Department of Transport and Regional Services

Bureau of Air Safety Investigation

Regional Airline Safety Study

Project Report

Released by the Secretary of the Department of Transport and Regional Services
under the provisions of Section 19CU of part 2A of the Air Navigation Act 1920.

When the Bureau makes recommendations as a result of its investigations or research, safety, (in accordance with its charter), is its primary consideration. However, the Bureau fully recognises that the implementation of recommendations arising from its investigations will in some cases incur a cost to the industry.

Readers should note that the information in BASI reports is provided to promote aviation safety: in no case is it intended to imply blame or liability.

ISBN 0 642 27460 6 May 1999

This report was produced by the Bureau of Air Safety Investigation (BASI), PO Box 967, Civic Square ACT 2608.

Readers are advised that the Bureau investigates for the sole purpose of enhancing aviation safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purpose.

As BASI believes that safety information is of greatest value if it is passed on for the use of others, readers are encouraged to copy or reprint for further distribution, acknowledging BASI as the source.

CONTENTS

TERMS AND ABBREVIATIONS

ACAS	Airborne Collision Avoidance System
AME	Aircraft Maintenance Engineer — an unlicensed worker performing maintenance on aircraft
ASIR	Air Safety Incident Report
Asymmetric	Flight with one or more engines of a multi-engined aircraft inoperative or flight simulated inoperative
ATPL	Air Transport Pilot Licence
AVTUR	Aviation Turbine Fuel
AWI	CASA Airworthiness Inspector
BASI	Bureau of Air Safety Investigation
BTCE	Bureau of Transport and Communication Economics
CAA	Civil Aviation Authority
CASA	Civil Aviation Safety Authority
CAO	Civil Aviation Order
CPL	Commercial Pilot Licence
CRM	Crew Resource Management
CTAF	Common Traffic Advisory Frequency
DME	Distance Measuring Equipment
FOI	CASA Flying Operations Inspector
FA	Flight Attendant
GFPT	General Flying Progress Test
GPS	Global Positioning System — a worldwide, satellite based, navigation system
GPWS	Ground Proximity Warning System
HCRPT	High-Capacity Regular Public Transport. Any regular public transport operation using one or more high-capacity aircraft.
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LAME	Licensed Aircraft Maintenance Engineer
LCRPT	Low-Capacity Regular Public Transport. Any regular public transport operation other than High-Capacity RPT (see HCRPT).
MEL	Minimum Equipment List
MBZ	Mandatory Broadcast Zone
MTOW	Maximum Take-Off Weight

NDB	Non-Directional Beacon (A radio navigation aid)
NOTAM	Notice to Airmen
PED	Personal Electronic Device, for example a mobile phone or CD player
RPT	Regular Public Transport
Safety deficiency	Any situation related to aviation that can reasonably be regarded as having the potential to affect adversely the safety of aviation (Air Navigation Act 1920, part 2A, section 19AD).
SAR	Search And Rescue
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range (A radio navigation aid)
V_1	Take-off decision speed. The indicated airspeed defining the decision point on the take-off roll beyond which, should one engine fail, the pilot should continue the take-off.
V_1 cut	The simulated failure of an engine during takeoff or initial climb at any stage between V_1 and the airspeed which will achieve the best single-engine rate of climb.
VMCA	Minimum control speed in flight with one engine inoperative under specified conditions.

SYNOPSIS

The 1995 House of Representatives Standing Committee on Transport, Communications and Infrastructure *Plane Safe* Report (Morris, 1995), found that 'a paucity of information' and 'an absence of safety indicators' were features of the low-capacity RPT sector of the Australian aviation industry. A Preliminary Information Paper published by BASI in 1996 concluded that a range of safety issues warranting further research existed within the regional airline industry. BASI then appointed a research team to comprehensively investigate the level of safety in the regional airline industry.

After a study of safety occurrences in the BASI database and visits to many regional airlines, a safety questionnaire was sent to every member of the regional airline industry. More than 28% of industry members responded to the survey.

The study examined all areas of the regional airlines operations, including cabin safety, flight operations, maintenance, airspace management, regulations and surveillance.

Overall, the results indicated that in 1996–97 the safety health of the industry was good, although some areas for improvement were identified. Ninety-two per cent of respondents rated the safety of their regional airline as adequate or better. On the other hand, 57% of respondents identified reasons for avoiding some regional airlines. The results showed that there was an industry wide awareness of the importance of a good safety culture.

Where a safety deficiency was identified by this study, safety action, in the form of a recommendation or a safety advisory notice, was taken by BASI. A summary of the safety action taken prior to the release of this report is contained in chapter 6.

This study was conducted with the support of the industry and shows that, on the whole, the industry does have a high regard for safety. However, it was found that in some airlines, commercial pressures were a significant factor in many safety deficiencies.

Note: The Bureau recognises that a number of changes have occurred within aspects of the aviation industry between the time the Regional Airlines Safety Study commenced and the release of this report. The findings of the study, as summarised in chapter 5 of this report, are based on the 1996–97 structure and climate of the aviation industry. Every effort has been made to acknowledge relevant changes.

1 INTRODUCTION

1.1 Background

The regional airline industry is a significant component of the Australian air transportation system, carrying 12% of the airline passengers within Australia (Bureau of Transport and Communications Economics, 1995). However, there are significant operational differences between regional airlines and domestic airlines. The regional airlines meet less-stringent legislative requirements for some aspects of their operations, operate smaller, less-automated aircraft, and frequently operate in uncontrolled airspace to airports which lack many of the support facilities found at major airports. Regional airlines are a significant and distinct sector of the commercial aviation industry and it was therefore appropriate to consider the specific safety issues of this industry sector.

Following the fatal accident involving a Monarch Airlines aircraft in June 1993, the House of Representatives Standing Committee on Transport, Communications and Infrastructure commenced an inquiry into the safety of general aviation and commuter airlines. In their report, the committee found that 'a paucity of information' and 'an absence of safety indicators' were features of the low-capacity RPT sector of the Australian aviation industry (Morris, 1995). As an outcome of that report, the Bureau of Air Safety Investigation began an in-depth study of the regional airline industry.

1.2 Definitions

Several terms and definitions have been applied to the regional airline industry. In Australia, the terms 'regional', 'commuter' and 'third level' are generally interchangeable in relation to regional airlines. Current regulations do not contain any definitions of a regional or commuter airline. This study adopts the definition given by the Civil Aviation Authority (CAA) in evidence to the House of Representatives Standing Committee on Transport, Communications and Infrastructure (Morris, 1995), in which a commuter airline was defined as a RPT operation using low-capacity aircraft to transport persons or cargo for hire or reward in accordance with fixed schedules. A low-capacity aircraft is defined as an aircraft which is other than a high-capacity aircraft. A high-capacity aircraft is defined as an aircraft certified as having a maximum seating capacity greater than 38 seats or a maximum payload greater than 4,200 kg.

For the purposes of this study, regional airlines were grouped according to the number of passenger seats fitted to the largest aircraft operated by that airline on 1 January 1997. The airline groups are defined in Table 1.

Table 1: Definition of 'Airline Group'

Airline group	Number of passengers seats in largest aircraft operated
Group 1	1 to 9 seats
Group 2	10 to 19 seats
Group 3	more than 20 seats

It should be noted that some Group 3 airlines operate aircraft with fewer than 10 passenger seats and aircraft with 10 to 19 seats, as well as the larger aircraft types.

1.3 Preliminary information paper

A BASI (1996c) report titled *Regional Airlines Safety Study: Preliminary Information Paper* was completed in November 1996. That paper contained the following:

- a summary of previous research conducted on regional airlines, both in Australia and overseas;
- safety statistics for Australian regional airlines from 1986 to 1995; and
- results of interviews and discussions conducted with regional airline managers and employees.

The paper concluded that a BASI project to study the safety of the regional airline industry was warranted.

1.4 Scope of this study

This study was limited to organisations that met the definition of a regional airline, and to organisations which supported or provided services to regional airlines, such as aircraft maintenance contractors and handling agents. Where a company was authorised to conduct more than one type of flying operation, for example, Low-Capacity Regular Public Transport (LCRPT) and charter, the study concentrated on the personnel, procedures, equipment and organisational structure associated with the LCRPT operations.

The study covered all aspects of regional airline operations, including training, flight operations, maintenance, publications, selection and qualification of personnel, support facilities, air traffic services, and regulation and surveillance.

1.5 Safety action

Bureau staff were tasked to further investigate the safety deficiencies identified in the findings of this preliminary study. The impetus for this investigation was to determine if any formal safety action was justified. All formal safety outputs issued by the Bureau prior to the release of this report have been reproduced in chapter 6. In addition, other relevant safety action has been summarised in this chapter.

Note: Editorial insertions have been included as part of some survey responses used as examples in this report. Such text has been added for the sake of clarity and has been included within square brackets [ ].

2 OBJECTIVES

The objectives of this BASI safety project were to:

(a) identify safety deficiencies affecting regional airline operations in Australia; and

(b) identify measures to reduce the adverse impact of these deficiencies on safety.

3 METHOD

The sources of data used in this study were derived from:

- visits to regional airlines and discussions with managers and employees;
- safety occurrence details in the BASI database over a 10-year period (1986 to 1995); and
- a survey of regional airline employees.

The information gathered during visits to regional airlines and the safety statistics obtained from the BASI database were discussed in the preliminary information paper on this project (BASI, 1996c).

