time and models. The current owner of the type certificate is Twin Commander Aircraft Corporation of Arlington Washington USA. This aircraft was originally called a Rockwell Commander 690B and was manufactured by the Rockwell Commander Corporation USA. In this report the aircraft will be referred to by its common name Aero Commander 690 for convenience.

Note 3. All aircraft hours quoted in the report were derived from Seaview Air records.

INTRODUCTION

The main purpose of investigating air safety occurrences is to prevent aircraft accidents by establishing what happened, how, and why the occurrence took place, and determining what the occurrence reveals about the safety health of the aviation system. Such information is used to make recommendations aimed at reducing or eliminating the probability of a repetition of the same type of occurrence, and where appropriate, to increase the safety of the overall system.

To produce effective recommendations, the information collected and the conclusions reached must be analysed in a way that reveals the relationship between the individuals involved in the occurrence, and the design and characteristics of the system within which those individuals operate.

This investigation was conducted with reference to the general principles of the analytical model outlined in International Civil Aviation Organisation circulars 247-AN/148 and 240-AN/144.

Common elements in any occurrence are considered to be:

- *organisational failures* arising from managerial policies and actions within one or more organisations (these may lie dormant for a considerable time);
- *local factors,* including such things as environmental conditions, equipment deficiencies and inadequate procedures;
- *active failures* such as errors or violations having a direct adverse effect (generally associated with operational personnel); and
- *inadequate or absent defences* and consequent failures to identify and protect the system against technical and human failures arising from the three previous elements.

Experience has shown that occurrences are rarely the result of a simple error or violation but are more likely to be due to a combination of a number of factors, any one of which by itself was insufficient to cause a breakdown of the safety system. Such factors often lie hidden within the system for a considerable time before the occurrence and can be described as *latent failures*. However, when combined with local events and human failures, the resulting combination of factors may be sufficient to result in a safety hazard. Should the system's defences be inadequate, a safety occurrence is inevitable.

An insight into the safety health of an organisation can be gained by an examination of its safety history and of the environment within which it operates. A series of apparently unrelated safety events may be regarded as *tokens* of an underlying systemic failure of the overall safety system.

SYNOPSIS

The flight was planned as a regular public transport flight from Williamtown to Lord Howe Island. After departure, the pilot reported to Sydney Flight Service that he intended climbing to flight level 230. However, as the aircraft passed flight level 200 the pilot advised flight service that he was now climbing to flight level 210.

The pilot did not report at the first scheduled position code named ‘Shark’ on time, but subsequently advised that he was descending to flight level 130. Shortly afterwards, the pilot reported having crossed ‘Shark’ and provided an estimate for the next scheduled position, ‘Shrimp’. He also stated at this time that the aircraft was maintaining flight level 160. No further communications were recorded by Air Traffic Services from the aircraft. However, during the above period the pilot was in radio communication with two other company aircraft, both bound for Lord Howe Island. One aircraft was crewed by the company managing director and the company chief pilot.

When Sydney Flight Service did not receive the ‘Shrimp’ position report communications checks were commenced, and following the failure of these checks to establish contact with the aircraft, a search-and-rescue uncertainty phase was declared.

After the managing director arrived at Lord Howe Island he contacted Melbourne Rescue Co-ordination Centre in response to a request from that centre and inquired about the aircraft. The crews of both other company aircraft subsequently reported hearing a radio transmission from the pilot of VH-SVQ stating that he had ‘lost it’.

An extensive air and sea search failed to locate the aircraft or its occupants. Only a small number of pieces of the aircraft were found floating on the sea surface.

The investigation determined that the flight was not a regular public transport flight as the company did not hold the required approval from the New South Wales Air Transport Council to operate such flights over the Williamtown to Lord Howe Island route.

The factors that directly related to the loss of the aircraft could not be determined. However, a number of factors relating to the operation this flight, the operation of the company and the oversight of that operation by the regulator were identified.

The report concludes with a number of safety recommendations.

1. FACTUAL INFORMATION

1.1 History of the flight

At 1018 hours EST, on Sunday 2 October 1994, the pilot submitted a flight plan by telephone to the Melbourne Regional Briefing Office of the Civil Aviation Authority. The flight plan indicated that Aero Commander 690 aircraft VH-SVQ would be conducting a regular public transport service, flight CD 111, from Sydney (Kingsford-Smith) Airport to Lord Howe Island with an intermediate landing at Williamtown. The flight was planned to operate in accordance with instrument flight rules with a nominated departure time from Sydney of 1100 hours. The aircraft was crewed by one pilot.

The aircraft departed Sydney at 1117, carrying baggage that had been off-loaded from another company service which was to operate direct from Sydney to Lord Howe Island that day. The flight to Williamtown apparently proceeded normally and the aircraft arrived at about 1140.

The company had no ground-based representatives at Williamtown but the pilot was observed by other persons in the terminal building to converse with passengers before proceeding to the aircraft. No other person saw the pilot and the passengers board the aircraft.

At 1206 the pilot informed Sydney Flight Service that the aircraft was taxiing at Williamtown for Lord Howe Island and that he intended climbing to flight level (FL) 210. Departure was subsequently reported as 1208 when the pilot reported tracking 060 on climb to FL230 which was the original planned cruising level.

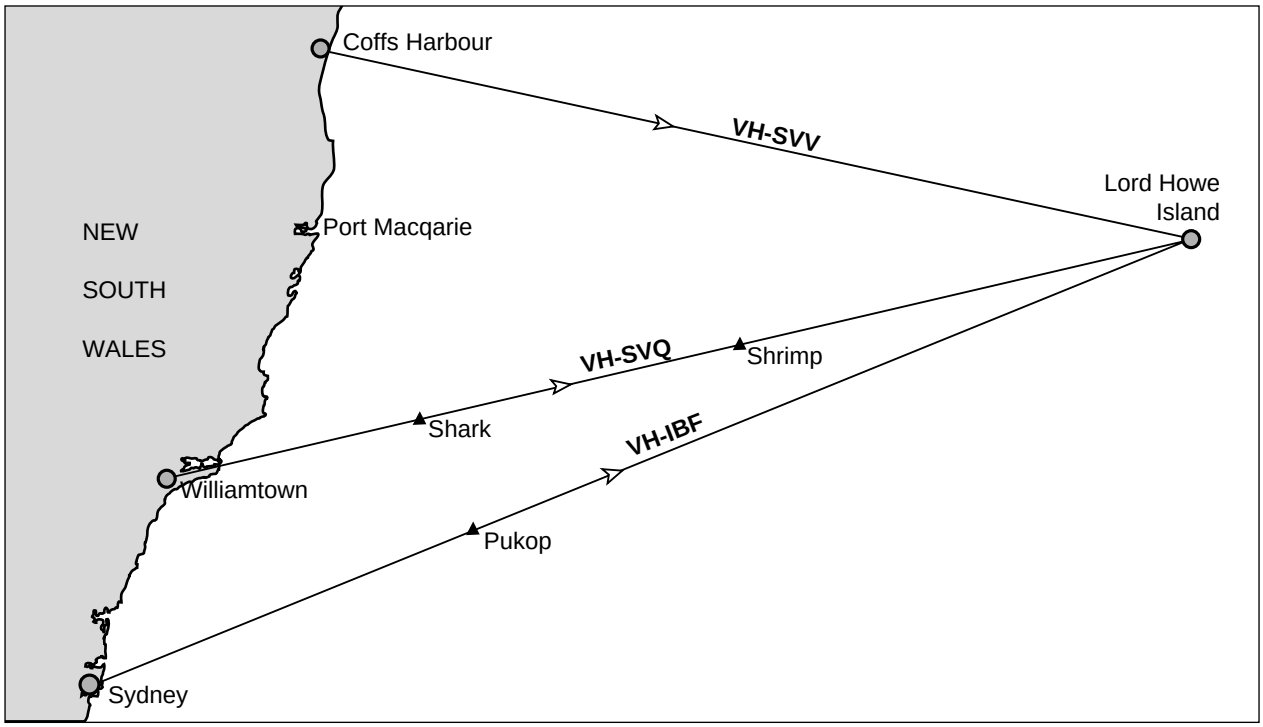
The pilot reported passing 20,000 feet on climb to FL210 at 1229 and shortly afterwards asked if VH-IBF, a company aircraft flown by the chief pilot and operating from Sydney direct to Lord Howe Island, had departed. The pilot was advised that it had departed. The radar trace showed that the climb was discontinued at 20,400 ft at 1231:22. Three seconds later the aircraft commenced descent. The last recorded radar trace for SVQ was at 19,800 ft at 1232:54. The pilot of SVQ did not report at the position 'Shark' at 1232 as scheduled in his flight plan, and at 1235 he notified that the aircraft had commenced a descent to FL130.

At 1238, the pilot of SVQ asked Sydney Flight Service if IBF was listening on high frequency and was advised that the aircraft was not due on frequency for another 30 minutes. He requested that the pilot of IBF call him on the company VHF frequency and reported that the aircraft had just passed 'Shark' and he would shortly provide an estimate for the next position, 'Shrimp'. At 1245, he provided an estimate for 'Shrimp' of 1310 and stated that the aircraft was maintaining FL160. No explanation of the amended level was given by the pilot or sought by Sydney Flight Service.

The chief pilot subsequently stated that he contacted SVQ on company frequency at about 1240 and that the pilot of that aircraft reported a severe vibration which he thought was caused by airframe or propeller icing. He also confirmed that he had turned the propeller heat on. The chief pilot recalled that he asked the pilot of SVQ if the cockpit indication showed that the propeller heat was working normally, to which he replied 'yes its working'. During this period, the chief pilot and the pilot of SVQ had also discussed crew rostering.

Prior to contact with the chief pilot, the pilot of SVQ contacted the pilot of VH-SVV, another company aircraft which was operating a flight from Coffs Harbour to Lord Howe Island.

At 1316, after SVQ had not reported at the 'Shrimp' position, Sydney Flight Service



commenced communications checks but was unable to establish communications with SVQ directly or through any other aircraft. At 1325 an uncertainty phase was declared and the Melbourne Rescue Co-ordination Centre was subsequently notified at 1331. At 1401 the duty officer at the Melbourne Rescue Co-ordination Centre contacted the Lord Howe Island aerodrome terminal and left a message for the pilot of IBF to telephone the Centre. After the arrival of IBF at Lord Howe Island, the company managing director, who was also on board the aircraft, called the Melbourne Search and Rescue Centre at 1410 to inquire about SVQ. Arrangements were made by the company and Civil Aviation Authority search and rescue to organise search aircraft and a distress phase was declared at 1411.

Subsequently, the crews of IBF and SVV reported hearing a radio transmission from the pilot of SVQ, stating that he had 'lost it'. Attempts at the time by the chief pilot to contact SVQ were unsuccessful.

1.2 Injuries to persons

	Crew	Passengers	Other	Total
Fatal	1	8	–	9
Serious	–	–	–	–
Minor	–	–	–	–
None	–	–	–	–
TOTAL	1	8	–	9

1.3 Damage to aircraft

The only wreckage recovered consisted of two external aerials, some cabin trim and seat cushions, a radio compartment panel and a section of wing insulation, all of which were found floating on the sea.

1.4 Other damage

No other damage was reported.

1.5 Personnel information

1.5.1 Pilot in command

Sex	Male
Age	25 years
Licence category	Air transport pilot licence
Medical certificate	Class 2 (Class 1 expired 7 September 1994)
Class 2 medical valid to	7 September 1997
Instrument rating	Multi-engine command
Instrument rating valid to	28 February 1995
Total hours	2,915
Total on type	60
Total last 90 days	241
Total on type last 90 days	60
Total VH-SVQ last 90 days	60
Total last 24 hours	3.8
Total VH-SVQ last 24 hours	3.8
Last route check in VH-SVQ	14 September 1994
Last base check on type	13 September 1994
Last dangerous goods check	22 May 1993
Last emergency procedures/ equipment check	2 January 1994

NOTE Flight and duty hours have been estimated from available company records, including the endorsement form and flight manifests. The most recently completed copy of the pilot's flight and duty record sheets held by the company covered April 1994.

1.5.1.1 Qualifications

The pilot held an air transport pilot (aeroplanes) licence which is held in perpetuity subject to note IX on the licence which states: 'This licence has effect only in conjunction with an appropriate medical certificate'. A valid Class 1 medical certificate is required before the licence holder can exercise the privileges of an air transport pilot licence.

The pilot's Class 1 medical certificate had expired on 7 September 1994. The Director of Aviation Medicine of the Civil Aviation Authority was unable to obtain evidence of the pilot undertaking a flight crew medical test to renew his Class 1 medical certificate.

1.5.1.2 Recent operational experience and schedule

The pilot had flown the Aero Commander 690, SVQ, for about 60 hours in the preceding 90 days. He had not flown the Williamtown to Lord Howe Island route in the preceding 90 days. However, he had been scheduled to fly sectors between mainland ports and Lord Howe Island

approximately 60 times in that period. At least 15 of these sectors were flown in SVQ. At the time of the occurrence, the pilot was employed by the company on a casual basis and was paid an hourly rate for hours flown.

The pilot's recent flying schedule prior to 2 October 1994 was:

27 September	Lord Howe Island to Coffs Harbour (overnight)
28 September	Rostered day off at Coffs Harbour
29 September	Coffs Harbour (dep. 1000) to Lord Howe Island (overnight)
30 September	Lord Howe Island to Norfolk Island to Lord Howe Island (overnight)
1 October	Lord Howe Island to Norfolk Island to Lord Howe Island to Sydney (overnight)
2 October	Sydney to Williamtown to Lord Howe Island

1.5.1.3 72-hour history

The pilot spent the evening of Friday 30 September on Lord Howe Island in accommodation provided by the company. A friend stated the pilot went to a bar, had two drinks and then returned to the house. Those who were also accommodated at the house indicated that he then spent the evening watching television.

Passengers on flights operated by the pilot on 30 September and 1 October stated he seemed in good health and good spirits. However, one family group who had travelled from Lord Howe Island to Sydney on 1 October 1994 noted that the pilot 'used' the oxygen mask on a number of occasions.

No person who saw the pilot on the evening of 1 October was found. However, information from another company pilot and a friend of the pilot of SVQ stationed on Lord Howe Island indicated that it was the pilot's intention to spend the night at his home in Sydney. Evidence indicated that the pilot had breakfast at his home on the day of the accident.

On the day of the accident, the pilot was seen by the chief pilot, the company managing director and a company pilot prior to departure for Williamtown. They stated that he appeared his normal self.

1.5.1.4 Pilot health

Information obtained from previous medical examinations conducted by Civil Aviation Authority designated aviation medical examiners did not indicate that the pilot was suffering from any medical condition which could have affected the performance of his duties up to and on the day of the accident flight.

On Thursday 29 September, the pilot visited the nurse at the Lord Howe Island Hospital. Then on Friday 30 September and Saturday 1 October, he visited the doctor on Lord Howe Island. He had an infection on his right arm. The doctor stated that the pilot had been prescribed Panadeine Forte and a course of antibiotics. The infection was clearing on the Saturday morning.

No information could be obtained to determine whether or not the pilot was taking the medication. However, medical opinion from the Civil Aviation Authority's Director of Aviation Medicine was that neither the infection nor the prescribed drugs, if taken in the correct dosage, would have had a material effect on the pilot's ability to operate the aircraft safely.

1.5.1.5 Pilot performance

According to company personnel and friends the pilot was a conscientious and thorough, and enjoyed flying SVQ.

On the day of the accident, the pilot made a number of slips and lapses (unplanned actions that occur during the execution of well-practised and familiar tasks) which were apparently out of character.

These were:

1. His presentation of flight plan information to the briefing office appeared, to the officer receiving the plan, to be disorganised.
2. He told Sydney Clearance Delivery that he did not have the current standard instrument departure document for a Williamtown Six departure when taxiing at Sydney. (SVQ was cleared by a standard radar departure.)
3. The flight-planned level for the Williamtown to Lord Howe Island leg was FL230. On taxi at Williamtown, the pilot stated he would be climbing to FL210.
4. On departure from Williamtown, the pilot advised he was tracking 060° instead of the correct track of 068°.
5. On departure, he reported to Sydney Flight Service that the aircraft was on climb to FL230 and was cleared to that level. As the aircraft passed 20,000 ft, the pilot reported that he was on climb to FL210.

1.5.2 Air traffic services personnel

All air traffic services personnel directly involved in processing the aircraft were appropriately licensed and held current ratings and medical certificates.

1.6 Aircraft information

1.6.1 Significant particulars

Registration	VH-SVQ
Manufacturer	Rockwell International
Model	Aero Commander 690B
Serial number	11380
Country of manufacture	USA
Year of manufacture	1977
Engines	2 Garrett TPE-331-251K
Engine type	Turboprop
Propellers	2 Hartzell HC-B3TN-5NL

Certificate of registration

Holder	John Francis Green trading as Seaview Air
No.	BNE 00409/04
Issued	20 July 1994

Certificate of airworthiness

No.	BNE/00409
Issued	20 July 1994

Maintenance release

No.	189810
Issued	16 August 1994
Valid to	16 August 1995 or 6,086.1 hours, whichever came first
Total airframe hours	6014.7

(The maintenance release was not recovered and hours were estimated using company flight records).