3.1 Development of the survey

A list of possible hazards affecting the regional airline industry was compiled from the interviews with airline managers and from focus group discussions with airline employees. Questions to solicit information on the frequency and severity of these possible hazards were drafted and refined into a questionnaire.

The questions were divided into two distinct areas of investigation:

- issues associated with day-to-day airline operations; and
- issues associated with the regulation and supervision of airlines.

3.2 Trial survey

Trial survey forms were printed and distributed to three regional airlines. The selected airlines were representative of the three major groups of regional airlines based on the size of aircraft which they operated. The survey forms were accompanied by a critique form which asked the respondents for comments about the survey. Responses were received from pilots, flight attendants, maintenance staff and operations staff.

Copies of the survey form were also sent for comment to CASA, Airservices Australia, the Australian Federation of Air Pilots, the Flight Attendants Association of Australia, the Australian Licensed Aircraft Engineers Association (ALAEA) and the Regional Airline Association of Australia. Comments on the trial survey were received from all of those organisations except the ALAEA.

Following the receipt of comments on the trial, the survey form was reviewed and modified. The resulting survey form contained five sections:

(a) demographic questions concerning the respondent's employment status, experience and current position with their employer;

(b) safety questions for maintenance staff only;

(c) safety questions for flight attendants only;

(d) safety questions for pilots only; and

(e) safety questions for all respondents.

The Flight Attendants Association of Australia offered to mail out the survey forms to their members in the regional airline industry. The survey forms were therefore printed in two different formats, one for flight attendants and one for all other airline employees. Copies of the survey forms used in this study are available from BASI on request.

3.3 Distribution

3.3.1 Employee survey

A total of 2,304 copies of the employee survey form were distributed. The primary means of distribution was via a nominated liaison officer at each regional airline. Survey forms were mailed to the nominated liaison officers in January 1997 for distribution to the employees.

In addition, notices advertising the survey were placed in *Asia-Pacific Air Safety* and the *Regional Airlines Safety Bulletin*, and displayed on the BASI Internet web site. The notices advertised a toll-free telephone number and an e-mail address that could be used to request additional copies of the surveys.

3.3.2 Flight attendant survey

A total of 358 copies of the flight attendant survey were distributed to the Flight Attendant Association of Australia (FAAA). Copies were also sent to the flight attendant managers of the nine regional airlines employing flight attendants who were not members of the FAAA.

3.4 Survey limitations

3.4.1 Identification of significant safety deficiencies

Using a survey as the primary means of obtaining data for this project had many advantages but also had some limitations. In order to gain airline employees confidence in the survey, information which could be used to identify individuals or companies was not collected. Therefore, one of the measures for deciding if a safety issue was significant was the number of respondents that reported it. Specific safety problems that were limited to a small sector of the industry would probably not have been reported by sufficient numbers of respondents to warrant consideration as a significant safety deficiency. However, the survey method did allow deficiencies which were widespread throughout the industry to be identified.

The survey was distributed in January 1997, and most of the returns were received at BASI during February and March. The responses provided in the survey were based on the industry and environment at that time.

3.4.2 Interpretation of ‘assess each hazard’

In the pilot, maintenance staff, and flight attendant sections of the survey, respondents were asked to assess, based on their experience, each of a number of hazards as being either ‘not a problem’, a ‘minor safety issue’, or a ‘major safety issue’. Unfortunately pre-testing of the survey questionnaire failed to reveal that the wording of that style of question left it open to misinterpretation. When the final data was being analysed, it became apparent that a significant minority of respondents interpreted the question as asking their opinion of the *seriousness* of the hazard, as opposed to the *frequency* with which they actually encountered the hazard in their day-to-day operations. Therefore, the responses to those questions were possibly unreliable and were analysed with caution. Only those issues showing the highest frequency of being rated as a major safety issue, and corroborated by information from other parts of the survey, are reported.

4 SURVEY RESULTS

4.1 Overall comments

The overall results of the survey show that, in general, those who work in the industry consider that regional airlines provide a safe transport service to the Australian public. Over 90% of regional airline employees rated the safety of their airline as 'adequate' or better, while more than 90% of those who held an opinion said that the safety of the industry as a whole had remained the same or had improved over the last 5 years. On the other hand, more than half of the respondents had serious safety concerns about some regional airlines other than the one for which they worked. That apparent contradiction in perceptions of the safety of the industry is discussed in greater detail in later sections of this report.

> I can only speak from the experience in my company. I feel it is very safe and professional. The only way safety could be jeopardised is by complacency or thinking that they were too safe. (Pilot, respondent 175)

> [I am] unsure about other airlines, but… I have never at any time felt that the safety of the aircraft was compromised. [This is due to] the attitude to safety and encouragement to speak up if you feel something is wrong. (Pilot, respondent 352)

> [The greatest safety problem is] the pressure placed on LAMEs by the company to 'pen' off the snag or defect so as to get the aircraft flying. Also pressure on pilots to fly their aircraft with known problems. The almighty dollar takes precedence. The airline can hire highly paid managers but not employ additional maintenance personnel, [or] buy spares and equipment to carry out maintenance tasks. (LAME, respondent 361)

4.2 General demographic information

4.2.1 Employment status

Most respondents (94%) worked for a regional airline at the time of the survey. Other respondents were no longer with a regional airline but had worked for one in the previous two years, or worked for a company which supplied services to regional airlines, for example handling agents.

Ninety-four per cent of respondents were employed on a full-time basis, while 3% were employed part-time or on a casual basis. The remainder were employed on some other basis or did not answer the question. Only 10% of respondents had another job in addition to their work in a regional airline. Hence, it could be concluded that the regional airline industry employs people predominantly on a full-time basis. As the majority of the respondents were current employees, their comments referred to the state of the industry at that time.

4.2.2 Employment history in the regional airline industry

The length of time that respondents had been employed in the industry ranged from 1 month to 37 years, with a mean of 7 years. Fifty-two per cent of employees had been in the industry for 5 years or less.

The survey results showed that flight attendants, as a group, had considerably less experience in the industry than the other members of the regional airline industry. The

majority of flight attendants had three years or less experience. Those figures indicated either a high turnover of staff, a rapid expansion of the industry or a combination of both. The high proportion of relatively inexperienced flight attendants would suggest that an emphasis should be placed on training and supervision.

4.2.3 Numbers of employees by airline grouping

Before the survey was conducted, estimates of numbers of employees in each regional airline were made to assist with the distribution of survey forms. Those estimates were based on information supplied to BASI by most regional airlines in January 1997. The numbers of responses to the survey have been compared with the estimated staff numbers and are shown in Table 2.

Table 2: Employees and respondents by airline group

Airline group	Number of airlines	Estimated employees	Number of responses	Estimated response rate
Group 1	26	327	44	13.4%
Group 2	9	371	100	26.9%
Group 3	8	1525	486	31.8%
Total	43	2223	630	28.3%

Note: Ten respondents did not answer the question on airline group and have not been included in the numbers of respondents.

4.2.4 Professional groups

The number of survey responses received from each professional group is shown in Figure 1.

Figure 1: Number of survey responses from each professional group

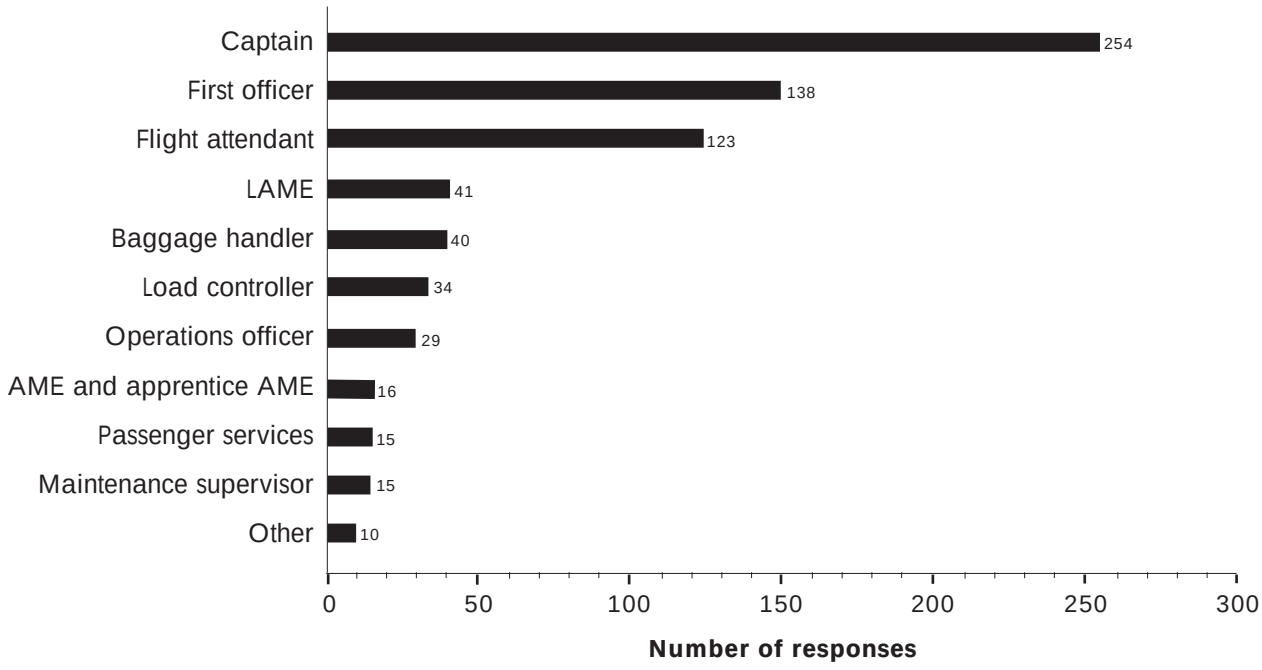


Table 3 shows the response rate for major professional groups compared to the estimated number of people employed in those groups by regional airlines in January 1997.