1.6.2 Weight and balance

The latest issue of the weight and balance documentation used to calculate these figures for SVQ prior to the accident was amended as Issue 5 on 6 May 1994. The company derived the weight calculations from this amendment but derived the balance calculations from the previous amendment. Issue 5 was not contained in the Civil Aviation Authority's copy of the approved flight manual.

No evidence was found at Williamtown of a completed load summary sheet for the flight. As a result, it could not be determined if the pilot completed weight and balance calculations prior to departure. It was also not possible to determine if there was any payload on SVQ additional to the passengers, their baggage and the items of baggage known to have been off-loaded from the aircraft operating the Sydney to Lord Howe Island flight and loaded onto SVQ.

The investigation team attempted to calculate the likely weight and balance of the aircraft at departure and at the estimated time of the accident. Two sets of passenger weights were used for the calculations with one set based on standard weights as described in Civil Aviation Advisory Publication (CAAP) No. 235-1(1), and the other set based on weights obtained from the New South Wales Police Disaster Victim Identification (DVI) Unit. The owners of the off-loaded baggage had weighed their bags and the baggage of two of the passengers was weighed at Williamtown by a passenger-handling agent of another airline. The weight of the remaining baggage was assumed to be the amount published by the company in their pre-departure information to passengers. The fuel weight used for takeoff at Sydney was 1,136 kg, and was the likely weight of the fuel calculated following tests conducted by the investigation team.

Maximum take-off weight	4,683 kg
Centre-of-gravity range at 4,683 kg	
Forward limit	5,418 mm aft of datum
Aft limit	5,553 mm aft of datum
Estimated	
Take-off weight (CAAP)	4,975.5 kg
Take-off weight (DVI)	4,949.5 kg
Accident weight (CAAP)	4,870.5 kg
Accident weight (DVI)	4,844.5 kg

At the time of takeoff from Williamtown and at the time of the accident, the aircraft weight was estimated to have exceeded the maximum allowable. As a result, the aircraft was operating outside the published centre-of-gravity envelope.

1.6.3 Aircraft history and significant events

1977	Aircraft manufactured by Rockwell Commander Corporation USA, to comply with United States Federal Aviation Administration (FAA) Type Certification

2A4. Certification basis was compliance with Civil Aviation Regulation 3 (Federal Aviation Regulation 23).

1977 - 1988	Following manufacture the aircraft was exported to Venezuela and registered YV-33CP. It was subsequently re-imported into the United States of America during August 1983 and registered N3980U. On 27 March 1984 the aircraft was issued with an Export Certificate of Airworthiness for export to Australia. The aircraft was in fact exported to New Zealand and registered ZK-PIP in March 1984.
12 Apr. 1988	The logbook entry for New Zealand Airworthiness Directive AD/AC/149, has a statement referring to operations limitations 'Not in ice' which is referenced to Federal Aviation Administration AD 87-24-07. This entry would suggest that at this time an ice restriction placard was probably installed.
Nov. 1989	Aircraft exported to Australia. Registered in the charter category as VH-FOZ. An exemption against the requirements of Civil Aviation Order 100.2 para. 5.5 (a) was approved for acceptance on the Australian register. As a result, the aircraft was issued with an Australian certificate of airworthiness without having an export certificate of airworthiness from New Zealand.
Dec. 1989	Aircraft was purchased by a West Australian operator.
22 Dec. 1989	Australian Certificate of Airworthiness No. BN409, issued in normal category, at 3,903 airframe hours.
Mar. 1992	Landing accident resulted in minor abrasion damage to the underside of forward fuselage and nose landing-gear doors.
25 Mar. 1993	AD/AC/85 (FAA/AD 87-24-07) titled 'Restriction placard–flight in icing conditions' certified complied with in the aircraft logbook.
Aug. 1993	Aircraft purchased by John Green, trading as Seaview Air.
Dec. 1993	Aircraft registration altered to SVQ.
20 July 1994	The certificate of airworthiness re-issued in the transport category which reclassified the aircraft as a Class A aircraft with a total of 10 seats. Operational category amended to regular public transport.
2 Oct. 1994	Aircraft missing en route Williamtown to Lord Howe Island.

1.6.4 Additional engine and propeller data

Garrett TPE-331-251K engine, Serial Number PO6752 was re-installed in the left position on 25 March 1993 following its removal on 13 August 1990 for rectification of a gearbox defect. The aircraft was operated with a replacement engine for 773 hours between the above dates. The last scheduled inspection of the engine took place on 22 September 1994. At the time of the accident the engine had completed 5,126.7 hours total time in service.

Garrett TPE-331-251K engine, Serial Number PO6751 was installed in the right position. The last scheduled inspection took place on 22 September 1994. At the time of the accident the engine had completed 5,436.3 hours total time in service.

The normal time between overhaul (TBO) for the TPE-331-251K engine is 5,400 hours. However, the manufacturer allows the TBO to be extended to 5,500 hours provided that all progressive inspection intervals have not been exceeded. The right engine had complied with the manufacturer's requirement for a 5,500-hour time limit between overhaul.

The company conducted daily engine trend monitoring by recording a number of engine parameters on flight record sheets. These recordings, taken between 17 April 1994 and 28 September 1994, showed an inter-stage turbine temperature for the left engine of 20–40°C higher than the temperature of the right engine at the same power settings. Analysis carried out by the engine manufacturer was not able to explain this anomaly. However, analysis of engine parameters obtained at a ground engine check during maintenance on 28 September 1994 indicated that both engines were developing rated power.

The propeller installed in the left position was Hartzell HC-B3TN-5NL, Serial Number BV 2477. It had a total time in service of 2,334.7 hours at the time of the accident.

The propeller installed in the right position was Hartzell HC-B3TN-5NL, Serial Number BV 1997. It had a total time in service of 2,381.5 hours at the time of the accident.

The propellers fitted to the aircraft have a time between overhaul of 3,000 hours. Maintenance documentation indicated that all applicable airworthiness directives had been completed on both propellers.

1.6.5 Significant aircraft maintenance history

The aircraft logbook statement showed that the aircraft was being maintained in accordance with Option 2 of the Gulfstream Commander Maintenance Manual section 13, 'Scheduled Inspection and Maintenance Requirements'. Option 2 comprises a four-stage, 200-hour phased inspection program. The statement provides for a periodic inspection if all four phase stages have not been completed in the previous twelve months.

The last scheduled maintenance for the issue of a maintenance release was completed at a C and D phase inspection on 16 August 1994. Following this inspection, Maintenance Release Number 189810 was issued for 200 hours. Aircraft maintenance records indicate that all airworthiness directives applicable to the aircraft had been certified as completed at this inspection.

The aircraft last received scheduled maintenance on 22 September 1994 when an A and B phase inspection was completed at 5,985.5 hours total time in service. No defects were recorded on the maintenance release, although a number of defects had been rectified. Following the completion of this inspection, there were no maintenance requirements recorded as being outstanding.

The maintenance records show ongoing rectification of cabin air-conditioning and pressurisation defects over a period of several years. In the 12 months prior to the accident, extensive maintenance was carried out in an attempt to rectify pressurisation leaks as the aircraft could not achieve the design differential pressure of 5.2 lb/in^2[M1]. From the records, various sections of the air conditioning ducting, the pressurisation controller, the ground blower, defog blower, differential pressure switch and the blower motor pressure switch were replaced. The bleed-air solenoids were removed and bench tested. Because the hot air valve was sticking, the bleed-air manifolds were removed and cleaned and various cabin leaks were sealed. There was no evidence in the maintenance records to indicate that the pressurisation deficiency was rectified to achieve the design differential pressure of 5.2 lb/in^2.

On 23 October 1992, an inspection of the lower spar cap as required by Airworthiness Directive AD/AC/83, was completed. No corrosion was evident. Compliance with the airworthiness directive is required every six years.

The stall warning transmitter was replaced on 22 September 1994 as a result of the horn sounding continually in flight. There was no record of further problems with the system.

During the six months prior to the accident, no record of a major defect (as defined by Civil Aviation Order 51A(1)) was found in either the aircraft maintenance documentation or in the Civil Aviation Authority's computer database.

1.6.6 Flight in icing conditions

Aero Commander 690 aircraft can be certified for continuous operations in icing conditions. To allow them to be operated in low capacity regular public transport operations they must comply with Civil Aviation Order section 82.3, sub-para. 6.3 which states that:

> each operator must ensure that aeroplanes operated over routes and in weather conditions where icing is forecast or known to exist are certified for unrestricted flight in icing conditions.

The information relating to an aircraft's icing certification is detailed in the type certificate data sheet for the particular aircraft type. To achieve this icing certification, an aircraft has to be equipped with various anti-icing and de-icing systems to protect it from loss of performance and/or control which is brought about by the accumulation of ice.

The manufacturer's standard anti-ice and de-ice systems fitted on the Aero Commander 690 aircraft include pneumatically inflated rubber boots on the leading edges of the wings and tailplane. They also include electrically heated windscreens, propeller blades, pitot heads (for airspeed indicators), rudder mass balance, fuel tank vents, generator cooling air inlets and engine air heating for the engine air intake duct.

In-service operation of the aircraft found that flameout from icing occurred under conditions which were not originally thought to be conducive to a flameout. Flameout is a loss of engine power resulting from the cessation of combustion in the engine. Therefore a United States Federal Aviation Administration airworthiness directive was issued requiring the use of continuous ignition or installation of automatic engine re-light systems.

The United States Federal Aviation Administration Airworthiness Directive AD 87-24-07 (Australian Airworthiness Directive AD/AC/85) essentially requires the accomplishment of two things:

(1) Revision of the aircraft Pilot Operating Handbook or Aircraft Flight Manual by inserting in the limitations section the text of appendix 1 of the airworthiness directive, which describes the use of continuous ignition and the circumstances in which it is to be used. The text also contains a caution which states that flight in icing conditions will be limited by the duty cycle of the ignition system, which it states needs to be verified for the particular aircraft by the operator. The text had been added to the Civil Aviation Authority's copy of the flight manual for SVQ and therefore should have been contained in the aircraft copy.

(2) For aircraft which have an ignition system with a duty cycle of less than 1 hour, the fabrication and installation of a placard is required on the instrument panel in clear view of the pilot stating: 'This airplane is prohibited from flight into known icing'. The aircraft was required to be operated in accordance with this limitation.

The requirements set out in (1) do not apply when an aircraft has been fitted with an automatic re-light ignition system in accordance with Gulfstream Custom Kit 138 dated April 1987, or Gulfstream Kit 139 dated 28 May 1987, or by the addition of other Federal Aviation Administration approved automatic re-light ignition systems for both engines.

The requirements set out in (2) are not applicable if the aircraft has an ignition system with a continuous duty cycle of 1 hour or more in accordance with Gulfstream Service Information SI 211 'and/or' SI-212, both dated 30 June 1986.

The Federal Aviation Administration Airworthiness Directive AD 87-24-07 indicates that the placard prohibiting flight into icing conditions may be removed when Gulfstream Service Information SI 211 'and/or' SI 212 are embodied. After examination of the manufacturer's documents, the investigation found that use of the term 'and/or' is misleading and should read only 'and', as it has been determined that both SI 211 and SI 212 need to be accomplished to ensure continuous ignition capability.

Information provided by the Federal Aviation Administration stated that the intention of AD 87-24-07 was that both SI 211 and SI 212 be incorporated before the placard was removed.

The two Gulfstream (airframe manufacture) SIs above refer to two Garrett service bulletins (engine manufacturer's). SI 211 refers to Garrett Service Bulletin (SB) TPE/TSE 331-74-0003 and SI 212 refers to Garrett SB TPE/TSE 331-75-0004.

SB TPE/TSE 331-74-0003 deals with the replacement of the existing ignition unit. The reason given for the replacement is that the ignition unit was duty-cycle limited and subject to failure when the aircraft flight manual limits were exceeded. The action required was to fit a newly developed ignition unit which had an extended duty cycle.

Part (a) of this service bulletin advised that the replacement ignition unit may be operated for up to 1 hour continuous duty.

Part (b) states that the new ignition unit may be operated as required without limitation provided that SB TPE/TSE 331-75-0004 has been complied with.

SB TPE/TSE 331-75-0004 deals with the rework of the anti-ice shield to eliminate anti-ice system hot air from impinging on the ignition unit when the anti-ice system is being operated. Overheating of the ignition unit had been experienced when the engine anti-ice system was operated.

Examination of SVQ maintenance records revealed that SI 212 was the one incorporated in the engines fitted to the aircraft. There was no record of an automatic re-light system having been fitted to either engine. This information and a study of the relevant technical data issued by the manufacturer, the Federal Aviation Administration Airworthiness Directive AD 87-24-07 and the Civil Aviation Authority Airworthiness Directive AD/AC/85, revealed that the aircraft was not appropriately equipped for continuous flight into 'actual or potential icing conditions'.

A Civil Aviation Authority airworthiness surveyor stated that he had noted the presence of a placard prohibiting flight into known icing conditions during a routine surveillance check in early 1994. However, information obtained from the company following the accident showed that the managing director, chief pilot, several company pilots, the maintenance controller, and the chief engineer of the company which normally maintained SVQ, were unaware of the restriction on operating in icing conditions. The information also indicated that the pilots had not seen a cockpit placard in SVQ stating that the aircraft was prohibited from flight into known icing conditions. The investigation was unable to determine if the restriction placard required by the airworthiness directive was fitted to SVQ at the time of the occurrence.

Given the ambiguous instructions contained within both airworthiness directives, it is unreasonable to expect that any person associated with the maintenance or operation of SVQ would have been aware that the aircraft was not appropriately equipped for continuous operation in icing conditions.

Note: In general, for Twin Commander Aircraft Corporation, service bulletins carry a more immediate compliance requirement than do service information notices.

1.7 Meteorological information

1.7.1 Introduction

Prior to beginning an instrument flight rules flight, the pilot in command is required to study, among other information, current weather reports and forecasts for the route to be followed and the aerodromes to be used. Weather information was supplied by the Bureau of Meteorology and was available to pilots through a Civil Aviation Authority briefing office or by the AVFAX or DECTALK systems.

When the pilot submitted the flight plan to the briefing office, he was asked if he required weather information and replied that he did. He was unable to advise the facsimile number at his location and advised that he would call back. There was no evidence that he had called the briefing office again. However, the company chief pilot advised that he obtained operational and weather information for both himself and the pilot of SVQ via the AVFAX system. Examination of the AVFAX system found that the chief pilot accessed the system at 0945, 1045 and 1048. The following information was provided at 1045:

- Terminal area forecast (TAF) and Notices to Airmen (NOTAMs) for Sydney.
- TAF/NOTAMs for Lord Howe Island.
- Route forecast for the route Sydney to Lord Howe Island, Norfolk Island to Port Macquarie, Coffs Harbour to Lord Howe Island.
- Significant weather prognosis.

At 1048 TAF/NOTAMs for Williamtown were provided. However, because of the way in which the provision of the information was recorded, it was not possible to determine the validity times of the forecasts, other than the significant weather prognosis provided by the AVFAX system.

Although the route forecast did not specifically include the route from Williamtown to Lord Howe Island, it covers the area within the surrounding locations of Sydney, Port Macquarie, Coffs Harbour, Lord Howe Island and return to Sydney.

1.7.2 Route forecast

The forecast valid from 1200 to 2400 indicated the presence of a high pressure system over the Tasman Sea with an easterly moving cold front over central New South Wales. The wind was from the north-west at speeds increasing from 50 kts at 10,000 ft to 75 kts at FL240. The forecast cloud was scattered cumulus between 4,000 ft and 10,000 ft with local broken tops to 18,000 ft west of longitude 155° east. Lord Howe Island is situated at approximately 159° east. There were also areas of broken alto-cumulus/alto-stratus between 10,000 ft and 25,000 ft and isolated embedded cumulo-nimbus between 4,000 ft and 35,000 ft west of 160° east. The freezing level was forecast at 11,500 ft with moderate icing and turbulence in the cumulus and alto-stratus/alto-cumulus cloud.

1.7.3 Bureau of Meteorology post-flight analysis

The Bureau of Meteorology analysis of the route planned and flown by the pilot of SVQ indicated that the aircraft left Williamtown in mainly clear conditions and would have passed through scattered or broken layers of middle level cloud, in which ice may have formed on the aircraft, between 1220 and 1230, while on climb.

Between 1230 and 1240, the aircraft would have passed through a layered band of alto-cumulus and alto-stratus cloud with a base estimated to have been about 12,000 feet and tops to 20,000 feet, with isolated tops to 26,000 feet. This band of cloud was situated between 65 NM and 100 NM from Williamtown. Conditions in these clouds would have been favourable for

the formation of icing on the aircraft, with air temperatures of -18° celsius at 20,000 feet and -10° celsius at 16,000 feet. The freezing level was calculated as 11,000 feet.

The forecast isolated cumulo-nimbus cloud and thunderstorms were not evident on the meteorological radar recording along the aircraft's track.

1.7.4 Pilot weather reports

Two other company aircraft were en route to Lord Howe Island at the same time as SVQ. The pilot of the aircraft tracking from Coffs Harbour reported that he was flying at 9,000 ft and that the base of the cloud was about 10,000 ft. The chief pilot, tracking from Sydney, reported that his aircraft was cruising at FL270 and that the cloud tops were about 20,000 ft.