Table 3: Employees and respondents by professional groups

Professional group	Estimated employees	Number of responses	Estimated response rate
Pilot	1078	392	36.3%
Flight attendant	285	123	43.1%
Maintenance staff	502	65	12.9%
Other staff	458	128	27.9%

Note: As some respondents replied that they were in more than one professional group, the total of the numbers of responses shown is greater than the number of surveys received.

4.3 Aircraft operations

4.3.1 Operations manuals

When pilots were asked if they operated their aircraft strictly by the operations manual, 91% replied that they did. Although a small number of pilots (8%) answered that they did not operate by the operations manual, anecdotal evidence suggests that some operations manuals were not able to be strictly followed. Therefore, the results of the survey did not indicate that a safety deficiency in regard to compliance with operations manuals existed in the regional airline industry.

4.3.2 Operational information

Operational information such as meteorological forecasts and information on the status of airfields and navigation aids is critical to flight safety because it forms the basis for the crew's operational decision making.

In 1991, the CAA operations control service was terminated and the responsibility for operational control, which included the decision to continue, divert or terminate a flight, was transferred to the pilot in command of the aircraft. In the USA, the responsibility for operational control of an airline flight is a responsibility shared by the pilot in command and a dispatcher on the ground. No similar system exists in Australia. Since 1991, the pilot in command has been solely responsible for operational control of the flight and therefore needs to maintain an awareness of en route weather, the operational state of the aircraft, and the weather and facilities at the destination and diversion airfields. The operational information obtained before the flight should be updated in flight where necessary, so that in-flight decisions are based on the most current information.

The BASI survey sought to clarify if the procedures for updating operational information in flight were effective. Seventy-two per cent of pilots considered that the procedures were effective, 18% said they were not, and 10% were unsure. The pilots who felt that the procedures were not effective came from airlines of all three airline groups. As a significant number of pilots felt their in-flight updating procedures were not effective, that matter was considered a safety deficiency.

4.3.3 Unlicensed airfields

An airfield is licensed if it meets all the appropriate requirements of the Civil Aviation Regulations and the details are published in the Aeronautical Information Publications. Any changes to the published status of a licensed airfield are published in Notices to Airmen (NOTAMs). In contrast, when using an unlicensed airfield, it is the pilot's responsibility to obtain information on the state of the airfield from the owner or operator of that airfield.

The majority of regional airline operations are conducted into licensed airfields. However, it was assumed that a significant number of flights were to unlicensed airfields and that it was therefore appropriate to cover that aspect in the BASI survey.

Twenty-two per cent of pilots felt that the condition of some unlicensed airfields that they used was hazardous. The same proportion of pilots reported that they could not always get reliable information on the condition of the unlicensed airfields. In their answers to those two questions, there was no significant difference between the responses of pilots from airlines in each of the three airline groups. As a significant minority of pilots using unlicensed airfields were advising of problems with them, the state of the airfields and the reliability of the information on them were considered safety deficiencies.

4.3.4 Aircraft weight issues

Limits are placed on aircraft take-off weights to ensure that:

- aircraft structural limitations are not exceeded; and
- aircraft can adhere to optimal climb gradients after takeoff to ensure obstacle clearance, particularly in the event of engine failure.

Current regulations allow airlines a number of alternative methods of calculating passenger weights. Pilots were asked if they believed that realistic passenger weights were used by their airline. The large majority of the pilots (90%) believed that that was not a safety issue. The proportion of pilots disagreeing (6.5% overall) was approximately the same in all three airline groups. Those responses indicated that the use of unrealistic passenger weights was not a widespread safety problem in the industry.

Pilots were asked whether they operated their aircraft at weights above the maximum take-off weight (MTOW). To that question, 85% answered 'never', while 15% replied that on at least some occasions they did operate above MTOW. The latter were significantly more likely to come from an airline whose largest aircraft had fewer than 20 seats (Group 1 or Group 2 airlines). A summary of responses to this question by airline group is shown in Table 4.

Table 4: Reported frequency of operations above maximum take-off weight

Response	Group 1 airlines 1 to 9 seats	Group 2 airlines 10 to 19 seats	Group 3 airlines > 20 seats
On some occasions	48%	24%	9%
Never	52%	76%	91%

Note: Percentages shown are of the pilots in the airline group.

Responses to questions in the survey relating to general safety issues indicated that the greatest safety problems facing regional airlines were perceived to be 'overloaded aircraft' and 'aircraft with degraded climb performance'. Those two issues are related. If the aircraft was overloaded, its climb performance would be reduced, particularly in the event of an engine failure. Anecdotal evidence suggested that the most common situation in which an aircraft was overloaded was when a full load of passengers and baggage had been planned, but adverse weather required the carriage of additional fuel. When the extra fuel was added, without offloading some of the planned payload, the aircraft weight could exceed its MTOW. When pilots were asked to describe a specific safety incident, aircraft operating above their maximum take-off weight was frequently mentioned.

From the responses discussed in this section, overloading aircraft was a significant safety deficiency. It did not appear to be caused primarily by unrealistic passenger weights. However, the problem does appear to be more common in airlines whose largest aircraft were less than 20 passenger seats.

> Pilots, although instructed not to overload, are presented with situations beyond their control by the aircraft booking system.... Bookings are predicated on the maximum seat capacity for the type and no allowance is made for each passenger carrying the maximum baggage allowance, or in those circumstances where alternate conditions exist and additional fuel must be uplifted for diversion or holding. (Pilot, respondent 552)

> Before this particular flight, I knew a full load of passengers were booked. I asked the managing director [about] the company's policy regarding offloading should all the passengers arrive with their allocated 12 kg of baggage, as this places the aircraft well above MTOW. His response was 'are you telling me something we've done for years, we can no longer do?' It was made very clear that my decision should not be made with regard to aircraft safety but to continued employment with the organisation. (Pilot, respondent 404)

4.3.5 Fuel

The survey covered aircraft operating with less fuel than the requirements contained in the company operations manual. As 97% of respondents answered that that never happened, it was concluded that operating with less than the required amount of fuel was not a safety deficiency.

4.3.6 Operations related hazards

Pilots were asked to assess the risks associated with the following ten hazards which had been raised by pilots during preliminary interviews. However, for the reasons outlined in Section 3.4.2 above, responses to those questions were considered unreliable and no conclusions were drawn from those results alone. The nominated hazards were:

- parachuting operations in busy circuit areas;
- lack of access to a synthetic flight trainer;
- lack of access to a full-flight simulator;
- insufficient flight training at regional airlines;
- alcohol abuse by flight crew;
- use of illegal drugs by flight crew;
- the effect of commercial pressures on flying;
- undeclared dangerous goods on aircraft;
- amount or size of carry-on baggage; and
- numbers of unaccompanied children on board.

Respondents were asked to nominate and rate any other safety hazard. A total of 80 hazards were nominated, and grouped by subject. The most frequently nominated hazard was confliction with other aircraft within Mandatory Broadcast Zones or Common Traffic Advisory Frequency zones. This has been raised as a safety deficiency in section 4.7. Only those aircraft operational issues (obtained from any section of the survey) with the highest frequency of being rated as a major safety problem, are discussed.

4.4 Instrument flying

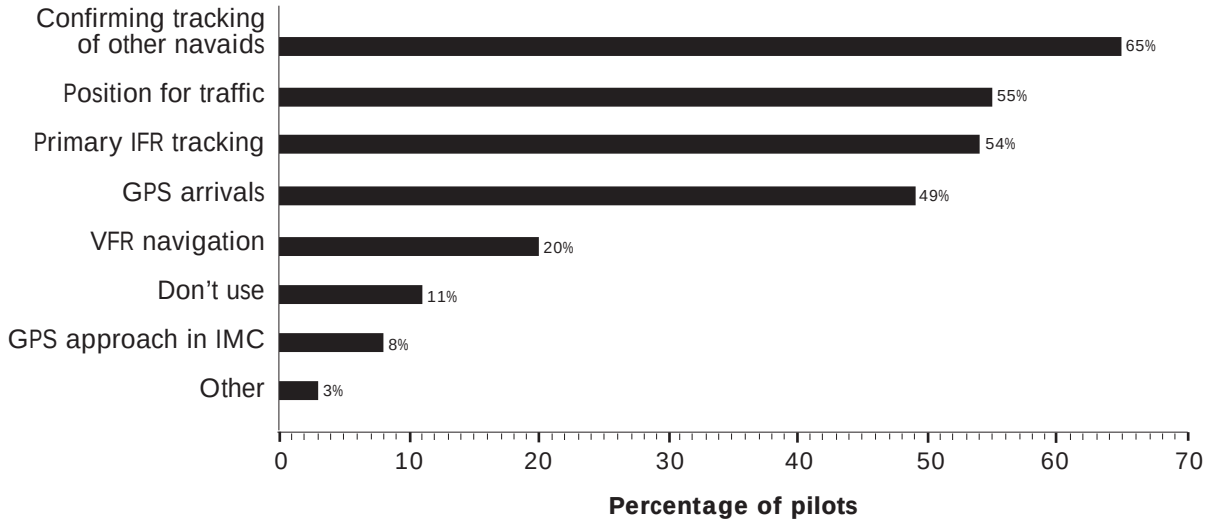
4.4.1 Co-pilot instrument rating requirements

Sixty-seven pilots (17.4%) replied that they held a co-pilot instrument rating, rather than a command instrument rating, on a multi-engine aircraft. The majority (75%) of the pilots holding a co-pilot instrument rating only, were flying 20+ seat aircraft which in general were complex high-performance aircraft. The CAOs included detailed training and currency requirements for a command instrument rating but no requirements for a co-pilot instrument rating. Although there was no evidence that accidents or incidents had resulted from that situation, the lack of definition of training and currency requirements in CAOs for a co-pilot instrument rating could have allowed inadequately trained co-pilots to fly airline aircraft in instrument conditions.