1.8 Aids to navigation

The aircraft was fitted with a number of navigational aids and no reports were received that any of these or the associated ground-based aids were unserviceable.

1.8.1 Global positioning system

The aircraft was equipped with an ARNAV 5000 global navigation system. No reports were received to indicate that the unit was not functioning correctly.

Although no continuous monitoring of the global positioning system's integrity was available in the Australian region for the period of the occurrence, it was ascertained that nine satellites would have been accessible for the period. The dilution of precision, which is a measure of the geometric strength of the global positing system satellite constellation, indicated that the position-fixing ability was excellent.

1.8.2 Transponder

The aircraft was equipped with a Collins TDR-90 air traffic control transponder. A secondary surveillance radar code of 3221 had been allocated for the flight from Williamtown to Lord Howe Island. Analysis of the recorded radar data showed that transponder signals from the aircraft commenced at 1210 as it climbed through 2,700 ft and ceased at 1233:15 when it was maintaining 19,800 ft and was approximately 77 NM from Williamtown. At 20,000 ft, secondary surveillance radar transponder returns should have been available to about 175 NM north-east of Williamtown. When the radar data were examined, the secondary surveillance radar code filters were deselected in case the transponder on the aircraft had been tuned to an unallocated code. No further secondary surveillance radar returns likely to have been associated with the aircraft were detected. There were no technical deficiencies in ground-based radar installations and the reason for the premature loss of the transponder signal could not be determined.

1.9 Communications

1.9.1 Communications facilities

The aircraft was fitted with two very high frequency radios and one high frequency radio. This fitment was appropriate for the flight undertaken.

At the time of SVQ's operation, Williamtown was designated a mandatory traffic advisory frequency aerodrome. This is a frequency for pilots to exchange traffic information, and in the case of Williamtown is applicable up to 2,500 ft and within the lateral boundaries of the Williamtown control zone. After leaving the Williamtown mandatory traffic advisory frequency area, the aircraft continued in uncontrolled airspace under the jurisdiction of Sydney Flight Information Service (FIS 4) until it reached 10,000 ft. The aircraft then entered

controlled airspace in which jurisdiction changed from Sydney Air Traffic Control Sector 2 to Sydney Arrivals East, and Brisbane Air Traffic Control Sector 8. However, the aircraft did not communicate with either Sydney Arrivals East or Brisbane Sector 8 but was transferred directly from Sydney Sector 2 to Sydney Flight Information Service FIS 1 whilst still in controlled airspace. The aircraft subsequently left controlled airspace as it descended through FL 180. All communication until the aircraft was transferred to Sydney FIS 1 were on very high frequency. Communications with Sydney FIS 1 were on high frequency.

1.9.2 Communications conditions

At the time of the flight there were no relevant Ionospheric Prediction Service warnings for high frequency communications. Despite this, recorded communications data indicated some moderate fadeout or skip conditions were prevalent and Sydney FIS 1 had some difficulty communicating with aircraft bound for Lord Howe Island. It should be noted that high frequency propagation conditions were generally poor due to the activity of the 11-year sun spot cycle. However, high frequency communications with SVQ were generally clear and very high frequency communications were all of good quality. The last known communication with SVQ on an air traffic services frequency was via high frequency at 1245.

1.9.3 Company frequency

The Civil Aviation Authority reserved two very high frequencies for 'company' use by charter operators. These frequencies are controlled by the Civil Aviation Authority and are allocated at the request of an operator. Seaview Air had not been allocated one of these frequencies.

Communications between the three Seaview Air aircraft were conducted on frequency 120.6 MHz. This frequency was referred to by company pilots as 'company frequency'. The frequency was in fact a pilot-activated lighting frequency used to activate the aerodrome lighting of a number of aerodromes throughout Australia, including several in New South Wales and southern Queensland. Communications on this frequency are not recorded on automatic voice recorders. The company was not approved to use this frequency for inter-aircraft communications.

1.10 Aerodrome information

The facilities at the departure and destination aerodromes were not pertinent to this occurrence.

1.11 Flight recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, nor were they required by regulation.

1.12 Wreckage and impact information

1.12.1 Introduction

At 1238, the pilot reported that the aircraft crossed the position reporting point 'Shark' (32°31.4″S, 153°37.5″E). This was the last position report received from the aircraft.

The impact position of the aircraft was not determined. In the early afternoon of 4 October 1994, two days after the occurrence, 12 items were recovered from the sea from a mean position of approximately 32°17″S, 153°28″E. Six of the items were identified as likely to have been components of the aircraft and four were personal items believed to have belonged to occupants of the aircraft. The other two items, although located in the area, were not likely to have been associated with the aircraft.

No other aircraft wreckage was recovered.

1.12.2 Recovered aircraft wreckage

Examination of the aircraft components recovered suggested that the aircraft impacted at high speed. The following components were recovered:

1. Piece of hard foam. This component was identified as being a piece of packing from between rubber fuel cells located in the wings. The piece did not exhibit signs of fire damage.
2. Distance measuring equipment aerial. This component would normally have been located on the forward underside of the fuselage. It had separated from the fuselage at its attachment point as a result of impact overload. The outer surfaces of the aerial were soot covered with one side being lightly blistered. The mating surface showed no sign of sooting or fire damage.
3. Visual omni-range aerial. This component would normally have been located high on the side of the aircraft vertical stabiliser. It was broken at one end and exhibited signs of impact damage, possibly as a result of contact with an airframe de-icing boot. It had not been affected by fire.
4. Radio rack cover panel. This panel would normally have been mounted above the radio rack in the rear compartment of the aircraft, protecting the radio components from the hot-air delivery lines to the aircraft's environmental control system. The underside of the panel was covered with an insulation material which was fire damaged with charring on the surfaces and edges of the panel. The upperside was heat-affected along the edges and in one corner. Examination of the screw mounting holes indicated that the panel had been pulled from its mountings. The upper surface of the panel had several strike marks across it that were not affected by fire. Similarly, the inside surfaces of the mounting holes were not affected by fire. Examination of the strike marks determined that the panel was torn out of position after the fire damage.
5. Vinyl cabin interior panel. This component would normally have been located on the passenger cabin side wall, most likely the right side. It was substantially charred at one end with less fire damage present for approximately two-thirds of the surface facing the inside of the cabin with only light sooting on the side facing outboard.
6. Seat cushion and cover. These components were from a passenger seat. The cover was badly charred with the cushion charred on both the upper and lower surfaces.

1.12.3 Examination of fire-affected wreckage

The fire-affected components were examined by a forensic fire specialist in an attempt to determine the timing of the fire in relation to the flight, the source of the fire and the burn duration.

On the basis of the initial examination the specialist concluded that, because of the more extensive damage to components in the rear fuselage and cabin area, the source of the fire was probably in the rear of the aircraft. However, due to the small sample of wreckage available for testing, he was not able to comment on the duration of the fire. The specialist report further advised that:

> unless more information and/or wreckage is obtained to indicate the precise location of the ignition source, it would not be possible to indicate whether the observed damage is in the primary area of this source or is secondary damage caused by the spread of the fire.

All of the available fire-related evidence, including photographs, video and information from the forensic report, was then forwarded to the Fire Safety Branch of the US Federal Aviation Administration for analysis and report. This report concluded that the fire damage was

consistent with that caused by a short duration fireball and post-impact fire. The probable scenario involved the aircraft breaking apart just prior to, or at, impact with the water. No evidence was found to indicate the presence of a prolonged in-flight fire.

1.13 Medical and pathological information

Forensic examination of recovered wreckage did not reveal any evidence in this area.

1.14 Fire

The examination of the recovered wreckage is addressed at sub-section 1.12.3 of this report. It is likely that the fire damage to components resulted from aircraft break-up, either airborne or on impact with the sea surface, when released fuel was ignited by electrical arcing and/or contact with high temperature aircraft or engine components.

1.15 Survival aspects

1.15.1 General

Examination of all items identified as having been on or part of the aircraft indicated that the impact was severe. As a result, the accident is considered to have been non-survivable.

1.15.2 Search-and-rescue action

The last communication received from the aircraft by Civil Aviation Authority air traffic services was at 1245, with the next scheduled communication being a position report at 'Shrimp' at 1310. When no position report was received from the aircraft by 1316, the aircraft was called on the assigned high frequency channel by the responsible air traffic services officer. As no response was received, communications checks were then commenced by other air traffic services operators in the region and aircraft on very high frequency, high frequency and the very high frequency international distress frequency.

At 1325, after all checks had failed to contact the aircraft, an uncertainty phase was declared and the Melbourne Rescue Co-ordination Centre was notified at 1331. The aircraft did not report arrival at Lord Howe Island at the estimated arrival time of 1343. Contact was made with an officer from the company at Lord Howe Island at 1351 and she advised that SVQ was not on the ground. At 1401, the rescue co-ordination centre contacted the Lord Howe Island Terminal and were advised that an aircraft had just landed and that the pilot would contact them.

At 1410, the managing director of the Seaview Air, who had been on board IBF operating from Sydney, telephoned the Melbourne Rescue Co-ordination Centre and informed staff of the contents of the last communication received from SVQ and of his attempts to contact the aircraft. Arrangements were made for two company aircraft to be readied for a search, and a distress phase was declared.

The Melbourne Rescue Co-ordination Centre organised other civil search aircraft and the first aircraft arrived in the search area at about 1545. The location of marine vessels was also requested from the Maritime Rescue Co-ordination Centre but there were no vessels within 100 NM of the area.

On 2 October, eight aircraft searched a total of 1,100 NM^2 prior to darkness. There were no sightings of survivors or debris and the search continued at night with three aircraft, using radar, night vision goggles and flares. Three merchant vessels joined the search at about midnight with a naval vessel joining the next morning.

Two items were sighted and recovered on 3 October. These were not aircraft components and it is unlikely that they were on the aircraft. On the afternoon of 4 October, further debris was

recovered by the naval vessel and associated helicopter. These items were flown to Bankstown and a number were identified as being from SVQ.

No further pieces of debris were sighted and the search was suspended at last light on 5 October. A smaller search effort was conducted on 7–8 October but no further sightings were obtained.

1.16 Tests and research

1.16.1 Fuel tank capacity

The Aero Commander 690 has 22 fuel cells providing a useable capacity of 1,453.5 L.

A refuelling test was conducted to determine the amount of fuel an Aero Commander 690 tank system could be expected to hold if refuelled until apparently full (by using the method of refuelling used for SVQ prior to its departure from Sydney).

The test concluded that the tanks would hold a total of 1,438 L, equivalent to 1,136.8 kg at the temperature prevailing at the time SVQ was refuelled prior to departing from Sydney.

1.16.2 Fuel test

A sample of fuel (AVTUR F-35) was taken from the tanker used to refuel the aircraft on the day of the accident. Laboratory analysis found that the sample was within the required specifications.

1.16.3 Air traffic services automatic voice recorder tapes

The automatic voice recorder tapes that recorded transmissions from the aircraft were examined for the flight from Sydney to Williamtown and then from Williamtown until the last recorded transmission at 1245 on 2 October 1994. The examination focused on seven transmissions, four of which were on very high frequency and three on high frequency. A further two very high frequency transmissions and one high frequency transmission were examined for the flights conducted on 1 October 1994. The purpose of the examination was to determine if any abnormalities in aircraft operation could be detected.

The examinations found that normal speech frequencies were present along with a 400-Hz tone and associated harmonics. These tones were considered to be electrical interference originating from the aircraft alternating current inverter. The high frequency transmissions also exhibited the normal speech frequencies and tones at 475 Hz and 1,287 Hz, which were again considered to have originated from the aircraft alternating current inverter. The difference in frequency from those of the very high frequency transmissions was due to distortion induced by the transmission mode of high frequency single side band.

The examination did not detect any frequency spectral patterns from any transmissions on either day that would indicate an abnormality in the operation of the aircraft.

1.16.4 Secondary surveillance radar coverage

Advice from Civil Aviation Authority technicians indicated that SVQ should have been observed by radar well beyond the position at which radar returns were lost. Subsequent advice received from an air traffic services supervisor at Sydney indicated that he would have expected radar coverage to be lost at about 77 NM north-east of Williamtown, on the route flown by SVQ. To verify the expected coverage of the radar along the Williamtown to Lord Howe Island route, a flight was conducted in another Aero Commander 690 aircraft on 14 June 1995.

The outbound leg of the flight was flown at FL190 with various deck angles and airspeeds used

to simulate a laden and climbing aircraft. Observation of the Brisbane air traffic control radar display revealed that the returns from the evaluation aircraft were lost when the aircraft was about 188 NM from Williamtown. Following descent to FL140 the aircraft was flown in the reverse direction along the route, and radar returns from the aircraft were observed at 185 NM. An analysis of the recorded radar information confirmed the observations.

1.16.5 Encounter with icing

As the flight continued the aircraft encountered a thin overcast with scattered cumulus, and rime ice accretion was observed on the propeller spinners, the unheated windscreen panels, the leading edge of the wings, and the windscreen wiper assembly. Anti-icing and de-icing equipment other than wing and empennage de-ice and engine ignition override were activated. The outside air temperature was observed to be -7° celsius. The crew stated that the performance of the aircraft was not degraded, and the airspeed was reduced and the deck angle increased to simulate a heavily laden aircraft.

Shortly after, the aircraft entered heavier cumulus cloud where rime and clear ice began to form rapidly. Within five minutes ice covered the top of the engine nacelles, propeller spinners, the leading edge of the wings, and unheated sections of the windscreen and wiper assembly, with streaks of clear ice also observed on the undersurface of the wings. Vibration, which increased to a shudder with an occasional bump, was felt through the airframe. Indicated airspeed was maintained above 120 kts, no vibration was evident through the control column, and the stall warning did not activate. The engines and propellers were stable and no out-of-balance condition was evident. When the wing de-icing boots were activated, the ice was removed from the leading edge of the wings. Normal cruise indicated airspeed and deck angle were resumed and the shuddering and occasional bumping ceased but the vibration continued. A descent was commenced and ice began shedding. When the aircraft passed through 10,000 ft, the vibration ceased. The flight was continued to destination without further incident.

Subsequent inspection of the aircraft found no evidence of control surface flutter or other aircraft unserviceability.

1.17 Organisation and management information

1.17.1 Seaview Air Pty Ltd

1.17.1.1 Background

The company was based at Lord Howe Island and was formed in 1979 by the present owner and managing director to operate scenic flights around the island. It held a charter air operators certificate and commenced operating multi-engine aircraft in 1984. The company then provided a passenger and freight charter service between the island and various east-coast mainland ports.

In September 1992, the company gained a licence from the New South Wales Air Transport Council to operate regular public transport services between Sydney and Lord Howe Island. The licence required that, prior to the commencement of regular public transport services, the company gain a regular public transport air operators certificate from the Civil Aviation Authority. Subsequently, Seaview Air requested that routes between a number of ports on the north coast of New South Wales, including Williamtown, be added to their licence.

Approximately one year after the licence was granted, it was revoked by the Air Transport Council. The company was advised that the licence would be restored when the Civil Aviation Authority air operators certificate was obtained. The Civil Aviation Authority issued a low

capacity regular public transport air operators certificate to the company on 25 July 1994. The Air Transport Council reissued the licence in August 1994. However, at the time of the accident, the request by Seaview Air to have the route from Williamtown to Lord Howe Island added to the licence had not been granted by the Council.

At the time of the accident, the company operated one Cessna 172, four Piper PA31 Chieftains, an Aero Commander 690 and a recently leased Beech 200.

1.17.1.2 Management structure and organisation

The company owner and managing director was a long-time resident of Lord Howe Island and was based at the registered office of Seaview Air on the island. The remainder of the management team were based on the mainland. The chief pilot was based in Sydney, with an office at the Sydney (Kingsford-Smith) Airport light aircraft terminal, and the maintenance controller was based in Wagga Wagga.

Most of the maintenance for SVQ was carried out by a Bankstown-based maintenance organisation while the other company aircraft (except for the Kingair) were maintained at Coffs Harbour by a maintenance organisation owned by the managing director of Seaview Air.

At the time of the accident, the company conducted a 'fixed charter' operation with a Sydney-based wholesale travel agent. To facilitate procedures with the travel agent the company had coded its route structure so that, for example, Williamtown to Lord Howe Island was coded CD111.

A fixed charter is possible under the provisions of Civil Aviation Regulation 206 b (ii): which states:

> (ii) the carriage, in accordance with fixed schedules to and from fixed terminals, of passengers or cargo or passengers and cargo in circumstances in which the accommodation in the aircraft is not available for use by persons generally.

A number of past passengers claimed that they were unaware that the flights on which they travelled were not regular public transport flights.

Although Seaview Air did not intend that the flight should be a regular public transport service, the use of a flight number (CD111) by the pilot on the flight plan submitted to the Melbourne Regional Briefing Office indicated that he intended operating a regular public transport service. Similarly, the use of the CD111 designator on flight coupons issued by travel agents gave passengers the perception that the flight was a regular public transport service.

1.17.1.3 Flight operations

At the time of the occurrence, the chief pilot was the only permanently employed flying operations staff member. He and the owner shared a 'full-time' equivalent position on the pilot flying roster. The other seven pilots were employed on a casual basis and were paid for hours flown. The pilot population was relatively stable, with five having been with the company in excess of 12 months. With the exception of the chief pilot and two of the casual pilots, one being the pilot involved in this occurrence, none of the other pilots had experience in charter operations prior to joining Seaview Air. The chief pilot had experience as a pilot with a regular public transport operator.