4.4.2 Use of Global Positioning System (GPS) equipment

Regulations current at the time of the survey allowed any GPS unit to be used by a VFR pilot to assist with, but not replace, navigation by visual means. Some GPS units were approved for the en route navigation of IFR aircraft, although other means of navigation had to be available as a backup. Although it is expected that GPS will eventually replace all other instrument approach aids, GPS approaches at night or in IMC were prohibited at the time of the survey. Practice approaches using GPS could be carried out in day visual conditions. GPS arrivals, which used GPS distance information and another navigation aid for lateral navigation, were the only approved methods of using GPS for navigation in IMC below the minimum en route altitude. The actual use of GPS equipment by regional airline pilots is shown in Figure 2.

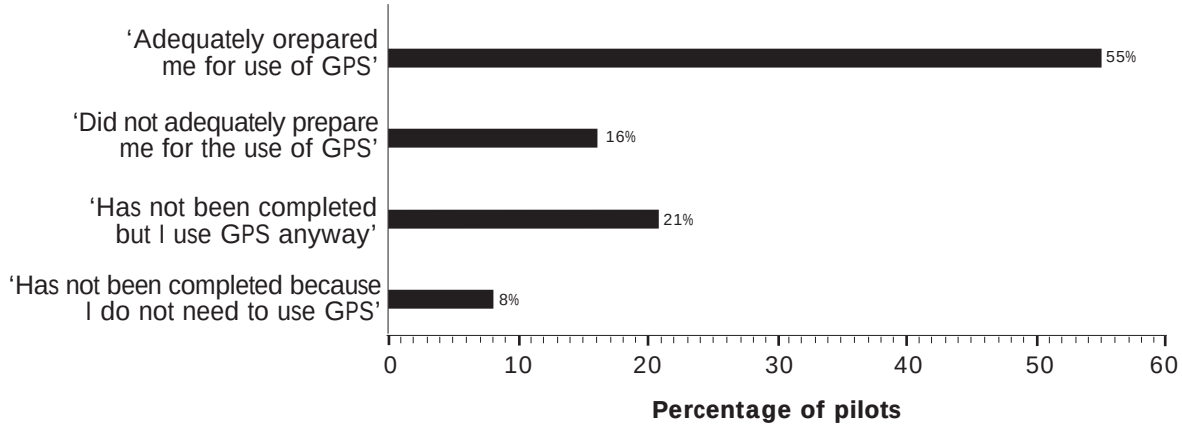
Figure 2: Use of GPS equipment by regional airline pilots



Twenty-nine pilots (7.9%) stated that they flew GPS approaches in IMC, even though that was illegal. Of those, only four pilots had not completed GPS training. It would appear that the training received by the other 25 had not taught them the importance of the correct use of GPS, or that they chose to ignore the rules.

Of the 257 pilots who had completed their GPS training, 22% stated that their training had not adequately prepared them for the use of GPS. An additional 78 pilots (21% of respondents) said that even though they had not completed their GPS training, they used GPS anyway (see Figure 3). Those pilots used GPS for primary IFR tracking and GPS arrivals.

Figure 3: GPS training for regional airline pilots



When asked about deviations from instrument flight rules, five pilots reported the use of unapproved GPS procedures. The reports included two cases of untrained pilots using GPS for IFR flight and three cases of pilots using GPS to fix the aircraft's position for the purpose of descending to a revised safety altitude, commonly the minimum safe altitude within 25 NM of the destination airfield. While the latter procedure has become an approved procedure, its use without a full knowledge and application of appropriate procedures does carry an unacceptable level of risk.

The following safety deficiencies related to the use of GPS were identified:

- Some pilots were using unapproved GPS to fly instrument approaches in instrument meteorological conditions.
- Some pilots were using GPS for instrument procedures before completing training on the equipment.
- Some GPS training courses did not adequately prepare pilots for using GPS equipment.

> [A common deviation from IFR is the] use of GPS arrivals by pilots not endorsed on GPS use, even though the airborne equipment is IFR approved. (Pilot, respondent 362)

4.4.3 Engine failure during instrument departure

The certification requirements for aircraft performance in the event of an engine failure vary according to aircraft maximum certificated take-off weight. The survey asked pilots if they were concerned by aircraft performance in the event of an engine failure.

The large majority of pilot respondents (83%) believed that terrain clearance procedures would ensure adequate safety in the event of an engine failure during an instrument departure. The 29 pilots (7.5%) who disagreed were predominantly from airlines flying aircraft with fewer than 19 passenger seats. That was consistent with the regulations, which

had more stringent engine-out climb performance requirements for the larger aircraft. Terrain clearance in the event of an engine failure during an instrument departure did not appear to be a safety deficiency.

4.4.4 Compliance with instrument flight rules

Safety incidents involving pilots breaking instrument flight rules (IFR) were one of the most common types of incidents reported in the survey.

Pilots were asked if their company operational requirements were strictly in accordance with the instrument flight rules. The majority (95%) of respondents replied that IFR requirements were strictly followed. There was no significant difference between responses from pilots from the three airline groups.

Descent below safety altitudes

For the purposes of this analysis, safety altitude is a generic term meaning lowest safe altitude, minimum safe altitude, the minimum altitude for a given DME/GPS distance in an arrival procedure, and minimum descent altitude in an instrument approach.

Twenty-seven pilots reported descending below safety altitude as a non-compliance with instrument flight rules. Deviations involving descent below a published safety altitude included:

- descent below the steps during a DME or GPS arrival while in IMC;
- descent to circuit altitude at night outside the instrument approach circling area;
- descent below instrument approach minimum descent altitude (MDA) while in IMC; and
- diverting off-track to descend in IMC over water to an altitude lower than the destination MDA.

The number of respondents reporting those deviations was small. However, all deviations involving descent below safety altitude increased the risk of a controlled-flight-into-terrain-accident and hence represented a significant safety deficiency.

> When breaking clear of cloud, [there is a] tendency to adopt visual procedures with little or no forward visibility in rain. If not visual upon reaching minimum altitude, a large number of captains immediately descend further. [This is caused by] lazy, undisciplined captains and a perceived ‘uncoolness’ in just missing an approach. (Pilot, respondent 85)

> [A common deviation from IFR is] descent below the lowest safe altitude on route sectors to aerodromes without a navigation aid in conditions that are non-VMC. [This is done] to enable the flight to get in to an aerodrome where conditions are marginal but is not surrounded by terrain or obstacles. (Pilot, respondent 178)

> One or two management pilots have a willingness to push the minimums i.e. they suffer from get-in-at-all-costs. Old habits die hard. One suffers tunnel vision and talks himself into continuing, for example, ‘it is only a couple of hundred feet’, ‘you’ve done it before’, ‘one must be flexible’ and ‘the rules are only a guide’. (Pilot, respondent 568)

Non-compliance with speed restrictions

Nine respondents stated that some pilots exceeded speed restrictions during DME/GPS arrivals, and three stated that this occurred during instrument approaches. While flying approaches or arrivals at high speed can increase the risk by increasing pilot workload during critical phases, the degree of risk is much less than some other deviations and was not considered to be a safety deficiency.

4.4.5 Current instrument approach procedures

The majority of pilot respondents (87%) agreed that 'current instrument approach procedures allow me to fly safe approaches'. Safety issues associated with individual instrument approaches are examined in detail in the following sections.

Circling approaches

Thirty-one respondents (8.1% of pilots) reported disorientation during night circling approaches in the previous year. Disorientation could result in a pilot inadvertently flying into terrain at night. There was no significant difference in response from pilots flying single-pilot or two-pilot aircraft. However, among pilots who flew two-pilot aircraft, 16% of first officers agreed with the statement compared to only 3.1% of captains. That difference could be related to the level of experience.

Thirty-nine respondents (10%) commented that a specific airfield needed a runway-aligned approach for each runway served by an instrument approach aid, instead of a circling approach. An additional 10 respondents made the comment that they considered circling approaches to be dangerous. Nine respondents made the comment that circling approaches in bad weather were one of the greatest hazards facing the regional airline industry. In the last 10 years, two of the three fatal accidents involving regional airline aircraft occurred during a circling approach in marginal weather conditions (BASI, 1996c). That evidence suggested that circling instrument approaches are a high-risk phase of flight and constitute a safety deficiency.

Since 1993, BASI has made three recommendations to CASA, and its predecessor, concerning terrain clearance during night circling approaches. Two recommendations were made following the Monarch Airlines accident of June 1993, (IR930231, IR930234) and a further recommendation was made in August 1996 (IR960027) (see appendix of this report). In each case, the recommendation was accepted by the regulatory authority.

> Circling [approaches] at night or by day in poor visibility have proven very dangerous manoeuvres by comparison with other IFR procedures. Eliminating them will improve operational safety. (Pilot, respondent 468)

Proximity to terrain

Loss of situational awareness has been cited as a significant factor in many accidents. The survey attempted to determine if pilots had experienced a loss of situational awareness, specifically in regard to terrain clearance.

Twenty-two pilots (5.7%) agreed with the statement that they 'had been surprised to find that the aircraft was closer to terrain than intended'. There was no significant difference between pilots flying single-pilot aircraft and those flying two-pilot aircraft. Even though the rates of such loss of situational awareness were relatively low, they were significant as any loss of situational awareness could have resulted in a controlled-flight-into-terrain accident. That evidence suggested that the loss of situational awareness by regional airline pilots was frequent enough to be a safety deficiency.

At the time of the survey in Australia, large turbine-powered aircraft with a maximum take-off weight in excess of 15,000 kg, and those which carried more than 30 passengers, were required to be fitted with a Ground Proximity Warning System (GPWS). ICAO (annex 6, part 1, para. 6.15.3) recommended that all turbine-engine aeroplanes, with a maximum certificated take-off weight in excess of 5,700 kg, or authorised to carry more than nine passengers, be equipped with a GPWS by 1 January 1999. A proposed amendment extended that recommendation to all piston-engine aeroplanes of that size. In

August 1996, BASI recommended that CASA expedite discussion with industry with the aim of complying with the ICAO advice on the fitment of the GPWS (Recommendation R960040). CASA issued a Notice of Proposed Rule Making (NPRM 9705RP, dated 4 November 1997) on *Ground Proximity Warning System (GPWS) Requirements in Australia*, and CAO 20.18 amendments have been drafted and approved by the Director/Board of CASA.

4.4.6 Safety problems at specific airfields

As well as identifying general safety deficiencies, the survey identified several specific safety deficiencies concerning particular airfields and approaches. Those are detailed below.

Runway 36 at Mount Gambier

Ten respondents commented on the need for a runway-aligned approach for runway 36 at Mt Gambier. Prior to 1995, a VOR/DME approach for each runway at Mt Gambier was published. With the removal of the Australian DME system in 1995, only VOR and NDB approaches were available at Mt Gambier. Due to high terrain to the south of the field, those approaches were flown to the north of the airfield. Thus runway approaches for runway 18 were available, but if runway 36 was to be used, the aircraft was required to fly a circling approach.

A runway approach for runway 36 at Mt Gambier should be published as a high priority. Options which should be considered are:

- a GPS approach; or
- a VOR or NDB approach using an offset finals track to avoid the high terrain to the south of the airfield.

Note: On 25 February 1999, CASA published a GPS approach for runway 36 at Mt Gambier.

Missed approach tracks

Six respondents stated that the missed approach tracks for specific approaches were towards high terrain and that alternative tracks would provide more terrain clearance. The airfields mentioned were Ballina, Lismore, Mt Gambier and Port Lincoln.

Practicability of instrument approaches

The ILS approach for runway 21 at Perth contained a procedure for intercepting the localiser from the 9-DME arc. Four of the survey respondents commented that attempting to intercept the localiser from the DME arc was difficult and may have resulted in the aircraft flying well above the glidepath, leading to an unstabilised approach. That was an example of an approach procedure which, although meeting all design criteria, may not have been ideal.

Lights near Gladstone airfield

Bright lights illuminated a railway marshalling yard adjacent to the final track for runway 10 at Gladstone. Four respondents stated that those lights could ‘drown out’ the runway lights and create the illusion of a false runway.

4.5 Flying training exercises

Even though the majority of pilots had no concerns about the safety of flying training, the 18% of pilots who made comments on that issue described incidents and practices which had a high potential to result in accidents. In particular, the number of pilots reporting high-risk asymmetric training exercises indicated that such exercises were sufficiently common to have been a safety deficiency.

Although some regional airlines had access to flight simulators, most flying training was conducted in aircraft, including training in handling aircraft emergencies. A frequently conducted exercise was the simulated failure of an engine in a multi-engine aircraft by reducing the power on one engine. Flight with one engine at idle or shutdown is known as asymmetric flight. A 'V_1 cut' is a simulated engine failure shortly after the point during the takeoff at which the aircraft has insufficient runway to stop and therefore must continue the takeoff.

4.5.1 Regulations

Civil Aviation Order 40.1.0 stated that a command endorsement must include at least two simulations of engine failure during takeoff after critical speed has been reached (V1 cuts). However, there was no similar requirement for a co-pilot endorsement. Aeronautical Information Publication, Operations (AIP OPS) stated that night asymmetric training must be conducted higher than 1,500 ft above ground level. However, there was no definitive legislation which gave legal effect to the AIP (BASI, 1997a). In April 1996, BASI recommended that CASA correct the legislation and take steps to inform and educate the industry on the hazards involved in asymmetric training in conditions of low visibility and at night (IR950224). That recommendation was accepted and CASA advised that appropriate action would be taken. However, that had not occurred by the end of 1998.

Regulations current at the time of the survey did not require a check-and-training pilot to have any previous experience or qualification as a flying instructor, nor was there any syllabus of training for check pilots (BASI, 1997a). In two recommendations, released in April 1995 and May 1996, BASI recommended that CASA review the current process of approval of check pilots and provide a syllabus of training and standards to be met before an applicant could be granted approval as a check-and-training pilot (IR950063, IR960034). In May 1997 CASA included material on the selection, training and approval processes for check-and-training pilots in the Air Operator Certification Manual. The results of that change are not reflected in the survey.

4.5.2 A training accident

On 16 September 1995, an accident occurred at Tamworth NSW, involving a Metro III aircraft operated by a regional airline. The flight was the second Metro III type-conversion training flight for the co-pilot. During a night takeoff flown by the co-pilot, the check-and-training pilot simulated an engine failure (V_1 cut) by retarding the left-engine power lever to flight-idle. Shortly afterwards the aircraft struck a tree and crashed, with the loss of two lives. The investigation (BASI, 1997a) found that significant factors in that accident were:

- there was a lack of enabling legislation prohibiting low-level, night asymmetric operations;
- the check-and-training pilot was assigned a task for which he did not possess adequate experience, knowledge or skills;

- the check-and-training pilot gave the co-pilot a task which was inappropriate for the co-pilot's level of experience; and
- the check-and-training pilot did not recognise that the V_1 cut exercise should be terminated and that he should take control of the aircraft.

That accident demonstrated the very small margin of error in some pilot training exercises and the need for adequate guidance and supervision of this type of regional airline flying.

After that accident, BASI recommended that CASA review the endorsement training requirements for aircraft above 5,700 kg MTOW where a simulator was not available (IR960035). CASA accepted that recommendation and in September 1996 issued a multi-engine training syllabus as Civil Aviation Advisory Publication CAAP 5.23-1 (0).

4.5.3 Most frequently reported training issues

Pilots were asked to outline any flying training exercises which caused them concern. Sixty-nine pilots responded to that question. The most common responses related to asymmetric flight, V_1 cuts, check-and-training captains, emergency flight training, and endorsement training. The number of pilots reporting high-risk training exercises indicated that such exercises were sufficiently common to be a safety deficiency.

Asymmetric flight

Forty-seven pilots were concerned about the dangers of asymmetric training. The most common concern was that simulated asymmetric flight was being conducted close to the ground, or in aircraft configurations or flight conditions that increased the risk of an accident.

> During a twin-engine, full-flap go-around, [the training captain simulated] an engine failure when power [was coming] up, leaving the aircraft hanging on one engine low to the ground. With or without the [landing] gear, the aircraft will not climb [on one engine] with full flap selected. (Pilot, respondent 465)

> [I am concerned about] Vmc demonstrations and practice. [They are] all very dubious demonstrations at this level of operation and definitely a safety hazard in practice for no gain in safety. (Pilot, respondent 472)

V_1 cuts

Twenty-three respondents who commented on the danger of asymmetric training said that V_1 cuts were excessively dangerous due to the marginal performance of the aircraft on one engine, or due to the manner in which this exercise was practised. Five respondents cited examples of V_1 cuts being practised at night and one described a V_1 cut while the pilot was wearing 'foggles' (devices to restrict the pilot's view of the instrument panel). Many pilots felt that V_1 cuts should only be practised in flight simulators. Many pilots mistakenly believed that V_1 cuts at night were prohibited by Civil Aviation Orders.

Check-and-training pilots

Eighteen pilots reported concerns in relation to their check-and-training pilots. For example, some check-and-training pilots were seen as having an aggressive attitude and adopting practices that were unsafe, unnecessary or unrealistic. In other cases it was felt that they were not qualified or competent to carry out their role, or that they may not have possessed the skills to recognise and recover from a poorly handled emergency. Many

pilots felt that check-and-training pilots needed previous instructional experience and more experience on the aircraft type before being approved.

> [I am concerned about] simulated asymmetric flight close to the ground. [On one occasion] directional control was lost and I had to recover by powering up the simulated failed engine. [This situation was caused by the] check captain taking it beyond his capabilities to recover safely. (Pilot, respondent 177)

Emergency flight training

Eleven pilots felt that some company procedures regarding emergency flight training were inherently unsafe. Examples given were the conduct of emergency flight training between or after regular commercial flights, and the carriage of supernumerary crewmembers during asymmetric training flights.