1.17.1.4 Chief pilot

A chief pilot can only be appointed by an operator after the nominated person is approved by the Civil Aviation Authority. Civil Aviation Order 82.0 appendix 1 states:

> The chief pilot for an operator is to have control of all flight crew training and operational matters affecting the safety of flying operations of the operator.

The order also sets out, in part, the responsibilities of the chief pilot as follows:

(a) ensuring that the operator's air operations are conducted in compliance with the Act, the Regulations and the Civil Aviation Orders;

(b) arranging flight crew rosters;

(c) maintaining a record of licences, ratings, and route qualifications held by each flight crew member including:

(i) validity; and

(ii) recency; and

(iii) type endorsements and any applicable licence restrictions;

(d) maintaining a system to record flight crew duty and flight times to ensure compliance with duty and flight time limitations, in accordance with Part 48 of the Orders;

(e) ensuring compliance with the loading procedures specified for each aircraft type used by the operator and proper compilation of loading documents, including passenger and cargo manifests;

(f) monitoring operational standards, maintaining training records and supervising the training and checking of flight crew of the operator.

The chief pilot at the time of the accident was employed by the operator and approved by the Civil Aviation Authority in March 1994. He had previously been employed as a check-and-training captain with two regular public transport operators and had been a chief pilot on three previous occasions.

In a memo to all pilots, dated 4 May 1994, the chief pilot instructed all pilots to forward copies of medical certificates to him so he could update the company records. In a further memo, dated 22 August 1994, the chief pilot instructed all pilots to complete their flight and duty record documents and submit them to him. However, he did not have a system in place to alert him if pilots under his supervision did not comply with his instructions. In particular, he did not have a system to alert him if a pilot's medical or other required certificate of currency or proficiency had lapsed.

1.17.1.5 Flight operations related manuals

The Seaview Air operations manual, which was accepted by the Civil Aviation Authority prior to the issue of the low capacity regular public transport air operators certificate, does not contain aircraft type-specific information on the Aero Commander 690. Despite the fact that the company operated four different aircraft types, the only type-specific information contained in the manual was for the Beech 200. This aircraft type had its first revenue flight on the same day as the accident. The chief pilot was the only pilot who flew operations using this aircraft.

The operations manual referred readers to the approved aircraft flight manual for type-specific information which in turn refers readers to the 'appropriate operations or manufacturer's manuals'. The manufacturer's pilot operating handbook covers in detail all Aero Commander 690 systems. However, this handbook is not specific to SVQ.

The aircraft flight manual for SVQ was carried in the aircraft and was not found following the accident. The Civil Aviation Authority copy of the manual did not have current weight and balance information, nor did it contain information in relation to the aircraft's suitability for flight in icing conditions.

1.17.1.6 Check and training

The chief pilot was responsible for the check and training of all company pilots. He was tested and approved by the Coffs Harbour district flight operations manager to give check and training, type endorsements and instrument rating renewals on the Aero Commander 690 aircraft type.

The investigation determined that there were no specific Civil Aviation Regulation or Civil Aviation Order requirements which covered essential training or testing prior to granting a multi-engine training approval.

1.17.1.6.1 Pilot Aero Commander 690 training

The requirements for an endorsement on this aircraft type were set out in Civil Aviation Order 40.1.0. para. 7.1. In general, they include undertaking training in aircraft operating limitations, procedures and systems, and flying training in normal and emergency flight manoeuvres. At the completion of training the trainee had to satisfy the trainer that he/she was competent to safely fly the aircraft. There was no requirement for any ground training or theory examination on aircraft systems or operating procedures, nor was there any minimum duration of flight training.

The company check-and-training manual required that pilots undergoing endorsement training on turbine aircraft complete an approved ground course and pass an approved engineering examination.

The pilot had reportedly completed ground school training, conducted by the chief pilot, prior to 4 July 1994. The course was conducted over two days and involved classroom lectures and a period of physically inspecting aircraft systems with an engineer. After the training, the pilot completed a written engineering examination on the aircraft and its systems. Although a copy of the examination was provided by the company, the chief pilot was unable to supply the actual examination completed by the pilot and graded by the chief pilot.

The flying training type endorsement sequences were conducted by the chief pilot. The training was recorded on the type endorsement sheet as having consisted of 2.3 hours dual, 2 hours co-pilot and 21.7 hours in command under supervision. There were no Aero Commander 690 co-pilot duties or responsibilities listed in the company operations manual. The pilot's command endorsement for the Aero Commander 690 aircraft was signed by the chief pilot and dated 4 July 1994 and 23 August 1994. The pilot was cleared for line operations on 14 September 1994.

Shortly after commencing line flying, the pilot reportedly experienced difficulty operating the air conditioning system. Subsequently, an engineer explained to the pilot the operation of the ground blower switch which rectified the problem.

1.17.1.7 Maintenance controller

For approval by the Civil Aviation Authority, operators of Class A (regular public transport) aircraft were required to appoint a maintenance controller who possessed and could demonstrate the requisite knowledge and understanding of the operator's maintenance control manual and the requirements in relation to the maintenance of the aircraft.

The role of the maintenance controller is to control all maintenance carried out on Class A aircraft. There were no laid down benchmarks against which potential applicants could be assessed by Civil Aviation Authority district officers. Therefore, the aptitude of a nominee could not be formally evaluated. The result was that some nominees were assessed and approved against criteria set ad hoc, and others were accepted without any evaluation.

The maintenance controller employed by Seaview Air at the time of the accident was based in Wagga Wagga. He also worked on a contract basis as a maintenance controller for other companies operating aircraft similar to SVQ. He had previous military and civil aircraft maintenance experience but was not a licensed aircraft maintenance engineer. He had been assessed and approved two years prior to this accident to act as a maintenance controller by the Civil Aviation Authority's Wagga Wagga district office.

1.17.1.8 Defect recording

Examination of the maintenance documentation for SVQ found little evidence of compliance with the prescribed regulations in the recording and processing of defects/unserviceabilities. For example, defects were not normally entered on the maintenance release but were usually orally reported to the chief pilot or owner. In general, unserviceabilities were then reported by the chief pilot or owner to the maintenance organisation for rectification.

1.17.1.9 Occurrence reports

From 1 January 1988 to 3 October 1994, 11 air safety occurrences were reported to BASI involving aircraft operated by Seaview Air. Two of these occurrences were reported as confidential aviation incident reports (CAIR), one of which alleged that Seaview Air were operating unauthorised regular public transport flights whilst overloaded. The other report alleged that cargo was unsecured, the life raft inaccessible and the aircraft overloaded and out of balance. Of the remaining nine occurrences; one was this accident, two were runway incursions, one was a gear-up landing at Archerfield, Queensland, one involved a company aircraft landing then departing from a runway that had been notified as unserviceable, one involved an incorrect clearance given to a Seaview Air aircraft, and the other three occurrences involved company aircraft not following the terms of an airways clearance. All occurrences were reported to the Civil Aviation Authority.

Civil Aviation Authority reports following ramp-check surveillance indicated that the CAIR-reported occurrence may not have been an isolated incident of overloading.

1.17.2 Civil Aviation Authority

1.17.2.1 The functions of the Civil Aviation Authority

The functions of the Civil Aviation Authority were specified in part II section 9 of the Civil Aviation Act. Section 9 (1) in part stated:

> The functions of the Authority are:
>
> (a) as provided by this Act and the regulations, to conduct safety regulation of:
>
> (i) civil air operations in Australian territory; and
>
> (ii) Australian aircraft operating outside Australian territory.

At the time of the occurrence, the Directorate of Aviation Safety Regulation (DASR) was responsible for the regulation of Australian civil aviation within the Civil Aviation Authority.

1.17.2.2 Directorate of Aviation Safety structure

1.17.2.2.1 Coffs Harbour district office

Seaview Air's operational headquarters were located at Lord Howe Island which was within the Civil Aviation Authority Coffs Harbour district office area of responsibility. The district flight operations manager and the district airworthiness manager assumed responsibility for the regulatory oversight of Seaview Air in October 1991.

From February 1994, the Civil Aviation Authority district flight operations manager worked from Brisbane and visited the Coffs Harbour office on an occasional basis. This situation arose from the closure of the Port Macquarie based Oxley Airlines which released resources within the Coffs Harbour office. In addition, the industry had complained about the lack of a flying operations inspector in south-east Queensland dedicated to helicopter operations.

The district flight operations manager was a helicopter specialist and following his move to the Brisbane office he had responsibility for 32 helicopter air operators certificate holders in that area along with 12 air operators certificate holders which he had retained from the Coffs Harbour district office. He also continued with his role as Coffs Harbour district flight operations manager which he estimated took 2 to 3 days per week. He stated that his workload was high but that this had not impacted on duties in regard to Seaview Air or his surveillance of the other air operators certificate holders.

The Coffs Harbour district office was part of the north-east region of DASR.

1.17.2.3 Philosophy and communication

Communication between the two Civil Aviation Authority officers responsible for overseeing Seaview Air, the district flight operations manager Coffs Harbour and the district airworthiness manager Coffs Harbour, was poor, and seemed to be restricted to an exchange of internal electronic minutes. This situation probably reflected a personality conflict between the two officers (evident to both the investigation team and others who were interviewed), and their differing localities.

The manner in which the two officers approached their respective roles also differed. The airworthiness manager was much more conservative and was considered by his superior to take more of a policing role with the industry. On the other hand, the district flight operations manager was considered by his superior to have not fully understood the difference between regulating and assisting the industry. This difference was recognised by both individuals and was reflected in interviews and Civil Aviation Authority files.

1.17.2.4 Work experience and training

The district flight operations manager's operational experience had primarily been in the helicopter sphere. He had never worked for a regular public transport operator and his oversight of low capacity regular public transport operations was limited to a 12-month period of Oxley Airlines prior to the surveillance of that operator being transferred to another district office.

Training undertaken by the district flight operations manager in relation to his job involved:

- an induction course which focused on a general knowledge of regulations (Air Navigation Orders and Air Navigation Regulations);
- a course prior to the transition to the flying operation inspector band which provided for cross training of examiners of airmen and airways surveyors;
- short courses on administrative and common law;
- a generic management course on managing for productivity; and
- a week-long 'quality auditor' course.

The Civil Aviation Authority had proposed but never instituted a training course to aid district flight operations managers and district airworthiness managers in the processing of air operators certificates.

The Coffs Harbour district airworthiness manager had over 20 years experience as a licensed aircraft maintenance engineer with a major Australian airline prior to joining the Civil Aviation

Authority. He had been responsible for the airworthiness aspects of the operation of a low capacity regular public transport operator for about 12 months prior to its acquisition by another operator. He had also previously been a member of an airworthiness standards team based in Brisbane whose task was to audit air operators certificate holders under its jurisdiction.

Training undertaken by the district airworthiness manager in relation to his job included:

- an initial induction course on joining the Civil Aviation Authority;
- short courses on administration and common law;
- technical courses on helicopters, engines and an aircraft field training course; and
- airworthiness courses covering the Civil Aviation Regulations.

The district airworthiness manager was not aware of the existence of the Civil Aviation Authority Manual of Air Operator Certification during the upgrading process for Seaview Air.

1.17.2.5 Requirements for a low capacity regular public transport air operators certificate

The general requirements for the issue of an air operators certificate were set out in Civil Aviation Order 82.0 and additional requirements for the issue of a low capacity regular public transport air operators certificate are included in CAO 82.3.

The Manual of Air Operator Certification detailed the Civil Aviation Authority's 'requirements and recommended practices for the certification and surveillance of air operators'. In relation to regular public transport operations, the Manual of Air Operator Certification indicated the requirements for high-capacity operators and then reflected on the differences which were applicable to regular public transport operators using other than high-capacity aircraft.

In summary, to gain a regular public transport air operators certificate, it was necessary for an operator to:

1. Submit and have accepted or approved the following manuals:
   – Operations;
   – Aircraft Flight;
   – Check and Training;
   – Maintenance Control (thereby ensuring that the system of maintenance was in accordance with Class A standards); and
   – Dangerous Goods.
2. Provide training courses for personnel involved in the handling of dangerous goods.
3. Establish an approved system of load control which must be described in the operations manual.
4. Appoint a maintenance controller.

Prior to the issue of a regular public transport air operators certificate, the Civil Aviation Authority was to conduct inspections to ensure compliance with requirements laid down in Civil Aviation Order 82.3 in relation to facilities, staff and equipment.

However, the significant differences which were applicable to low capacity regular public transport operators were:

1. Emergency evacuation and ditching demonstrations were not required.
2. Proving flights could be waived by the district office, where the chief pilot is familiar with all ports of operation and has operated to each of them within 12 months of the date of commencement of service.
3. The experience level of company managerial nominees could be lowered at district office discretion.

1.17.2.6 Processing of low capacity regular public transport air operators certificate

The flying operations area took the primary carriage of the processing and held the delegations to approve air operators certificates. The airworthiness area provided input to the assessment.

Considerable work had been undertaken prior to Seaview Air's formal application for an upgrade of their licence to low capacity regular public transport, which was made on 28 April 1994.

Most of the evaluation in relation to airworthiness aspects was conducted by the senior airworthiness inspector at Coffs Harbour. Considerable correspondence on the file related to the district airworthiness manager's concern over the coverage of airworthiness issues in the operations manual.

At the June 1994 inspection, the Coffs Harbour district flight operations manager annotated the air operators certificate checksheet as having completed the checklists at appendixes D1 to D6 and G to the Manual of Air Operator Certification volume 1, part A, chapter 2. These checklists related to inspections of administrative facilities, records keeping, crew scheduling, operations planning centre, loading and load control, passenger handling facilities and the certificate of approval of applicants' facilities required before the issue of an air operators certificate. The checksheet was not signed for the inspections at appendixes E and F, Aircraft and Outposts.

A flying operations inspector from Brisbane, who oversighted a local low capacity regular public transport operator, was tasked with conducting additional surveillance of the company on Lord Howe Island and Norfolk Island on 7 to 9 June and 16 to 18 June respectively. He met with the chief pilot on 1 July 1994.

All work had been assessed by the Coffs Harbour district flight operations manager as being completed by 25 July 1994.

There was no evidence in files provided to the investigation by the Civil Aviation Authority that:

- proving flights had been completed or alternatively that the chief pilot was familiar with the ports of operation;
- aircraft were physically inspected;
- checks had been completed of flight crew documents including the pilot hours sheet; and
- inspections were conducted of the operator's maintenance facilities and documentation.

According to the Manual of Air Operator Certification, the flying operations inspector member/s of the certification team 'should normally have at least twelve months service in the appropriate category of operations. Officers who do not meet this requirement may be attached to the team but may not be primary members of the team'. The Coffs Harbour district flight operations manager did not have the necessary experience to meet this requirement.

1.17.2.7 Approval and/or acceptance of manuals

There was some degree of confusion within the Civil Aviation Authority as to whether manuals had to be approved or accepted. This was particularly evident in the differences in operating practices between the north-east and the south-east regions, with the south-east region approving manuals. The difference between 'approval' and 'acceptance' was uncertain.

The investigation could not determine the root cause of the confusion. However, factors which may have created the confusion were the ambiguous wording within the Civil Aviation Authority publications and the belief that the industry would not accept the cost of approving all manuals.

The inconsistency in approach was demonstrated in this case with the maintenance control and systems manual, flight manual and check-and-training manual being 'approved', whereas the remaining documents were 'accepted'.

1.17.2.8 Civil Aviation Authority response to reported deficiencies

Concerns regarding Seaview Air's operations prior to the accident came from both internal and external sources. The external sources included the New South Wales Air Transport Council and passengers who contacted the Civil Aviation Authority's Bankstown office in December 1993 and June 1994.

Reports to the Air Transport Council indicated that Seaview Air was effectively running a regular public transport service under the provision of a charter air operators certificate. In April 1994, the executive officer of the Air Transport Council wrote to the Civil Aviation Authority expressing his concerns regarding the safety implications of such allegations.

Between September 1992, the month in which Seaview Air submitted its intention to gain a regular public transport air operators certificate, and the date of the issue of the air operators certificate, the investigation found that eight ramp checks had been conducted on Seaview Air aircraft. These had been undertaken in response to concerns within the Civil Aviation Authority about Seaview Air's operations, which were highlighted by reports of:

1. an aircraft being flown without a valid maintenance release (23 December 1992 to 12 January 1993);
2. a runway incursion at Sydney Airport, which, according to the chief pilot, was the result of a pilot unfamiliar with the airport, being allowed to operate into and out of Sydney. The chief pilot also indicated that the pilot was being checked by another Seaview Air pilot without his authorisation; this occurred at a time when the chief pilot had no check-and-training approval;
3. a gear-up landing at Archerfield following a total electrical failure (30 December 1993); and
4. Seaview Air being mentioned in Hansard on 4 May 1994.

Examples of deficiencies identified by the ramp checks included:

- annual wet drills not completed in accordance with Civil Aviation Order 20.11;
- aircrew failure to use or carry a flight plan, and not preparing or completing fuel logs;
- loads not secured;
- aircraft overweight and out of centre of gravity; and
- defects not listed on maintenance release.

A special audit was conducted after the gear-up landing, from which the Civil Aviation Authority concluded that the aircraft's loading impeded the emergency gear extension equipment.

1.17.2.9 Surveillance

Prior to the issue of the regular public transport air operators certificate, the surveillance required in relation to Seaview Air was to be undertaken in accordance with the Manual of Air Operator Certification chapter 9. The requirement was for a minimum of one periodic inspection per annum and at least one ramp check or flight deck and cabin inspection per annum for each aircraft operated.

As previously stated, eight ramp checks were completed in the period between September 1992 and 25 July 1994. Airworthiness representation was present in only three of the eight ramp checks. It seems that all were completed by persons other than those with the responsibility for the direct oversight of Seaview Air. In the same period, three periodic inspections were reportedly conducted by the district flight operations manager in

September 1992, February 1994 and June 1994. There was no airworthiness involvement in either of these inspections.

The investigation found that, at the time of the accident, the company did not have up-to-date flight crew records in respect of flight and duty hours and validity and currency of crew licences. It is considered that any checks carried out during the June 1994 inspection were thus inadequate. In addition, failures in the Seaview Air defect reporting procedures and control of emergency equipment were not identified during surveillance inspections.

On 1 July 1994, the Civil Aviation Authority introduced the Aviation Surveillance and Safety Program which was a strategy of surveillance to be undertaken in a systematic manner to provide an assessment of the overall safety level of the aviation industry. It was intended that the surveillance of Seaview Air be undertaken under this program, and the first such surveillance had been planned by the Coffs Harbour district airworthiness manager for 10 October 1994. No surveillance of the company had been undertaken between the issue of the low capacity regular public transport air operators certificate and the day of the accident.

It is of note that there is provision in the Civil Aviation Regulations for the Civil Aviation Authority to apply administrative fines. However, there were no procedures in force to allow officers of the Civil Aviation Authority to issue such fines. As a result, breaches of regulations were normally pursued by administrative action requiring letters to explain action from offenders with the suspension or cancellation of licences or certificates being the final step.

1.17.2.10 Amendment of airworthiness directives

The Civil Aviation Authority had issued Airworthiness Directive AD/AC/84 in 1987. It addressed the manufacturer's service bulletin, SB 206, concerning an inspection of the empennage attachment area of Aero Commander 690 aircraft (see section 1.18.1.3). When a subsequent service bulletin, SB 218, was issued in May 1994, it replaced SB 206 and required action within the next 50 hours for aircraft with an excess of 2,000 hours total time in service.

In July 1991, the Civil Aviation Authority issued Airworthiness Advisory Circular 6-23 which addressed the Authority's policy on airworthiness directives and review procedures for overseas airworthiness directives and service bulletins issued by manufacturers. In the airworthiness advisory circular, the Civil Aviation Authority stated that urgent safety-of-flight service bulletins, which are defined as those requiring action ranging from immediate to within 100 flight hours, would be reviewed and Australian airworthiness directives issued where necessary. Service Bulletin 218 fell within the parameters stated in Airworthiness Advisory Circular 6-23, yet no action was apparently taken as AD/AC/84 was not amended or cancelled despite the service bulletin to which it referred now being invalid.

The airworthiness advisory circular also stated that service bulletins of a routine nature would not necessarily be assessed by the Civil Aviation Authority. However, it admitted that these service bulletins were no less important to safety and it was, therefore, extremely important that owners/maintenance organisations review all service bulletins and action them when a safety matter was involved.

1.17.2.11 Reviews of Directorate of Aviation Safety Regulation

A number of reviews have addressed the manner in which the Directorate of Aviation Safety Regulation, and its predecessor the Safety Regulation and Standards Division, conducted their operations. These include the Safety Forum (August 1992) and the Terrell Report (February/March 1993). More recently, a parliamentary inquiry was established. Most of the submissions to the parliamentary inquiry have been made public and its findings were published in the report Plane Safe in December 1995.

In the Civil Aviation Authority's submission to the parliamentary inquiry (15 September 1994), it stated (p. 8):

> 3.4.2 With the benefit of hindsight, a number of problems in the regulatory area, going back many years, were evident. These problems include:
>
> – the lack of a structured and consistent national planned surveillance program;
> – regulations and orders that were developed without head of power;
> – system safety issues which were not addressed in any coherent manner;
> – field staff and industry that were given extensive delegation with little or no guidance on how such delegations should be applied—causing a consistency problem;
> – the lack of any enforcement guidelines;
> – the lack of systems that allowed for the systematic and national collection of safety information on the industry—as such, making safety trend analysis almost impossible;
> – inadequate succession planning, staff development and training programs necessary to keep abreast of the changing aviation and technological environment.

The submission then went on to state (p. 28): 'the Authority has re-affirmed the primacy of safety in all areas of its operations'.

1.17.3 New South Wales Air Transport Council

Air services within New South Wales have to be licensed in accordance with the provisions of the Air Transport Act 1964 Number 36 of New South Wales. The Air Transport Council aligned licences to those categories used by the Civil Aviation Authority and issued charter and regular public transport licences accordingly. These licences are authorisations to operate on specific routes as distinct from air operators certificates issued by the Civil Aviation Authority.

In September 1992, the New South Wales Air Transport Council granted Seaview Air a licence to operate a regular public transport service between Sydney and Lord Howe Island. The licence was awarded on the basis of the support afforded Seaview Air by the Lord Howe Island Board and the local community.

The route was granted on the condition that Seaview Air received a variation to its air operators certificate and had appropriate insurance cover. Procedures have since been varied, with licences only being issued to companies who have received an air operators certificate.

1.18 Additional information

1.18.1 Airworthiness aspects

1.18.1.1 Flight control system

On 23 December 1981, Gulfstream American (the organisation then holding the type certificate of Aero Commander 690 aircraft) issued Service Bulletin SB 186. This service bulletin emphasised the importance of ensuring that trim tab free play for each control surface was within prescribed limits, and defined the action to be taken to ensure no excessive free play existed. This inspection requirement was later included in the Gulfstream 690 A and B maintenance manual.

On 6 December 1993, following an accident in the USA which involved an Aero Commander 690 in an uncommanded roll while on descent apparently at high speed, the US National Transportation Safety Board sent safety recommendations to the US Federal Aviation Administration concerning ailerons of Aero Commander 690 aircraft. The recommendations required the checking of aileron control rigging in accordance with Twin Commander maintenance procedures. They also recommended an engineering design review of the

aileron control system installed in Aero Commander 690 aircraft. On 22 February 1994 the Federal Aviation Administration advised the National Transportation Safety Board that they would consider issuing a 'notice of proposed rulemaking' on the subject of aileron control rigging. They further advised that they had contracted engineering consultants to review and analyse the aileron control system installed in Aero Commander 690 aircraft.

Twin Commander issued a service alert on 4 January 1994 and revised and re-issued an alert on 19 April 1994 to re-emphasise the importance of ensuring the trim tab free play on each control surface was within limits. Compliance with the service alert was required within the next 50 flight hours or six months, whichever came first.

Subsequently, in November 1994, Federal Aviation Administration supervised flight tests were conducted by Twin Commander with an Aero Commander 690A aircraft. For the tests the ailerons were 'misrigged' in stages, up to 2.75° up at the trailing edge, equivalent to approximately 0.6 inches. The National Transportation Safety Board found that the ailerons of the aircraft upon which the recommendations to the Federal Aviation Administration were based were 'misrigged' by 0.23 inches. The tests concluded that 'no evidence of "aileron snatch" or tendencies in this direction were noted during any of the conditions tested'. The information was conveyed to the Federal Aviation Administration and by them to the Civil Aviation Authority.

SVQ was required to be maintained in accordance with the manufacturer's system of maintenance which specified that the flight control trim tab free play inspection be conducted each 100 flight hours. The last check requiring such an inspection was conducted on 22 September 1994. Despite this inspection having been certified as completed, there was no record that the inspection had been completed in accordance with the instructions in the manufacturer's maintenance manual.

The Civil Aviation Authority issued an emergency airworthiness directive (AD/AC/89) on 5 October 1994. This airworthiness directive required compliance with the Twin Commander service alert issued on 19 April 1994.

1.18.1.2 Emergency equipment

The Seaview Air maintenance control and systems manual required that each 'lifed' component fitted to an aircraft, such as life rafts and life jackets, have a separate history card. Each card was to record information on the component such as name, part number, serial number, overhaul period, installation and removal details and date of last and next service.

Two Australian airworthiness directives (AD/EMY/4 and AD/EMY/2) cover the inspection of life rafts and life jackets.

Attempts were made to determine the status of the emergency equipment on SVQ and it was found that the items were not controlled in accordance with the company maintenance control and systems manual, as no card records were kept. As a result, there was no record of the safety equipment or the serviceability status of such equipment on the aircraft. It was subsequently determined by a process of elimination, that at the time of the accident, the aircraft was equipped with a nine-person life raft and sufficient life jackets for those on board. The company advised that all the life jackets on board SVQ were serviceable.

The nine-person life raft was the only such raft owned by the company (the others being of a lesser capacity).The company operated over-water flights in other aircraft capable of carrying passenger loads equivalent to SVQ. Thus it is possible that aircraft were, from time to time, operated with inadequate life raft capacity for the passengers carried, unless more than one raft was carried on the flights where the number of occupants exceeded single raft capacity.

The nine-person raft was last serviced in March 1993 and was required to be serviced again in March 1994. No record of this servicing could be found.

1.18.1.3 Empennage attachment inspection

Australian Airworthiness Directive AD/AC/84 was first issued in 1987 and had an effective date of 31 October 1987. The requirement was for an inspection in accordance with Gulfstream Aerospace SB 206. This service bulletin referred to the use of incorrect hardware and/or loss of torque on the attachment bolts and the possible cracking of the tailplane attachment and fin lower ribs. The initial inspection requirement was to be completed (for aircraft with 2,000 hours total time in service) within 25 hours, the inspection to be then completed every 12 months or 500 hours in service, whichever came first.

Another service bulletin, SB 218, was issued on 19 May 1994 and was subjected to revisions on 11 July 1994 and 23 September 1994. It replaced in its entirety SB 206 but was not required to be actioned for aircraft recently inspected under SB 206 until 12 months or 500 hours after the SB 206 inspection. SB 218 was in two parts: the first requiring an inspection to be repeated at the same intervals as SB 206, the second part was required before further flight if any damage was detected in the part one inspection. SB 218 part 2 also required either the fitment of a modification kit (once completed no further action on this service bulletin was required) or continued inspections each 12 months or 500 hours. In essence, SB 218 covered those areas inspected in SB 206 plus areas of the vertical stabiliser for cracks in the lower ribs and associated stabiliser skin and rear spar. In the service bulletin the manufacturer states that if any damage in the area is left unrepaired, it could propagate to the point of failure of the vertical tail.

The organisation that maintained SVQ was also responsible for the maintenance of similar aircraft and had originally found the damage that led the manufacturer to promulgate SB 218. It had been provided with a copy of SB 218 by the manufacturer on 8 July 1994. However, it had not been advised by the aircraft owner that SB 218 had been issued.

Information from the manufacturer indicated that it was unaware that an Aero Commander 690 aircraft was owned by Seaview Air and that the aircraft owner had not requested the company to provide service bulletins relating to the aircraft. This was in spite of the requirement in the aircraft logbook for the aircraft to be maintained in accordance with the manufacturer's maintenance schedule. Also, the manufacturer required that all service bulletins issued by it be mandatory maintenance. The fact that Seaview Air were not in receipt of Twin Commander service bulletins relating to SVQ was not determined by surveillance conducted by the Civil Aviation Authority either during the air operators certificate upgrade process or beforehand during routine surveillance.

SVQ was inspected in compliance with SB 206 on 17 March 1994 at 5441.3 hours when no defect was found. The aircraft records showed that it was further inspected in accordance with SB 206 on 16 August 1994, 444.8 hours after the previous inspection. However, by this time, SB 206 was invalid and the investigation was unable to determine on what basis the maintenance organisation carried out that service bulletin instead of the appropriate SB 218. The Seaview Air maintenance controller had not informed the maintenance organisation of the need to complete SB 218.

No record of compliance with SB 218 was found for SVQ.

Following the issue by the manufacturer of SB 218, the Civil Aviation Authority did not take any further airworthiness directive action in this area.

1.18.1.4 Bleed-air system

Engine bleed air (air about 340°C at high power settings and drawn from the compressor section of the engine) is utilised for pressurisation and air conditioning in the Aero Commander 690 aircraft. There are a number of service bulletins issued by the manufacturer concerning the bleed-air system. These relate to inspections of the system for leaks, the installation of clamps to prevent line chaffing, the installation of an aft fuselage thermostat and an engine firewall bleed-air shut-off valve.

The aft fuselage thermostat installation was designed to provide an indication to the pilot of abnormal temperatures in the rear of the aircraft. The engine shut-off valves were to shut off bleed-air supply in the event of a bleed-air leak downstream. SVQ was not fitted with either of the above modifications. The last bleed-air system leak check was conducted on 16 August 1994 at 5886.1 total time in service and there were no recorded defects.

1.18.1.5 Aircraft certification

The aircraft was first issued with an Australian certificate of airworthiness, in the normal category, after it was imported from New Zealand on 22 December 1989 (when registered VH-FOZ). For operations on low capacity regular public transport routes, the aircraft was required by Civil Aviation Order 82.3 to be issued with a transport category certificate of airworthiness. This was achieved on 20 July 1994.

During an examination of the documents associated with the certification process, no evidence could be found that a certificate of type approval had been issued for Aero Commander 690 aircraft. Nor was any evidence found of an assessment being made against the requirements listed in Civil Aviation Order 101.4, which sets out the airworthiness certification requirements for imported aircraft in the transport category. It was also not possible to determine from an examination of the material available if a certificate of type approval was necessary for the Aero Commander 690 aircraft. In summary, the examination of the certification process concluded that:

1. no documents were found which defined the role of the various areas of the Civil Aviation Authority involved in aircraft certification;
2. there was a lack of relevant guidance material available to Civil Aviation Authority officers on the subject of aircraft certification;
3. there were no airworthiness instructions covering the type approval of the aircraft; and
4. there was no clear definition of the role of the approved flight manual in airworthiness control.

1.18.2 Dangerous goods

Because the contents of the baggage and freight carried on the aircraft were unknown, it could not be determined if any dangerous goods were carried on the aircraft.

The pilot had successfully completed a Civil Aviation Authority approved dangerous goods training course in May 1993.

1.18.3 Flight planning

The Civil Aviation Authority Melbourne Regional Briefing Office held standard flight plans for some Seaview Air routes but not for the Sydney to Williamtown to Lord Howe Island route.

The flight-planned time intervals for the flight from Williamtown to Lord Howe Island were:

- Williamtown to 'Shark' (24 minutes);
- 'Shark' to 'Shrimp' (23 minutes); and
- 'Shrimp' to Lord Howe Island (33 minutes).

The pilot advised the aircraft would climb at an indicated airspeed of 160 kts, but other company pilots reported that in practice they climbed at 150 kts and allowed the indicated airspeed to reduce until 130 kts was reached. This speed was then maintained until top of climb was reached.

Using a climbing indicated airspeed of 160 knots and the forecast wind velocity along the route, it was calculated that a more appropriate time interval from Williamtown to 'Shark' would have been 30 minutes.

The pilot reported a departure time of 1208 and later advised passing 'Shark' at 1238, a elapsed time of 30 minutes.

1.18.4 Air traffic services communications

In the period immediately prior to and at the time of the occurrence, radio communications with the aircraft were on high frequency with Sydney Flight Information Service 1. The operational status and configuration of the relevant air traffic services workstations were normal.

The control and presentation of high frequency workstations were such that once the high frequency facilities were activated, there were several control functions which could affect the audio program presented and recorded. When one of these functions ('receiver select') for a specific frequency was selected, it also prevented recording of any actual transmissions from an aircraft on all other frequencies active at the workstation. Also, the automatic voice recorder records only the audio program as selected and heard by the air traffic services officer at the relevant workstation and not the program actually received by individual frequency receivers.

An examination of domestic high frequencies recorded on the Melbourne automatic voice recorder did not find any transmissions from SVQ. The high frequency propagation conditions were such that the high frequency network support for the primary frequency for Sydney was not the primary frequency for contact with Melbourne.

1.18.5 Air traffic services procedures

The air traffic services officer in communication with the aircraft advised that he had incorrectly assumed that the aircraft was outside controlled airspace when the pilot reported that SVQ was descending to FL130. As a result, he did not consider obtaining a clearance or advising the pilot that a clearance was required prior to descent. Also, the significant change in level advised by the aircraft did not cause the officer to have any concern for its safety as aircraft often changed levels by significant amounts on oceanic routes.

2. ANALYSIS

2.1 Introduction

The aim of air safety investigation is to maintain and improve the safety of the total aviation system. This is normally done by investigating accidents and incidents and determining those factors which played a direct part in the development of the particular occurrence. Where possible, recommendations are made to prevent a repetition of the occurrence.

It is equally important to examine the broader circumstances surrounding an occurrence and to identify those factors which, while perhaps not directly related to the particular occurrence under investigation, are potential factors in other occurrences.