> One check was carried out on myself after 6 hours of commercial flying, 8 hours on duty and five actual instrument approaches already completed that day (three to minima). A 10-minute break included a change of aircraft. The company check captain and a CASA check airman boarded and a complex series of approaches [were briefed]. After a very dangerous situation occurred during the initial takeoff when the check captain was unable to read the approach chart due to bad light, I abandoned the check and did it at a more appropriate time. (Pilot, respondent 631)

Endorsement training

Seven respondents considered that some aspects of their initial endorsement training on a specific aircraft type were unsafe. Some felt that the sequence of instruction for the endorsement was unrealistic, with multiple failures and very high workload. Others said that their endorsements included inadequate or inappropriate emergency procedures training.

> [I am concerned about] endorsements and instrument renewals—particularly those involving asymmetric exercises. The pre-flight briefing was minimal—usually 5 to 15 minutes while seated in the aircraft. Many of the procedures were not those recommended by the aircraft manufacturer and some did not comply with the aircraft flight manual or the CAOs. (Pilot, respondent 545)

Some pilots considered their initial training on the aircraft type was inadequate, the amount of refresher emergency training was inadequate, and that crew resource management training was inadequate or completely lacking.

4.6 Aircrew rostering and fatigue

Fatigue of flight crew has been shown to be a significant factor in many aircraft accidents. Regional airline operations were characterised by many relatively short flights. In addition, pilots operating aircraft with fewer than 10 seats frequently did all the ground duties such as loading baggage, checking tickets and calculating aircraft weight and balance. Regional airline operations could be characterised by having a high pilot workload over most of the duty period. As most flights were conducted partly or entirely in uncontrolled airspace, the pilots of those flights were solely responsible for separation from other aircraft, terrain clearance, and evaluation of meteorological conditions. Accordingly, regional airline operations had a greater potential for fatigue than operations over longer routes or in controlled airspace.

> While our 36-seater is a very safe aircraft equipped with GPWS and autopilot, the 19 seater is hand-flown for up to eight sectors in one duty [period], sometimes in very poor

weather. At 250 knots when some sectors are only 15–20 minutes with an approach at each, on the sixth or seventh sector, the fatigue experienced by the crew can be debilitating. (Pilot, respondent 155)

4.6.1 Flight time limitations

To minimise the impact of fatigue on safety, Civil Aviation Order (CAO) Section 48.1, which was applicable to regional airline operations, specified limits for the following:

- the maximum length of time that a pilot could be rostered to perform duties associated with flying, called a tour of duty;
- the maximum number of hours a pilot could fly in:
  - one tour of duty,
  - any consecutive 7-day period,
  - any consecutive 30-day period, and
  - any consecutive 365 day period;
- the maximum allowable extension, in terms of flying hours and duty hours, to a pilot's tour of duty, once it had begun;
- the minimum rest period required between a pilot's tours of duty;
- the additional rest period required following an extended tour of duty; and
- additional rest periods required after 7 consecutive days of duty.

CASA could issue a dispensation to vary one or more pilot duty time limits. There were no regulations covering a flight attendant's times on duty, hours flown or rest periods.

Pilots were asked whether their company complied with the flight and duty time limits specified in the CAOs or in a dispensation granted by CASA. Seventy-three per cent of pilots said their company always complied with the limits, whether laid down in CAOs or an dispensation. Although most respondents who reported that their companies did not always observe flight and duty limits said that non-compliance was an infrequent event, there was evidence of a safety deficiency in relation to the observance of flight and duty time limitations.

4.6.2 Aircraft scheduled periods between flights

Many tasks must be performed in the scheduled period between flights. Those tasks include the disembarkation and embarkation of passengers, the unloading and loading of freight, aircraft refuelling, servicing and cleaning, and the pre-flight inspection of the aircraft by the flight crew.

Pilots and flight attendants were asked if they had sufficient time during turnarounds to complete all their required duties. Forty-four per cent of pilots replied that they always had sufficient time, 33% frequently had sufficient time, but 23% had sufficient time 'sometimes', 'rarely' or 'never'. When the responses from pilots were compared by airline group, there were no significant differences.

Forty-two per cent of flight attendants agreed that they had sufficient time during turnarounds, but 43% disagreed. In addition, a frequent comment made in response to the general questions at the end of the survey was that turnarounds were too short.

> Pressure to complete checks on turnarounds quickly (rushed) is very high. Little fat in schedules unduly increases workload and can lead to rushed turnarounds with the possibility of missed items [in checklists]. (Pilot, respondent 579)
>
> Flight attendants are responsible for moving disabled passengers from exit seat rows, taking excess baggage from passengers, ensuring seatbelts [are] fastened, making announcements, doing headcounts and giving safety briefings to elderly/disabled passengers. There's just too much for them to do that a lot of flight attendants just give up and become more and more lax. There is just not enough time to do everything properly. (Flight attendant, respondent 123)

The proportion of pilots and flight attendants saying that they did not always have sufficient time to complete their duties during turnarounds suggested that in some airlines the time scheduled for some turnarounds may have been too short. That was considered to be a safety deficiency.

4.6.3 Length of rest period

During the rest period between duties it is essential that regional airline aircrew get time for sufficient sleep and meals, particularly when their workload during their duty period is high.

A frequent comment in response to the general questions was that the minimum rest period specified in CAO 48.1 was inadequate, particularly when the rest period occurred at the home base. Many comments reflected the feeling that the ten-hour rest period was insufficient to allow for travelling to and from work, normal domestic tasks and a good night's sleep.

With insufficient overnight rest times, pilots and flight attendants tended to cut short the length of sleep to meet timetable needs, making the crews tired before they began their next duty period.

> [After completing a] tour of duty of 10 hours, sign off at 2315. Ten hours off, 2 x travel time, 2 x eating and dressing, etc results in a maximum of 6 hours in bed. [Then] sign on at 0915 for another 9.8 hours of duty in IMC. This is a problem which occurs regularly. Crews flying a 36-passenger aircraft should not be in this position. (Pilot, respondent 276)

The number of comments on this subject showed that the use of minimum mandatory rest periods was common and they may not have been adequate in all cases. In particular, the minimum rest periods specified in CAO 48.1 may have been inadequate for an overnight rest period unless accommodation close to the airport was provided.

BASI had previously addressed the issue of pilot fatigue in July 1995 when it recommended (Recommendation R940219) that CASA should:

> …educate pilots and operators on the effects of fatigue and the need to establish flight and duty times that are commensurate with the demands of their flight operations. In particular, the CAA should stress that the limits imposed by CAO 48.0 are maximum limits and lower limits may be appropriate to some types of operations.

In response to that recommendation, CASA indicated that it would address that subject in future industry education programs. The Bureau has recently been advised that an article related to fatigue issues is to be included in CASA's magazine, *Flight Safety Australia*.

4.6.4 Dispensations to flight and duty time limitations

In the early 1990s, CASA granted dispensations against CAO 48.1, pending a review of the regulations. However, the review has not been completed and regional airlines have been

operating on a variety of flight and duty time systems. CASA has not evaluated pilots' reactions to the flight and duty limits set out in dispensations.

It is apparent from pilot comments that the issues of flight and duty time limits have not been resolved satisfactorily. Some flight crew suggested that dispensations were used by some airlines without full consideration of their impact.

> The [dispensation] system should be disbanded and revert back to the straight CAO 48 because if a pilot is worked (by the company) to the maximum that the dispensation allows, the fatigue becomes a major factor for that person. (Pilot, respondent 200)

> I have seen [CASA approved] duty time 'experiments' with no consultation with the guinea pigs—the pilots. (Pilot, respondent 444)

CASA has established a working group to review flight and duty time limitations. However, progress towards new standards has been slow. There is a need to achieve a regulatory resolution of these issues and ensure that appropriate flight and duty time limits are applied across the industry. There is also a need to evaluate the impact on safety of any approved dispensations to the present limitations.

4.6.5 Drug and alcohol abuse

This survey found no evidence to suggest that alcohol abuse or illegal drug use was a widespread safety problem in the regional airline industry. Drug and alcohol abuse featured in none of the reported incidents and was mentioned by only two respondents in the general questions on the greatest safety problems.

4.7 Airspace management

4.7.1 Flight notification and search-and-rescue (SAR)

Pilots of regular public transport flights were required to provide details of their flight to air traffic services (ATS) or to a responsible person so that search-and-rescue (SAR) action could be initiated if the aircraft did not arrive safely at its destination. To meet that requirement, pilots of IFR aircraft were required to submit a flight plan, but pilots of VFR aircraft flying RPT services had the option of submitting a flight plan or leaving details with a responsible person on the ground. The Manual of Air Traffic Services defined SARTIME as a time nominated by a pilot for the initiation of SAR action if an ATS unit had not received a report by a nominated time. SARWATCH was a generic term covering SAR alerting based on either reporting at positions nominated on a flight plan or reporting at nominated times or SARTIME.

Over the last five years, BASI has received a number of reports relating to incidents of pilots arriving at their destination and finding that the ATS unit covering their destination was unaware of the aircraft's SARTIME. The survey sought to determine the extent of the problem.

The most common form of flight notification used by the survey respondents was to file IFR flight plans. Ninety-four per cent expected an ATS unit to initiate SAR action if the pilots failed to notify their arrival at their destination, while 5% expected SAR action to be initiated by their company operations staff. When asked whether the relevant ATS unit always knew of their SARWATCH or SARTIME, 93% of respondents believed that ATS were always aware, 3% felt that ATS was not always aware and 3% were unsure.

The responses outlined above and the absence of any safety concerns from respondents regarding flight notification and SAR, indicated that no widespread SAR-related safety problems were apparent in the regional airline industry.

4.7.2 Frequency congestion

ATS procedures current at the time of the survey allowed for both air traffic controllers and flight service officers to provide services to aircraft outside controlled airspace. The term 'flight service frequencies' used in this report refers to those aeronautical frequencies that were monitored by flight service officers.

All VFR aircraft flying above 5,000 ft and all IFR aircraft were required to monitor the appropriate flight service frequency when outside controlled airspace. During periods of low traffic density, a number of frequencies may have been combined so that they could be monitored by one flight service officer. In that case a retransmit facility was usually provided so that a transmission on one of the frequencies was retransmitted on the combined frequencies. When frequencies were combined in that way there was a potential for communication congestion. The Manual of Air Traffic Services recommended that a retransmit facility should be switched off whenever practicable.

At the time of the survey respondents were asked if they had experienced, in the last 12 months, delays of more than 2 minutes due to congestion on flight service frequencies. Seventy-two per cent of respondents replied that they had. Pilots were also asked to nominate any areas or frequencies where they had experienced a problem with congestion. Answers were provided by 271 pilots (70% of the pilot respondents) nominating 84 different locations or frequencies. Replies varied from individual airfields to regions (for example, north coast of NSW) and states.

The two most frequent comments provided were:

- that the congestion problem was greatest when frequencies were combined and retransmit was in use; and
- that the congestion problem was greatest at weekends.

> Broadcasts from aircraft in Geraldton can be heard on a different area frequency in Kalgoorlie or Esperance. These locations are 600 miles apart. (Pilot, respondent 15)

It was concluded that congestion on flight service frequencies, particularly when frequencies were combined and retransmission was in use, constituted a safety deficiency. The number of different locations nominated and their wide distribution across Australia suggested that this safety deficiency was widespread.

4.7.3 Airfield traffic density

Some airfields, usually those with higher traffic density, were designated as Common Traffic Advisory Frequency (CTAF) or Mandatory Broadcast Zone (MBZ) airfields. At those locations, a frequency, different from the area frequency, was designated for pilots to communicate with each other and arrange their own separation.

When pilots were asked for the greatest safety problem faced by regional airlines, one of the most frequent answers was the density of traffic at CTAF and MBZ airfields.

Pilots were specifically asked to nominate any uncontrolled airfields (those without a control tower), at which the density and mix of traffic made it difficult to maintain safe separation with other aircraft. A total of 248 pilots responded, nominating 98 different airfields. In descending order, the 12 airfields most frequently reported were:

- Port Macquarie, NSW
- Bundaberg, Qld
- Wagga Wagga, NSW
- Dubbo, NSW
- Devonport, Tas.
- Gladstone, Qld
- Wynyard, Tas.
- Hervey Bay, Qld
- Bathurst, NSW
- Lismore, NSW
- Kingscote, SA
- Ayers Rock, NT.

All were MBZ or CTAF airfields. The list was based on the number of reports from respondents and did not take into account the frequency of regional airline operations at those locations. It is possible that the density and mix of traffic at the above uncontrolled airfields may be a safety deficiency.

4.7.4 Common traffic advisory frequencies

All aircraft within an MBZ and all radio-equipped aircraft within a CTAF were required to make broadcasts on the frequency allocated to that airfield. MBZ airfields were allocated individual frequencies but most CTAF airfields were allocated the same frequency of 126.7 MHz. Some CTAF airfields were allocated a different frequency. For example, Orange and Cudal were allocated 119.0 MHz. The common frequency for most CTAFs was introduced to assist pilots in remembering that frequency.

When two or more CTAF airfields were situated within radio range of each other, pilots were required to announce the airfield that they were using at each radio call. CTAF airfields were sufficiently numerous that most were within radio range of at least one other CTAF airfield.

Survey comments indicated that the following problems were occurring at CTAF airfields:

- pilots frequently forgot to include the name of the airfield in transmissions, resulting in confusion among other pilots using CTAFs within radio range; and
- at times congestion made it impossible to make the required transmission before entering the CTAF zone boundary. Hence regional airline aircraft were arriving at the airfield without receiving information on other traffic and without advising other traffic of their arrival.

Only one respondent advised of a problem with congestion on an MBZ frequency. That was related to Wynyard and Devonport in Tasmania, which were on the same frequency. As only a short distance separated those two airfields, one MBZ covered both and only one frequency was allocated.

The fact that the respondents did not, in general, mention similar problems at MBZ airfields, suggested that allocating the same frequency to most CTAFs caused those problems. While there was merit in having a common frequency for all CTAF airfields, that may have needed amending where a number of CTAF airfields were in close proximity. The allocation of the same frequency (126.7 MHz) to most CTAF airfields was found to be a safety deficiency.

4.7.5 Primary control zone size

In the two years prior to the survey, the dimensions of some primary control zones (the controlled airspace surrounding major airfields) were reduced. Anecdotal evidence suggested that the new control zone boundaries resulted in some regional airline aircraft leaving and entering controlled airspace several times when flying their normal descent profile. This resulted in a high workload for the ATS staff and the pilot, with the risk that the regional airline aircraft may have conflicted with other aircraft operating just outside the control zone boundary. Descent profiles of some aircraft may have been difficult to alter as they were dependent on aircraft speed limits and engine-handling considerations.

In 1994, BASI recommended to the CAA that aircraft which planned to fly in controlled airspace remain in that type of airspace unless the pilot requested otherwise (IR940164). The CAA accepted that recommendation and amended the Manual of Air Traffic Services accordingly.

In the survey, pilots were asked if their aircraft would depart controlled airspace while following a normal descent profile into a primary control zone. Thirty per cent of respondents replied that that would happen. The proportion of pilots reporting that difficulty was significant, and indicated that that problem was not restricted to one or two control zones or a small number of airlines. Therefore, the dimensions and design of some primary control zones were considered to be a safety deficiency.

4.7.6 Traffic conflictions

Regional airlines operated to many destinations with uncontrolled airports. During the considerable proportion of the time that they operated outside controlled airspace, pilots were responsible for maintaining their own separation from other aircraft. Loss of separation incidents constituted 12% of the regional airline aircraft incidents that were reported to BASI for the period 1986–1995.

The most frequently described incidents from the survey were near-collisions. As there were no separation standards for operations outside controlled airspace, any situation where a pilot felt that operations were compromised by the proximity of another aircraft was classed as a near-collision. Thirty-seven per cent of pilots who responded advised that they had experienced a near-collision in the previous twelve months. The locations of those events are shown in Table 5.

Table 5: General locations of reported near-collisions

Location	Number of reports	(%)
In an MBZ	64	46%
In a CTAF	31	22%
In controlled airspace	13	9%
Other location (such as GAAP airfield)	12	9%
Outside controlled airspace and more than 20 NM from an airfield	9	7%
Within 20 NM of an uncontrolled airfield (not an MBZ or CTAF)	6	4%
Just after leaving controlled airspace	4	3%

The results indicated that in the majority of cases the other aircraft was operating under VFR. Two-thirds of respondents reported that the pilot of the other aircraft had not made the correct radio calls before the incident. Twenty-two per cent of pilots advised that the two conflicting aircraft were operating on different frequencies at, or immediately before, the occurrence.

It appeared, therefore, that non-adherence to correct radio procedures was a significant factor in those near-collisions. It is possible that, in many cases, the correct radio calls were made on an incorrect frequency. The large number of VFR aircraft involved suggested that the non-adherence of VFR pilots to correct radio procedures, and their inability to confirm they were on the correct frequency, may have been safety deficiencies.

Twenty-four per cent of pilots agreed that they had inadvertently made radio calls on the wrong frequency when entering an MBZ or CTAF. Hence, that type of error may have been a factor in a number of the near-collision incidents.

A substantial proportion of pilots (39%) reported that they had missed a radio call from conflicting traffic while changing between the flight service area frequency and the MBZ/CTAF frequency. The responses suggested that the radio procedures at MBZ and CTAF airfields were factors contributing to some near-collision incidents.

The survey results suggested that the highest risk of a mid-air collision involving a regional airline aircraft was in MBZ/CTAF airspace. The data also indicated that the risk of a collision in the cruise phase of flight was far less than in the terminal area, even though the greater part of the flight time was in cruise.

When respondents were asked for the greatest safety problem facing regional airlines today, the highest number of responses related to air traffic services and airspace management. The most frequent comments on this subject were:

- the inadequacy of see-and-avoid as a primary means of separating aircraft, particularly at the speeds of modern turboprop aircraft;
- VFR pilots who were not sufficiently aware of the procedures used by IFR pilots and were therefore unable to perceive a confliction and take appropriate action; and
- the lack of information available to IFR pilots about VFR aircraft, as the ATS system no longer provided details, and many VFR pilots were not using correct radio procedures.

In July 1996, BASI recommended that CASA publish details of the final inbound instrument approach paths at aerodromes in a form which would assist VFR pilots to avoid these areas. It also recommended that CASA highlight to VFR pilots the need for caution and vigilance when operating in the vicinity of final instrument approach legs (IR950206).

In its report *Limitations of the See-and-Avoid Principle*, BASI (1991) concluded:

- unalerted see-and-avoid is subject to serious limitations, such as time spent performing duties other than looking for traffic, the field of view available from the cockpit, and the limitations of the human eye in detecting another aircraft at a distance;
- unalerted see-and-avoid should never be the sole means of separation for scheduled services; and
- alerted see-and-avoid, in which the pilot is alerted to the presence of the traffic, is more effective for avoiding collisions than unalerted see-and-avoid.