2.1.1 Fire

A number of the recovered components of the aircraft showed signs of having been exposed to fire. The investigation considered the possibility of an in-flight fire that may have had its origin in the bleed-air system, as this system provides hot air for air conditioning and pressurisation. The bleed-air lines are routed above the fire-damaged radio rack cover to the air cycle machine in the rear compartment. However, no evidence was found of any prolonged in-flight fire. Added to this was the lack of comment by the pilot of any aircraft fire. It is therefore considered that the fire damage was the result of aircraft break-up in flight and/or impact with the sea surface.

2.1.2 Aileron flutter/snatch

An investigation conducted by the US National Transportation Safety Board made recommendations related to the possibility of aileron flutter/snatch being involved in the loss of control of Aero Commander 690 aircraft.

One issue was the method of rigging of the flight controls and in particular the ailerons. The manufacturer issued instructions, Service Bulletin SB 186, on the method of rigging all flight controls in 1981 and later amended maintenance manuals to incorporate the SB 186 requirements in normal servicing. Although it was determined that on SVQ the aileron rigging may not have been completed in accordance with the maintenance manual requirements, there was no method of determining if the ailerons were rigged outside specification.

In late 1993, an Aero Commander 690 was subjected to Federal Aviation Administration controlled flight testing to determined the effect of control misrigging. The tests determined that with ailerons misrigged in excess of twice that found in the aircraft inspected by the National Transportation Safety Board, there was no tendency for aileron snatch.

The last advice received from the pilot of SVQ was that the aircraft was maintaining FL160 and no subsequent mention was made to either company or air traffic services personnel that the aircraft had commenced a descent. Thus it is likely that SVQ was not in the same flight regime as the aircraft referred to by the National Transportation Safety Board (the latter aircraft was in a high-speed descent), and as a result SVQ was less likely to have suffered from the effects of aileron snatch.

2.1.3 Empennage problems

There is a possibility that the vibrations referred to by the pilot could have been an airframe-related failure. Previously, inspections had found problems in the tail-attachment area of Aero Commander 690 aircraft.

SVQ had been recently inspected for compliance with SB 206 but not for SB 218 which had replaced SB 206. SB 218 requires a more extensive inspection and it is possible that despite the experience of the maintenance organisation in this area, there may have been undetected damage to the vertical stabiliser of the aircraft. It is therefore not possible to resolve whether or not the reported vibrations may have emanated from the empennage.

2.1.4 Wing spar corrosion

There had been problems with wing-spar corrosion on similar aircraft, but at the last inspection of SVQ in October 1992 no corrosion was evident. The next inspection was not due until 1998. No conclusion in this area could be drawn.

2.1.5 Flight in icing conditions

In his conversation with other company personnel, the pilot referred to the possibility of the aircraft carrying ice. However, he was not specific as to where the ice had formed on the aircraft.

Analysis by the Bureau of Meteorology found that the aircraft would have passed through a layer of cloud in which the formation of ice was possible while it was on climb. The pilot discontinued the climb at 20,400 ft and advised that he was descending to FL130. The fact that the descent was discontinued at FL160 may indicate that the aircraft was then clear of icing conditions. In any case, the nature of the cloud was such that the pilot could have descended below the base or diverted around any significant build-ups. The climb segment of the flight was recorded on radar and the aircraft was observed to maintain a constant track with no attempt to divert around cloud that may have been associated with ice accretion.

The pilot reported passing 'Shark' seven minutes later than his flight plan estimate. However, it seems that when he submitted his flight plan, the pilot had made an error in the time interval from Williamtown to 'Shark'. It was calculated that a more correct time interval would have been 30 minutes. This indicates that although ice may have built up on the aircraft, the performance of the aircraft did not appear to be adversely affected.

2.1.6 Pilot performance

While the pilot of the aircraft could be considered experienced in both flying hours and on the route over which the aircraft was to be operated, he had only minimal experience on the Aero Commander 690. There had been a prior occasion when the pilot had reported a problem with the aircraft air conditioning system and it was found that this was caused by a deficiency in his systems knowledge. The company was unable to provide a copy of the aircraft type engineering examination completed by the pilot and as a result, the level of his systems knowledge at the time of the endorsement is unknown.

On the day of the accident, the performance of the pilot in a number of areas differed from the professional approach which his peers suggest was normal in this regard: the submission of the flight plan was slightly disorganised, the current departure charts were not carried in the aircraft, the pilot was also unaware of the associated Notice to Airmen changes, the advised departure track was not that flight-planned or published on the chart, and the nominated level on departure from Williamtown varied from that flight-planned and notified after departure. Again, there was insufficient information to relate any of these slips and lapses to the medical problem suffered by the pilot. Indeed, the company personnel who were in contact with the pilot before departure from Sydney reported that he appeared to be his normal self.

2.1.7 Summary

While the pilot was obviously concerned about a problem with the aircraft, his level of

concern was such that he apparently did not consider returning to the departure point, or advising anyone other than company personnel.

In summary, the investigation was unable to determine what happened to cause the loss of the aircraft. However, it identified two factors which were directly related to this occurrence: the issue of the validity of the medical certificate held by the pilot, and the icing modification status of the aircraft. The following analysis discusses those factors which are related to the effectiveness of the system in which the aircraft was operated.

2.2 Accident related issues

2.2.1 Pilot medical certificate

The Civil Aviation Orders prescribe medical standards for pilots. These standards vary according to the type of flight conducted and provide a safeguard to ensure the medical fitness of the pilot/s operating a flight. In the case of this flight, a commercial operation, it was required that the pilot hold a Class 1 medical certificate. That standard was not met as the pilot had not completed the required medical examination when it was due more than three weeks earlier. The reason the pilot did not complete the medical examination is unknown.

There were two areas in which organisational factors played a role in not supporting compliance with the prescribed standards. Firstly, the fact that the company rostered the pilot to operate the aircraft when he was not licensed appropriately was probably due to inadequate record keeping and inadequate monitoring of pilot details. Secondly, although the Civil Aviation Authority had a role in the ongoing surveillance of the company prior to the application for a low capacity regular public transport air operators certificate, this surveillance was obviously inadequate as the company's poor record keeping was not corrected. Also, with the application for a low capacity regular public transport air operators certificate, an inspection in this area as part of the upgrade was required by Civil Aviation Authority Manual of Air Operator Certification procedures. Again, while this inspection was signed on the relevant checklist as having been completed, the surveillance did not correct the shortcomings in company record keeping.

2.2.2 Flight in icing conditions

The aircraft was fitted with airframe, propeller and engine nacelle de-icing and anti-icing equipment in accordance with certification requirement for flight in icing conditions. The pilot reportedly told his chief pilot that the propeller heating system's indicators showed that the system was operating normally. The only impediment to flight in icing conditions should, therefore, have been the length of time the engine ignition units would operate with the impingement of the hot air from the engine anti-icing shield, when the engine anti-ice system was in operation.

The aircraft manufacturer issued Service Instructions 211 and 212 which provided a safeguard for the operation of the aircraft in icing conditions. In essence, this safeguard was only provided when both service instructions were completed.

The US Federal Aviation Administration issued an airworthiness directive (FAA AD 87-24-07) which allowed removal of the limitation on flight in icing conditions and the restriction placard in the aircraft cockpit when 'SI 211 and/or SI 212' were completed. This airworthiness directive failed to provide the safeguard provided by the manufacturer in issuing the service instructions. The Australian Civil Aviation Authority then issued Airworthiness Directive AD/AC/85 which refers to the Federal Aviation Administration airworthiness directive and covers the same subject. In doing so, the Civil Aviation Authority airworthiness directive

failed to correct the Federal Aviation Administration airworthiness directive, and again failed to provide the safeguard intended by the manufacturer.

In the case of SVQ, the aircraft had complied with the Civil Aviation Authority airworthiness directive in that SI 212 had been completed for both engines, but because both service instructions were not completed, the aircraft had not achieved the result intended by the manufacturer, and therefore was not adequately protected for flight in icing conditions.

2.3 System related issues

BASI adopts a systems safety approach to its investigations. It therefore considered not only those factors which were directly related to the accident, but also any issues which might provide an insight into the safety health of the aviation system. While most of the issues addressed below may not have had a direct bearing on the accident, they nonetheless provide an understanding of some of the potential weaknesses of the system. Consideration of system defences makes it possible to identify the necessary remedial action. In this analysis, issues under consideration relate to the operating company and the regulatory authority.

2.3.1 Defences

The civil aviation system incorporates a number of defences that are designed to detect and provide protection in the event of a human or technical failure. These defences are in place to eliminate or reduce the effects of the failure. However, at times the defences either fail, are circumvented, or are absent.

2.3.1.1 Failed defences

Surveillance conducted by the Civil Aviation Authority had the purpose of ensuring compliance with the regulations and thus with safety standards. It was therefore a vital part of the system's defences. The surveillance was generally carried out on operators by periodic inspections and ramp checks. In the two years before the company was issued with a low capacity regular public transport air operators certificate, two periodic inspections and eight ramp checks were completed. Of these, only the periodic inspections were conducted by the Coffs Harbour district flight operations manager, with the ramp checks carried out by officers of other offices. The ramp checks were precipitated by some event or concern within the Civil Aviation Authority about the operation of the company. As a result, the surveillance was not organised to conduct a systemic safety health check of the operations of the company, and several deficiencies in both operational and airworthiness areas were missed. These included: the fact that the company was not in receipt of service bulletins from the aircraft manufacturer; the company's incorrect control of lifed items such as life rafts and life jackets; the almost complete non-use of the maintenance release in the company's defect recording system; and the lack of a procedure by the company to monitor flight-crew hours, licences, ratings and medical classification.

2.3.1.2 Absent defences

The Manual of Air Operator Certification provides guidance on the manuals, facilities and systems that need to be in place before an operator commences regular public transport services. However, there was no requirement that the Civil Aviation Authority assess the effectiveness or the acceptance amongst company management and staff of these items before commencing scheduled services.

The authority for granting, or upgrading, an air operators certificate was normally delegated to the district office level in the Civil Aviation Authority. While in the case of a low capacity regular public transport air operators certificate this may be appropriate, there was no

procedure for certificates granted at this level to be reviewed by a more senior officer in the organisation. The absence of such a review procedure did not provide for an audit of the internal procedures of the issue for an air operators certificate.

When the pilot reported that the aircraft was descending to FL130 and later advised that the aircraft was maintaining FL160, no explanation was given. The air traffic services officer in communication with the aircraft accepted both changes to previously advised intentions without query. When the first change of level was advised, the aircraft was in controlled airspace and was required to request a level change rather than merely advise intentions. The air traffic services officer had incorrectly assumed that the aircraft was outside controlled airspace and that no clearance was necessary. The significant change in level was, in part, accepted by the air traffic services officers because it was common for the aircraft on overwater routes to the east of the coast to vary altitude without explanation. There was no requirement for air traffic services officers to request a reason for a significant level change, nor were pilots required to advise reasons for level changes.

2.3.1.3 Circumvented defences

Company staff did not always comply with requirements and procedures prescribed in their manuals and the Civil Aviation Orders. The defects noted with the aircraft from time to time were not recorded in accordance with the company operations manual. On the flight from Williamtown to Lord Howe Island, the aircraft was calculated to have departed in excess of the maximum allowable take-off weight. The evidence in this area indicated that the pilot probably did not calculate the take-off weight prior to departure. Regardless of that, the extent of the overload should have been apparent to both the pilot and the company who were aware of both the fuel and passenger loads to be carried.

The company was required to maintain the aircraft in accordance with the manufacturer's maintenance schedule, yet it failed to advise the manufacturer that it operated an Aero Commander 690, and was thus not provided with the service bulletins which were aimed at enhancing the safety of the aircraft.

2.3.2 Preconditions

Preconditions are task, situational or environmental factors that promote the occurrence of active failures.

In this investigation, some preconditions were observed which, while perhaps not leading to an active failure in this occurrence, nonetheless have the potential to lead to future active failures.

2.3.2.1 Ambiguous procedures

It was found that within the Civil Aviation Authority a number of procedures and perceptions differed from region to region, from office to office within a region, and within offices. A particular example of this was the handling of the various manuals required for the issue of an air operators certificate. In some offices they were 'approved', while in others they were 'accepted'. The approval procedure apparently took longer as the document was more acutely scrutinised and, as a result, the 'customer' paid a higher fee. However, whichever course was followed, there was no standard upon which persons and manuals could be assessed.

2.3.2.2 Training

The airworthiness officers responsible for the upgrading of the air operators certificate were unaware of the existence of the Manual of Air Operator Certification and had received no training in the steps required prior to the issue of an air operators certificate. Similarly, the

Coffs Harbour district flight operations manager, who was responsible for the issue of the low capacity regular public transport air operators certificate, had received no specific training in the application of the guidelines covered by the Manual of Air Operator Certification.

2.3.2.3 Workload

The Coffs Harbour district flight operations manager, apart from being responsible for the oversight of Seaview Air, was also responsible for the oversight of 43 other air operators certificate holders. In addition to managing the Coffs Harbour office, he was the only helicopter flying operations inspector in the southern part of the region and as such spent most of his time in Brisbane. It is likely that the diversity of his tasks and locations reduced his effectiveness in dealing with the air operators certificate upgrade.

2.3.3 Organisational factors

Organisational factors are weaknesses or inadequacies within organisations which are not apparent and can remain dormant for extended periods. These latent failures often become apparent when combined with active failures.

2.3.3.1 Primacy of safety

Statements had been made by the Executive of the Civil Aviation Authority regarding the primacy of safety in the Civil Aviation Authority's mission. Indeed, the Airworthiness Safety and Surveillance Program manual stated that surveillance would take priority over service tasks. However, ambiguity and confusion at least at the district office level were evident in the handling of the air operators certificate upgrade. This was demonstrated by the correspondence that passed between the Coffs Harbour district flight operations manager and the district airworthiness manager. This correspondence revealed their differing views on their respective roles in the process of upgrading the air operators certificate, and the fact that the air operators certificate was seemingly processed with no consideration of the deficiencies which were found during surveillance.

It is therefore important that all Civil Aviation Authority (now Civil Aviation Safety Authority) officers be convinced of the need for high quality surveillance in the maintenance of a safe aviation system and to take appropriate safety action on the basis of that surveillance.

2.3.3.2 Fragmentation of structures

The operator's management structure was such that key personnel were stationed in different locations, thus making the command and control of the organisation and its staff more difficult. This aspect was highlighted by a number of actions:

- the pilot of this flight planned the flight as regular public transport when the company did not hold a licence for the particular route;
- the defect reporting system in most cases did not involve the use of the maintenance release and as such, did not afford the maintenance controller adequate control over the maintenance of the fleet; and
- the emergency equipment on the aircraft was not correctly controlled.

2.3.3.3 Administrative fines

Although the Civil Aviation Regulations allowed for the application of administrative fines (as is also the case in some overseas countries), the management of the Civil Aviation Authority did not implement any procedures or issue instructions to staff that would have allowed the fines to be imposed. It is possible that had such a system been in place, those straightforward breaches of regulations that prompted much of the surveillance of the company may have

been more efficiently dealt with, and the system provided with a more adequate indication of the organisational health of the company prior to the issue of the low capacity regular public transport air operators certificate.

3. CONCLUSIONS

3.1 Findings

1. The pilot held an air transport pilot licence and a command multi-engine instrument rating, and was appropriately endorsed on the Aero Commander 690.
2. The pilot's Class 1 medical certification had expired. Because the pilot's Class 1 medical certification had expired, his air transport pilot licence was not valid, and he was not entitled to act as pilot in command of a commercial flight.
3. The pilot was being treated with antibiotics and pain relief medication for an infection on his right arm.
4. The chief pilot did not maintain adequate records of flight crew licence validity.
5. The pilot should not have been rostered to operate the flight because of the status of his medical certificate.
6. The pilot flight-planned before obtaining weather reports and Notices to Airmen. However, these were reportedly provided to the pilot prior to departure Sydney.
7. The pilot planned the flight as a regular public transport flight with the Flight Number CD 111.
8. The take-off weight at Williamtown exceeded the maximum allowable and, as a result, the aircraft was loaded outside the centre-of-gravity envelope.
9. At the time of the accident, the aircraft weight was still in excess of the maximum allowable for takeoff.
10. There was sufficient fuel on board the aircraft to complete the planned flight.
11. All recorded radio communications with air traffic services were normal and the pilot did not indicate any emergency or operational problem. There was no indication in any of the transmissions to air traffic services made by the pilot that operations were other than normal.
12. The final transmission from the aircraft to air traffic services occurred five minutes before the reported time of the last communication with the other company aircraft.
13. The final transmission from the aircraft was on very high frequency 120.6 MHz. This frequency is not a normal air traffic services communications frequency and is not recorded by any air traffic services facility.
14. All indications were that the aircraft was serviceable on departure from Sydney.
15. All airworthiness directives applicable to the aircraft had been certified as having been completed.
16. The engines of the aircraft were not correctly modified to allow continuous flight in icing conditions.
17. Airworthiness directives issued by the Federal Aviation Administration and Civil Aviation Authority did not correctly specify the engine modifications to be completed before allowing flight in icing conditions.
18. The flight control rigging at the last servicing, while certified as having been completed, was not done in accordance with the manufacturer's maintenance manual as required by the maintenance schedule used by the company.

19. The manufacturer's Service Bulletin SB 218 had not been completed on the aircraft.
20. The Civil Aviation Authority had not followed its published procedures in monitoring service bulletins.
21. There was no control of life jackets and life rafts and the nine-person life raft carried on the aircraft had exceeded the time required for servicing.
22. The weather forecast indicated the possibility of moderate icing in cumuliform cloud on the route to Lord Howe Island.
23. Post-flight meteorological analysis indicated that the aircraft may have encountered conditions conducive to icing on the climb to 20,400 ft and the descent to FL160.
24. Seaview Air was not licensed by the New South Wales Air Transport Council to operate regular public transport services from Williamtown to Lord Howe Island.
25. There was little evidence of compliance with the prescribed regulations in the recording and processing of defects.
26. The required airworthiness-related inspections of facilities, staff and equipment were not completed prior to the air operators certificate upgrade.
27. Ramp checks were carried out in response to events or breaches of regulations by the company, rather than as a check on the safety health of the company.
28. The surveillance that was conducted did not ensure compliance with a number of applicable regulations.
29. Surveillance checks had not been conducted since the operator was granted the low capacity regular public transport air operators certificate. However, checks were planned for 10 October 1994.
30. There was inadequate follow-up of deficiencies which were identified in Seaview Air's operations prior to the issue of a low capacity regular public transport air operators certificate.
31. Deficiencies were treated in isolation from those which had previously been identified.
32. Civil Aviation Authority district offices displayed significant differences in their respective operating practices.
33. The certification of low capacity regular public transport operators was almost entirely based on the approval/acceptance of various manuals. In this case the operator was not required to demonstrate to the Civil Aviation Authority that the organisation and its employees would/could operate according to the standards laid down in the manuals.
34. The Civil Aviation Authority had no internal procedure to review the issue of air operators certificates.
35. The search-and-rescue action and search activity was timely and effectively managed.
36. The practice of aircraft changing levels frequently had probably desensitised the air traffic services personnel to the timely recognition of abnormal operations signified by significant level changes.
37. All relevant air traffic services personnel were appropriately rated and current for the duties they were performing.

3.2 Significant factors

The factors that directly related to the loss of the aircraft could not be determined

4. SAFETY ACTIONS

Interim recommendations

During the course of the investigation the Bureau of Air Safety Investigation issued a number of interim recommendations (IRs) to facilitate safety actions being addressed before the publication of the final report. The recommendations, identified by the Bureau's reference number, and relevant responses are reproduced below.

Classification of responses

The Civil Aviation Safety Authority and Airservices Australia respond to the Bureau's formal recommendations in accordance with memoranda of understanding between BASI and these agencies. Although no formal procedures are in place for other respondents to Bureau recommendations, the Bureau expects to receive and normally receives responses, from all recipients of BASI recommendations.

The Bureau considers responses against the occurrence report and/or the recommendation text and assesses the acceptability of the response. These assessments do not necessarily indicate whether or not the action agency has accepted the recommendation in full or in part, but that the agency has:

- considered the implications of the recommendations;
- correctly recognised the intent of the recommendations without misinterpretation;
- offered acceptable counter-arguments against implementation, if it decides not to do so;
- offered an alternative means of compliance; and
- identified, if appropriate, a timetable for implementation.

Responses are classified as follows:

(i) CLOSED – ACCEPTED. The Bureau accepts the response without qualification. BASI continues to monitor the effectiveness of action taken by the other agency.

(ii) CLOSED – PARTIALLY ACCEPTED. The Bureau accepts the response in part but considers other parts of the response to be unsatisfactory. However, the Bureau believes that further correspondence is not warranted at this time.

(iii) CLOSED – NOT ACCEPTED. The Bureau considers the response to be unsatisfactory but that further correspondence is not warranted at this time.

(iv) OPEN. The Bureau considers that the response does not meet some or all of the criteria for acceptability for a recommendation that the Bureau considers to be significant for safety. The Bureau will initiate further action.

Safety outputs

In the following sections, Bureau safety outputs appear in bold. They are reproduced from original Bureau documents and may vary in textual layout.

Response text

Response text is published as received by the Bureau.

4.1 Interim recommendations and responses

IR950062 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority review all documentation relating to Maintenance Control Manuals and Maintenance Controllers to ensure that:

(i) the content of the Civil Aviation Regulations is clarified as to the intended requirements;

(ii) subsidiary guidance material related to the Civil Aviation Regulations is consistent with the requirements of those Regulations;

(iii) the guidance material is disseminated to Civil Aviation Authority Regional and District office staff;

(iv) the term "acceptable to the Authority" is either clearly defined or not used; and

(v) Regional and District office staff be given training in the use of published guidance material to ensure consistency of application throughout the Civil Aviation Authority.

CASA Response (received 14 July 1995)

The Authority agrees with the recommendations contained in the above Interim Recommendation. The Authority is currently in the process of preparing amendments to the Civil Aviation Regulations to require Maintenance Controllers and Maintenance Control Manuals to be approved by the Authority. The amendments will overcome any existing ambiguity on this issue.

Matters related to Airworthiness Instructions are also under review as part of the revision of CASA procedures.

Response Status: CLOSED – ACCEPTED

IR950067 (issued 3 July 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority ensures that AOC applicants comply with mandatory requirements in relation to the control of all time-lifed role equipment, including emergency equipment, fitted to aircraft prior to the issue or variation of an AOC.

CASA Response (received 19 April 1996)

I refer to your interim recommendations number IR950067 and IR950098 concerning the accident involving Rockwell International 69OB, VH-SVQ on 2 October l994. I apologise for the delay in this response.

Summary

CASA accepts the spirit of interim recommendation IR950067.

Background to Response

CASA accepts the spirit of the recommendation. The need to ensure that there are adequate procedures in place by AOC holders will be highlighted to all staff.

Response Status: CLOSED – ACCEPTED

IR940277 (issued 17 November 1994)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority immediately initiate appropriate action to ensure the integrity of the aircraft bleed air system on all Australian registered turbine powered, pressurised Twin Commander aircraft, covered by US Federal Aviation Authority (FAA) Type Certificate 2A4. (Note: These aircraft are also referred to as Aero Commander, Gulfstream and Rockwell).

CAA Response (received 4 April 1995)

I refer to BASI Air Safety Interim Recommendation IR940277 regarding the Twin Commander aircraft bleed air system and our subsequent response dated 19 January 1995.

After receipt of the safety recommendation the Authority arranged for an engineering review of the bleed air system in Aero Commander aircraft to be performed. The purpose of this review was to determine whether there were any significant airworthiness shortcomings in the bleed air systems of the aircraft and thus identify the need or otherwise for airworthiness action.

The review found that there has been no significant failure history of bleed air systems in the subject aircraft. Information on the Australian, Canadian and US Service Difficulty Report and Major Defect Report data bases revealed only six entries relating to all 690 A, B, C and 695 aircraft in the last twenty years. The review also highlighted the fact that there is very little information available to a pilot to enable him/her to detect a bleed air problem or do anything about same in 690A or B aircraft.

The design standard for all the aircraft was CAR 3 of 15 May 1959, and of course the aircraft have been found to comply with that standard. However, the design philosophy embodied in that standard does not require that the aircraft be able to continue safe flight and landing after failures or combinations of failures that may not be improbable.

Bleed air leaks may pose a hazard to the aircraft, particularly in those aircraft that do not provide a bleed air shut off facility at the engine firewall. However, the design of the bleed air system piping is very conservative. Lines are able to withstand very high pressures and are subject to very low pressures in service.

The results of the review lead us to the conclusion that there are no major airworthiness shortcomings with the bleed air systems in the subject aircraft and this is borne out by the service history. Accordingly, no formal airworthiness action is considered necessary.

Notwithstanding the above conclusions and in view of :

a. the possible effects of failures of the bleed air system, and

b. the potential for less than adequate maintenance inspections of the bleed air system in the rear fuselage area (due to the less than ready access to the area),

the Authority will be advising Certificate of Registration holders of Aerocommander Model 690 A and B aircraft that a thorough maintenance inspection of the bleed air system in their aircraft, in particular in the rear fuselage area of the aircraft, may be advisable.

Response Status: CLOSED – ACCEPTED

BASI Note

A letter to all certificate of registration holders was dispatched by the CAA on 17 March 1995.

IR950065 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority review surveillance procedures to ensure that AOC holders have a system in place to alert them when a pilot's certificate of currency or proficiency is about to lapse. This aspect of regulatory compliance should also be monitored prior to the issue of an AOC and during subsequent periodic and ramp checks.

CASA Response (received 14 July 1995)

CAO 82.0 Appendix I para 2.2 (c) requires a chief pilot to maintain a record of licenses, ratings and route qualifications held by each flight crew member including validity, recency and type endorsements and any applicable license restrictions. In addition, CAO 82.3 Appendix I para 2.5 requires an operator to maintain up-to-date records showing the recent experience status of each flight crew member and the currency of licenses, ratings and endorsements. These records are checked during the conduct of surveillance - ASSP Manual p A7-63 refers. In the current rewrite of MAOC a similar provision will be included.

Response Status: CLOSED – ACCEPTED

IR950063 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority provide a syllabus of prescribed test requirements as a standard for the testing of an applicant for the granting of a check-and-training approval on a specific aircraft type. The test should ensure that the applicant has adequate knowledge and understanding of all systems essential to the safe operation of the aircraft, in all flight regimes, and that the applicant has the ability to pass on such detail to a student.

CASA Response (received 14 July 1995)

Guidance on the conduct of check pilot approvals including flight test requirements are contained in MAOC Vol I Part A Ch 10 Appendix C3. The Authority agrees with this recommendation and has commenced a project to produce a standard flight test report form for candidates - both instructors and check and trainers - seeking multi-engine training approval. In support of this form the Authority will also produce a syllabus and a test-conduct guide.

Response Status: CLOSED – ACCEPTED

IR950064 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority review the requirements for the issue of a type endorsement as specified in CAO 40.1.0. This review should be conducted to ensure that:

(i) a minimum ground school syllabus is specified for an initial multi-engine rating and for endorsement on multi-engine aircraft below 5,700 kg MTOW of a higher Performance Category; and

(ii) the ground school training includes an engineering examination for the aircraft type.

CASA Response (received 14 July 1995)

The Authority agrees with this recommendation. A draft multi-engine training syllabus was

produced early last year as was an endorsement flight check proforma and a generic engineering exam. Due to lack of resources, work on the drafts has not proceeded. However, a recent increase in staffing has allowed a resumption of work. Appropriate amendments to legislation will be prepared in conjunction with this work.

Response Status: CLOSED – ACCEPTED

IR950096 (issued 3 July 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) review the process of assessment of manufacturer's data to ensure that Australian Airworthiness Directives referring to such data reflect the latest revisions, if warranted; and

(ii) review Low Capacity Regular Public Transport (LCRPT) operator's maintenance documentation to ensure consistency in requirements between the operator's documents, the aircraft manufacturer's requirements and the provisions of the CARs.

CASA Response (received 15 January 1996)

I refer to your interim recommendation number IR950096 concerning the accident involving Rockwell International 690B, VH-SVQ on 2 October 1994. I apologise for the delay in providing this response.

Summary

CASA will review the introduction to CAO 105.

The system of maintenance is approved when an aircraft enters service and is periodically reviewed thereafter.

Background to Response

Item (i)

CASA acknowledges that not all Airworthiness Directives (ADs) may reflect the latest amendment status of a manufacturers Service Bulletin referred to in ADs, at all times. Paragraph 3.3 of the 'Contents' section of CAO 105 was intended to address this situation by deeming that compliance with a later issue of a Service Bulletin was acceptable.

CASA still relies on the intent of paragraph 3.3. However, the process of reviewing manufacturers data to reflect the latest revisions to Service Bulletins, and changes in Service Bulletin numbers in ADs, is now a part of the AD procedures.

AD/AC/84 was amended in March 1995 to require inspections in accordance with SB218 Part 1.

Item (ii)

All systems of maintenance for Class A aircraft are approved by CASA. Those systems must adequately provide for the continued airworthiness of the aircraft having regard especially to inspection programs and documents issued by the aircraft manufacturer. CAR 42M refers to this point. The system of maintenance is approved when an aircraft enters service and is periodically reviewed thereafter.

Response Status: CLOSED – ACCEPTED

IR950098 (issued 3 July 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) inform the United States Federal Aviation Administration of the ambiguous requirement detailed in FAA AD 87-24-07;

(ii) review the content of Airworthiness Directive AD/AC/85 and all referenced material to clarify the requirements to be met before aircraft may be flown in icing conditions;

(iii) ensure that Approved Flight Manuals contain only information that is pertinent to the particular aircraft;

(iv) consider incorporating a section in Approved Flight Manuals which specifies the placards required to be fitted to aircraft; and,

(v) ensure that company Operations Manuals detail the operating limitations specific to each aircraft operated.

CASA Response (received 19 April 1996)

I refer to your interim recommendations number IR950067 and IR950098 concerning the accident involving Rockwell International 69OB, VH-SVQ on 2 October l994. I apologise for the delay in this response.

Summary

Item (i) of IR950098 has been overtaken by events.

Item (ii) has been addressed in amendments to flight manuals and requires no further action.

Item (iii) CASA does not have the capacity to maintain Flight Manuals dedicated to individual aircraft.

Item (iv) CASA does not have the capacity to offer this level of airworthiness control.

Item (v) CASA does not believe that the company Operations Manual should be required to contain operating limitations of individual aircraft.

Background to Response

IR950098

Item (i) has been overtaken by events. We note in the body of the text that you (BASI) have already alerted the FAA by virtue of your discussions with them relating to your concerns with their AD.

Item (ii) AD/AC/85 has been raised in issue to Amendment 1 and an associated flight manual amendment issued to adequately address this issue. No further action is required by CASA at this time.

Item (iii) A significant proportion of existing Flight Manuals for Australian aircraft contain information that is generally applicable to the aircraft type and model but not applicable to all individual examples. For example, many Australian Flight Manuals comprise the manufacturers Pilots Operating Handbook. These are not tailored to individual alternatives and options, most of which are not installed in every aircraft.

The effort and expense necessary to maintain Flight Manuals dedicated to individual aircraft would be excessive. CASA does not have the capacity to offer this level of airworthiness control

Item (iv) Some modern Flight Manuals produced by aircraft manufacturers identify placards installed at the time of manufacture. However, in the majority of Flight Manuals there is no such section and the effort and expense that would be required to provide them is considered excessive.

Many placards are a temporary measure as one option under an Airworthiness Directive. Formal action to incorporate these in the Flight Manuals of aircraft taking that option and subsequently to remove them, would also be excessive.

CASA does not have the capacity to offer this level of airworthiness control.

Item (v) CASA does not believe that the company Operations manual should be required to contain operating limitations of individual aircraft. The CAR 215(2) requirement specifically exempts information, procedures or instructions that are set out in other documents required to be carried in the aircraft in pursuit of these Regulations." It is the aircraft Flight Manual which is required under CAR 138(2)(b) to contain "...the operating procedures and limitations of the aircraft.

While most fixed-fleet airlines will incorporate into the Operations Manual any differences in the systems, procedures or limitations applicable to individual aircraft, this is impracticable for the majority of GA operators who may often need to cross-hire aircraft. As the Operations Manual is specific to the AOC holder, an aircraft dry leased from another company would not be covered unless and until such time as the lessee's Operations Manual was amended. It would on the face of it be legally untenable to require an AOC holder to conform to a limitation which was promulgated in another company's Operations Manual.

Response Status: CLOSED – PARTIALLY ACCEPTED

IR950061 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority review its standards, practices and procedures, with a view to ensuring that its officers comply with CAO 82.3 in regard to Low Capacity Regular Public Transport Air Operators Certification.

CASA Response (received 14 July 1995)

Manual of Air Operator Certification (MAOC) procedures are presently being extensively revised with particular emphasis on the Low Capacity Regular Transport (LCRPT) sector. In addition the Authority is closely monitoring proposals by the NTSB and FAA to raise the aircraft, flight crew and operating standards for this sector of the industry. Any changes which the Authority may propose in respect to entry standards will be the subject of industry consultation.

Response Status: CLOSED – ACCEPTED

IR950074 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) promulgate minimum standards required for operations manuals;

(ii) formulate procedures for the "approval" of operations manuals instead of the current "acceptance" practice;

(iii) formulate procedures for the review of operations manuals by appropriate delegates from both Flying Operations and Airworthiness; and

(iv) train FOIs and AWIs to provide guidance in the preparation of operations manuals and in the required standards for the inspection of operations manuals.

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CASA Response (received 14 July 1995)

Although operations manuals are not approved under CAR 215, the operations manuals of AOC holders must be approved under CAO 82.0. CAO 82.0 para 3.3 states:

"An applicant for a certificate must... provide to the Authority for its approval an operations manual..." Guidance on the contents of operations manuals is contained in a CAA publication titled "Guide to Preparation of Operations Manuals" dated October 1988 which is presently being updated and MAOC Vol 1 Part A Ch 2 para 2.4.2.1 and Appendices C1 and C2. The regulatory requirements pertaining to operations manual are contained in CAR 215. An operations manual provides guidance to company personnel on how flying operations are to be conducted within that company. It is not a substitute for legislative requirements. Comments on the specific recommendations are:

(i) This is covered in the operations manual guide, MAOC and ASSP (p A7-65 and A7-69).

(ii) Proposed new CAR part 119 dealing with operator certification will make it clear that operations manuals must be approved prior to issue of an AOC. This will overcome any perceived confusion between CAO 82.0 and CAR 215.

(iii) Operations manuals are subject to periodic inspection (see ASSP P A765)

(iv) Ample guidance on the legal requirements, contents, compliance checks, style and layout of operations manuals is available to both industry and CAA staff.

Response Status: CLOSED – ACCEPTED

IR950069 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) modify the recording capability of the AVFAX system to ensure that complete and comprehensive recovery and reconstruction of transactions can be provided. This should include message origin times, entire text and period of validity for the data delivered;

(ii) develop improved managerial/supervisory practices to ensure that ATS officers use the existing recording facilities for all internal and external operational communications in the prescribed manner;

(iii) modify audio input devices so that continuous recording is provided regardless of control selections;

(iv) ensure that the origin and destination of all inter and intra-unit voice communications exchanges are identifiable; and

(v) inform BASI at the earliest opportunity when planning to commission any operational voice communications systems which deviate from the standards of existing systems and, as a result, may not be compatible with existing recording replay facilities.

Airservices Australia Response (received 11 July 1995)

Response 950069 (i)

This recommendation is not agreed. The AVFAX system is fundamentally a data retrieval and forwarding system used for the distribution of pre-flight information. The Authority does not intend making this type of modification to the AVFAX system.

Response 950069 (ii)
This recommendation is not agreed. The existing provision of MATS chapter 18-1-1 specifies the use and methods of recording facilities and adequately covers this matter.

BASI Note
As a result of discussions between BASI and Airservices Australia following this response, it was agreed that MATS 18-1-1 did provide adequate guidance, but additional supervisory effort may be required to ensure that the stated objective is achieved. Airservices Australia issued a memorandum to this effect on 10 August 1995.

Response 950069 (iii)
Airservices agree in principle with Recommendation (iii) in IR950069 regarding the recording of audio channels. ATS will however, need to determine the systems implications, particularly those associated with TAAATS, and the associated costs these modifications might incur before proceeding with changes to our overall systems architeture.

Response 950069 (iv)
MATS Chapter 12 Section 3 provides sufficient guidance to ATS staff regarding the correct methods of initiating and responding to communications exchanges. However, this matter will be reinforced with supervisory staff to ensure that due regard is given to the application of standard procedures.

Response 950069 (v)
This recommendation is agreed. BASI will be kept informed of likely changes to the voice recording systems to ensure, as far as possible, that the systems by the CAA and BASI remain compatible.

Response Status: CLOSED – ACCEPTED

IR950070 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) develop improved management/supervisory practices to ensure that ATS officers are complying with prescribed standard operating procedures in the timely exchange of complete and comprehensive co-ordination exchanges and conformance with the prescribed standard operating procedures for Search and Rescue alerting; and

(ii) revise the prescribed standard operating procedures and training for handling in-flight emergencies to include actions required by flight service officers particularly with respect to level deviations by high performance and pressurised aircraft.

Airservices Australia Response (received 17 July 1995)

Response 950070 (i)
This matter will be addressed jointly with recommendation 950070 (ii) below in terms of ATS application of standard procedures for co-ordination and SAR alerting. A supervisory instruction will be developed describing the circumstances and actions that might have been more appropriate at the time.

Response 950070 (ii)
This matter will be addressed jointly with recommendation 950070 (i) above. IFER training is in the process of being extended to include Flight Service Officers. With regard to the matter of level deviations, this matter is addressed in MATS Chapter 17-3-1 paragraph 5 c., but in itself

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unplanned major level changes would not necessarily be considered abnormal by Flight Service unless accompanied by reference to an in-flight irregularity. It is important to recognise that the pilot is a "partner" in the provision of effective search and rescue services. The effectiveness of the service relies to a large degree on pilots reporting irregularities so that the appropriate action can be taken to provide assistance to the flight.

Response Status: CLOSED – ACCEPTED

IR950068 (issued 21 April 1995)

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority:

(i) verify that the existing HF network support facilities ensure contiguous coverage and is available from relevant HF transmitter/receiver sites. Maximum effective coverage should be available for all areas and air routes where HF is the sole means of continuous two-way communications throughout all phases of the solar cycle and associated random ionospheric disturbances; and

(ii) amend standard operating procedures and practices to ensure that more than one HF facility is capable of maintaining continuous two-way communications with active and expected air traffic movements for all areas and air routes where HF is the sole means of continuous two-way communications, regardless of ATS HF control selections.

Airservices Australia Response (received 29 June 1995)

Response 950068 (i)

Because of the vagaries of the ionospheric medium upon which it depends, HF communications can never approach over long distances the performance demonstrated by short range VHF communications. However for longer distances, HF will provide a service where otherwise there might be none. With careful system design, reliable communications can be provided, but this can never reach 100% on a long term basis. In practice the Operational requirement has been defined as being that that the service reliability of HF circuits be better than 90%, averaged over the 11 year sunspot cycle. The 90% describes the probability that the air - ground circuit signal will be readable at least one ground station. In technical terms, this is taken as a signal to noise ratio of at least 10dB, this figure being adopted following advice from experts in the field.

The HF rationalisation project to which BASI refers in its interim recommendations is an overdue exercise which has the objective of minimising the number of outlets while at the same time maintaining the required Operational service level. The former network had 28 outlets, and these were commissioned when HF air ground communications were conducted using AM, from manned sites With networking and the changeover to SSB, which has much higher efficiency than AM, it has become possible to provide the required coverage from fewer outlets.

In order to establish which of the current outlets could be deleted, a detailed engineering study having two aspects has been undertaken. The first of these has been the measurement of the receiver site noise levels. This is fundamental to the exercise, as site noise sets the useful range of any given site. The second aspect, which therefore depends on the first, has been a detailed system design to determine the configuration of outlets which will meet the Operational requirement. The assessment work associated with this phase is complex, and was carried out on our behalf by the Ionospheric Prediction Service, which is the only organisation in this country with the expertise and tools necessary for the task. This phase is now close to completion, and the resulting rationalised network is expected to comprise up to 14 stations as below:

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NW RDARA: Derby, Darwin, Alice Springs (NW), and Gove. On coverage grounds, the Gove outlet is not required, but is included for the time being at ATS request.

NE RDARA: Mt Isa, Townsville, Charleville, Brisbane and Weipa. The Weipa and Charleville outlets are not required on coverage grounds, but are included for the time being at ATS request.

SW RDARA: Meekatharra, Kalgoorlie and Perth.

SE RDARA: Alice Springs (SE), Mildura, Uriarra (ACT).

Based on the IPS results, this network amply satisfies the 90% reliability of contact criterion, and in practice exceeds it in many cases by virtue of providing 90% probability of contact with at least two stations.

The above remarks relate to communications reliability as determined by the ionospheric medium. The individual outlets are designed to a Class B availability standard. The practical realisation of this is that each site is of fully redundant configuration so as to provide backup in the event of failure of any element of the station, or of the communication links between the station and the Flight Service Operator.

To summarise, the BASI Recommendation is that (a) there be contiguous HF coverage, and (b) that there be maximum effective coverage under all conditions where HF is the sole means of communication. The CAA has long been conscious of the importance of HF to civil aviation, and has adopted a rigorous engineering approach to its HF system design. The consequence of this is that full HF coverage will continue throughout the Australian FIR, and at all points this will be as reliable as can reasonably be expected given the vagaries of the signal propagation medium.

Response 950068 (ii)
ATS supervisory responsibilities include those associated with the disposition of staff and ensuring that services are provided efficiently and effectively.

The configuration of domestic HF in Australia provides coverage throughout Australia as described in our response to Recommendation 950068 (i). It is neither possible nor practical using the HF medium to provide a guarantee that communications will be available 100% of the time. System design is such that frequency coverage can be expected to be available nationally to all traffic, on a service reliability basis of better than 90%, albeit there may be times that support to the primary network is provided on a different RDARA group.

Response Status: CLOSED – ACCEPTED

Subsequent Civil Aviation Safety Authority response received 12 September 1996

A subsequent response from the Civil Aviation Safety Authority updating actions taken in regard to specific recommendations is reproduced below:

I refer to your letter of 18 July 1996 requesting an update of actions taken following the recommendations regarding the accident involving Rockwell Aerocommander 690B, VH-SVQ. The Authority's progress under the various items is outlined below in the order in which you raised them. I am sorry for the delay in forwarding this response.

IR960062
An interim change to the legislation to implement the requirements for approval of a Maintenance Controller and the Maintenance Control manual has been recommended to the Minister.

The review of Airworthiness Instructions (AWI's) has indicated that about so, are now included in CASA's internal policy and operations manuals. Consideration is currently being given to consolidating the remaining AWIs into an interim manual, pending their inclusion in other existing manuals

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IR950067

A new Air Operator Certificate Manual (AOCM) is being developed to replace the existing Manual of Air Operator Certification (MAOC). The high capacity RPT part of the AOCM is due for release at the end of September 1996, with the low capacity RPT part to follow in November 1996.

Both RPT parts of the AOCM contain advice to CASA staff, and checklists for the inspection process, which shall assist CASA staff in satisfying themselves that Air Operator Certificate (AOC) holders are complying with requirements. Staff training in the provisions of the AOCM will commence later in 1996. Civil Aviation Advisory Publications (CAAPs) are also being developed to provide guidance on the maintenance requirements of relevant role equipment.

IR950065

As noted above under the response to IR950067, a new AOCM is under development, Both RPT parts of the Manual contain procedures for ensuring that the operator addresses appropriate documentation and procedures to ensure that the flight crew meet legislative requirements before conducting a flight. The relevant aspects are covered in specific annexes within the AOCM - annexes 2.1.7 and 2.1.8 for high capacity RPT and annexes 3.1.7 and 3.1.8 for low capacity RPT.

IR950063 and IR950064

The new AOCM addresses the requirements for check and training pilots employed in operations covered by Civil Aviation Regulation (CAR) 217. This details the requirements of a Training and Checking Manual, with regard to minimum experience, selection criteria, training syllabi, and who may conduct training and checking in a CAR 217 organisation.

The training syllabus, which requires the Authority's approval, must address instructional techniques as well as outlining both the training and checking roles. The syllabus for check pilot training must also include instruction about, and observation of, at least two tests conducted by the check pilot trainee.

A multi-engine training syllabus, designed for the initial multi-engine rating and subsequent type endorsements, is being produced. The general aim of the syllabus is to improve the knowledge and skills of general aviation pilots, and the benefit of this training will flow through to CAR 217 organisations.

The syllabus has an equal mix of theory and flight instruction (7 hours each). Included in the training package is an engineering data and performance questionnaire and a flight test report. The engineering questionnaire examines candidate on aeroplane systems, performance and asymmetric flight, The flight test report examines both normal and emergency operations. The flight test form has a mandatory examination item to 'Demonstrate ability to use all aeroplane systems, avionics, navigation aids, automatic pilot and flight director.'.

As the relevant Civil Aviation Orders (CAOs) do nor include a requirement for a theory examination for all endorsements, it is intended to initially issue the multi-engine endorsement via a CAAP. The CAAP is currently being finalised and should be issued within the next two months.

It is planned to incorporate the provisions of the CAAP into new CARs before the end of 1997. However, the priority applied to CASA's future legislative development will be subject to the review of the joint CASA/industry Technical Committees that are presently being established to enable the Authority to revise its regulatory framework. The Technical Committees will include one for Personnel Licensing and the CASA representative will seek to have this issue treated as a priority by that Committee.

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IR950096

Amendment of the introduction to CAO 105 is being undertaken in conjunction with amendment of the Airworthiness Directives procedures manual. This project is currently underway.

IR950061

As noted under the update for IR950067, the new AOCM has specific chapters to address both high capacity and low capacity RPT operations. The AOCM replaces the old MAOC and updates the overall conditions applying to the issue of an AOC. Overseas developments for low capacity RPT operations will continue to be monitored and incorporated in future updates of the Manual as considered necessary.

IR950074

The proposed CAR part 119 has been drafted as part of the Regulatory Structure Validation Project (RSVP). This project is taking existing legislation and reformatting it into a structure aligned with that used for the United States Federal Aviation Regulations.

The draft is presently being reviewed by the relevant technical areas within the Authority. It is planned to be submitted, along with the remainder of the RSVP package, to the Attorney General's Department for clearance, in October 1996. Subject to the clearance of Attorney General 's, the package of amended legislation should be released in early 1997, for implementation as at 1 July 1997.

Subsequent Civil Aviation Safety Authority response received 5 November 1996

IR950065

The new edition of AOCM covers this requirement in Chapter 2.1 paragraph 7.3.3 and at Annex 2.1.7 in relation to high capacity RPT operations. The same requirement has been documented for low capacity RPT and charter and aerial work operators.

IR950063

CASA considers a set syllabus will not provide sufficient guidance to its Flying Operations Inspectors. Instead comprehensive guidance is provided in AOCM on the evaluation and approval of the applicant's Training and and Checking Manual, the inspection of training and checking programs and facilities, the certification of the head of the training and checking part of the applicant's organisation, the certification of the applicant's training and checking organisation, and the approval of applicant's check pilots. This procedure is seen as meeting the above interim recommendation.

IR950096

The second paragraph should read: CASA still relies on the intent of paragraph 3.3. However, the process of reviewing manufacturer's data to reflect the latest revisions to Service Bulletins, and changes in Service Bulletin numbers in Ads, will be reflected in the Airworthiness Directives procedures manual.

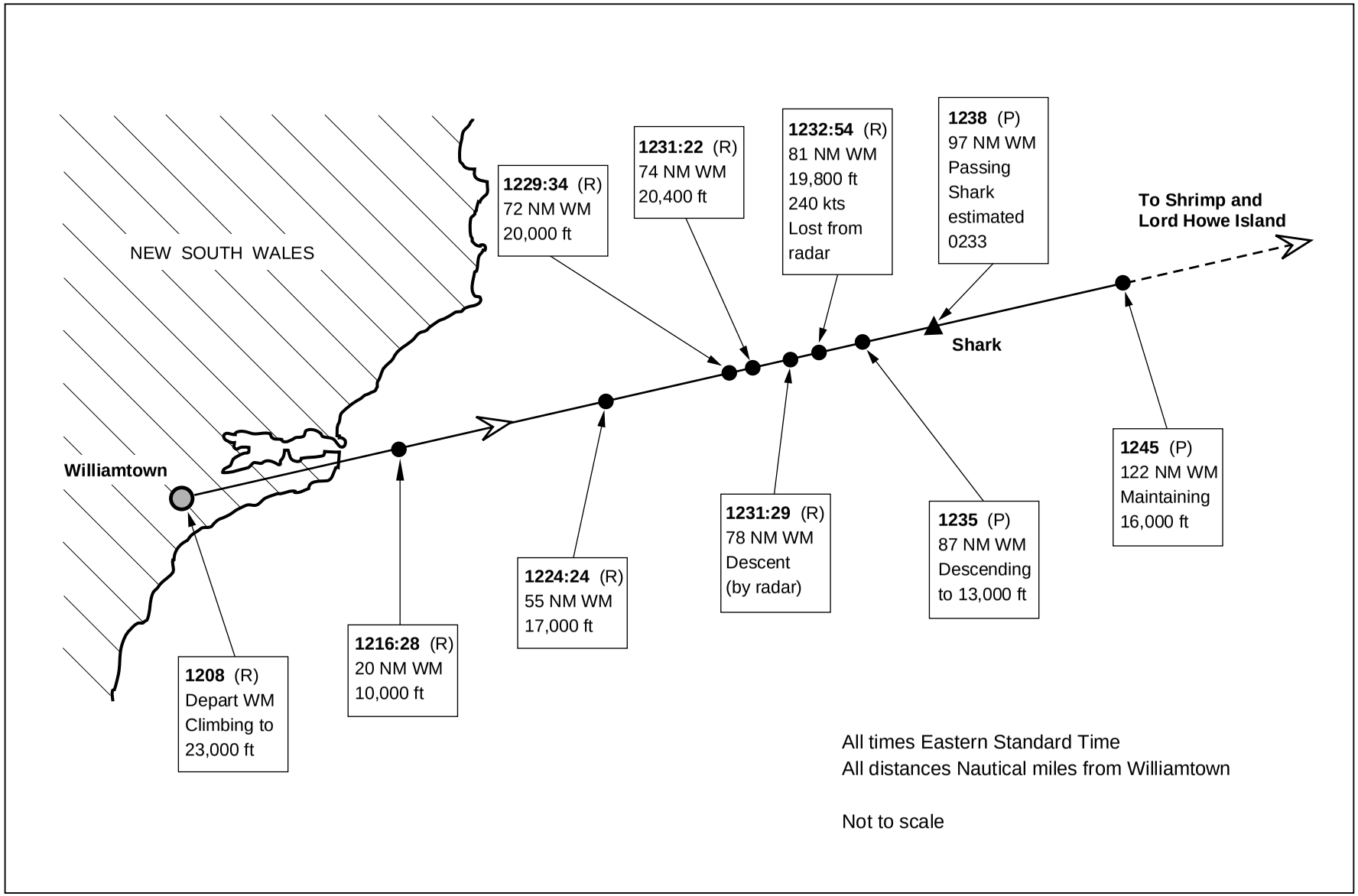

Chart showing positions taken from the radar trace (R) and pilot reports (P) of VH-SVQ.