Since that report, changes to air traffic services in 1991 removed the service which provided IFR pilots with traffic information on VFR aircraft that were flying above

5,000 ft. The incidents reported to BASI, and the comments in this survey indicated that, in many cases, VFR pilots were not following the required procedures for broadcasting their positions to other traffic. Therefore, in many cases, the only means of providing separation from VFR aircraft available to regional airline pilots was unalerted see-and-avoid.

> [Our greatest safety problem] is VFR aircraft outside controlled airspace and within MBZ and CTAF areas. Private pilots seem reluctant to talk on the radio to RPT aircraft. [It is] often hard to extract basic positional information from them to avoid possible conflict situations. The see-and-avoid concept is totally unacceptable in a high-workload, high-speed modern turboprop operating into CTAF areas with no radio requirements. (Pilot, respondent 455)

> [Our greatest safety problem is] departure/arrivals/descent into uncontrolled airports where many light aircraft don't reply or listen to required frequencies. Also the fact that many now don't even have to use a radio or notify their presence—and they don't. (Pilot, respondent 521)

> Prior to the changes to the airspace, [Flight Service] gave us all known traffic and we decided if a collision risk existed and reacted accordingly. Now the pilot with the least experience listens to our broadcasts and he only responds if he thinks a risk exists. He often has his hands full flying his own aircraft and has absolutely no idea of how fast high performance aircraft can get into his area. Safety has been put in the hands of the lowest common denominator. (Pilot, respondent 325)

The significant number of regional airline pilots who expressed concern about operations in MBZs and CTAFs, the data supplied by pilots on the characteristics of near-collision incidents, and the number of incident reports received by BASI, all indicated that risk of a mid-air collision in an MBZ or CTAF was a safety deficiency. The minimum traffic separation procedure for regional airline aircraft should have been alerted see-and-avoid. That could have been achieved by a number of means including:

- requiring all regional airline aircraft to be equipped with an Airborne Collision Avoidance System (ACAS) and mandatory transponders in all aircraft in MBZ/CTAFs. In response to the BASI Interim Recommendation (IR950117), issued in June 1995, CASA announced that it would mandate the fitment of ACAS to large commercial aircraft and is developing an NPRM for the introduction of ACAS/TCAS equipment for aircraft fitted with less than 30 seats.
- introducing a ground-based system that interrogated transponders of aircraft within the MBZ/CTAF and broadcast traffic information on a discrete frequency;
- improving procedures for the broadcasting of position information by VFR aircraft, e.g. mandatory radios for aircraft operating in an MBZ/CTAF when there were RPT operations, a means of confirming that an aircraft was transmitting on the correct frequency such as Aerodrome Frequency Response Units, and the monitoring and enforcement of mandatory radio procedures in MBZ/CTAFs; or
- establishing an ATS unit or Unicom at the airfield.

In January 1994, BASI recommended that the CAA commit greater resources to ensuring that pilots comply with MTAF and CTAF radio procedures (R930204). However, the CAA indicated that it had insufficient resources to conduct that task.

In July 1997, BASI recommended that CASA and Airservices review MBZ and CTAF procedures to ensure that aircraft operate on the correct frequency. Airservices responded to the recommendation in September 1997 and introduced changes to procedures. CASA responded to the recommendation in November 1997 and has implemented some changes to procedures and regulations. (see chapter 6 of this report – Safety Action)

4.7.7 Provision of operational information

NOTAMs

Before conducting any flight, flight crew must obtain current information relating to that flight. NOTAMs contain information that is of a temporary nature or requires immediate publication. NOTAMs may advise of:

- airfield facilities temporarily not available (for example, runways being repaired);
- current or imminent changes to air traffic services (for example, closure of a control tower);
- the activation of restricted airspace, such as for military firing activities;
- any unserviceability of a communication or air navigation facility, such as the failure of a navigation beacon; or
- a hazard to air navigation (for example, a tall crane being operated near an airfield).

At the time of the survey there were three types of NOTAMS:

- Head Office NOTAMs (applicable to the national aviation system);
- Flight Information Region (FIR) NOTAMs (applicable to specific regional areas); and
- Location NOTAMs (applicable to specific airfields, navigation facilities or restricted airspace).

Guidance on the production of NOTAMs is provided by ICAO Annex 15, which advises that,

> NOTAMs shall be composed of the significant/uniform abbreviated phraseology assigned to the ICAO NOTAM Code, complemented by ICAO abbreviations… and plain language.

The Manual of Air Traffic Services instructs NOTAM office staff to keep NOTAMs to a reasonable length consistent with clarity.

There were several means for flight crew to obtain current meteorological information and NOTAMs. They could obtain a verbal briefing by telephone, or a faxed briefing from Airservices Australia's AVFAX service. Most airlines had a current AVFAX briefing in their flight-planning room for the use of pilots; however, crews commencing their duty period away from their home base would usually have to make their own request to AVFAX.

The majority (85%) of pilots surveyed were satisfied with the information obtained from AVFAX, while 13% were not satisfied. Ninety-three per cent of pilots reported that they understood the information and 70% felt that they received too many irrelevant NOTAMs through AVFAX.

General comments about the AVFAX service included:

- information was not route-specific;
- information was not in plain English and used too many abbreviations;
- briefings contained too many NOTAMs, particularly Head Office NOTAMs;
- individual NOTAMs were too long or contained too much information;
- AVFAX provided a good service; and
- selection codes could be confusing.

Since the survey, Airservices Australia has changed the NOTAM service to include Specific Preflight Information Bulletins (SPFIB) and Stored Routes. Those facilities allow pilots to

be more selective in their requests for NOTAMs and should alleviate many of the problems highlighted by the survey.

NOTAMs were originally disseminated by telegraphic means and, to minimise the cost of transmission, the text was kept short by the extensive use of abbreviations. With the introduction of AVFAX and electronic briefings, the need to keep NOTAMs to the shortest possible length is less important. Potter and Nendick (1997), in their study of the NOTAM service, noted that NOTAM text frequently contained unnecessary jargon, abbreviations and potentially misleading terminology.

Even though the NOTAM procedures were in accordance with ICAO recommendations, the comments of pilots in the survey suggested that those procedures were not adequate. If the pilot could not understand the NOTAM then vital safety information could be missed.

The following example of a Head Office NOTAM illustrates the frequent use of abbreviations.

FROM: 02 240043 PERM

AMD WENER PSN IN AIP ERSA GEN-46 EFF 5 DEC 96

AMD WENER TO READ S26 15.8 E128 56.8

The above NOTAM advised of the permanent correction, with effect from 0043 GMT on 24 February, to the coordinates of a reporting position called WENER which was listed in the Aeronautical Information Publication Enroute Supplement Australia, 5 December 1996 edition, page 46 of the general section. The corrected coordinates were latitude 26 degrees 15.8 minutes south, and longitude 128 degrees 56.8 minutes east.

> Clarity suffers because of abbreviations used excessively. The reality is that negligible paper is saved by using abbreviations in text. (Pilot, respondent 546)
>
> Plain language would stop a lot of the ambiguity in the text. The abbreviations of NOTAMs etc. is in my opinion, one of the major causes of violations of restricted airspace. (Pilot, respondent 631)
>
> Masses of irrelevant NOTAMs sometimes obscure the more important ones. (Pilot, respondent 466)

Overall, it appeared that AVFAX was providing a satisfactory service. However, some pilots were experiencing difficulty understanding NOTAMs due to the abbreviations they contained. The training that pilots received on NOTAMs and their abbreviations needed to be reviewed.

Meteorological services

Pilots obtain a forecast for the weather conditions expected during their flight and plan accordingly. Updates to forecasts can be obtained in-flight. Destination weather conditions determine whether additional fuel must be carried to allow the aircraft to hold in the air until the weather improves, or to divert to another airfield. An inaccurate forecast could cause an aircraft to carry more or less fuel than was required.

Pilots were asked to name any localities or areas where the meteorological forecasts had differed from the actual conditions to the extent that the safety of their flight was compromised. Forty-six per cent of pilots reported problems and 115 localities or areas were mentioned. Most localities were cited only once or twice, indicating that inaccurate forecasts were not a common problem. However, two airfields, Dubbo and Emerald, were cited by fourteen pilots each, Armidale and Merimbula both received ten reports, Broken Hill and Lismore nine reports, and Moruya and Mt Gambier eight reports each.

The number of reports citing unreliable weather forecasts suggested that a safety deficiency existed with regard to the reliability of forecasts at those eight airfields. Although three of the airfields (Dubbo, Armidale and Mt Gambier) were among the group of ten airfields with the highest numbers of regional airline movements, the other six were not served as often.

4.8 Cabin safety

4.8.1 Flight attendant training

Aircraft carrying between 20 and 36 passengers are required to carry one flight attendant (CAO 20.16.3). As that capacity aircraft is commonly operated by regional airlines, most flight attendants employed in the regional airline industry operate as 'solo' flight attendants. Therefore, those flight attendants, after they complete their training, usually work without the direct supervision of a more experienced flight attendant. Any in-flight cabin emergencies, such as a passenger collapsing or a cabin fire, had to be dealt with by the sole flight attendant.

When asked whether their initial training adequately prepared them for in-flight emergency situations, 58% of flight attendants agreed that it had, while 26% disagreed and 16% were unsure. Eighty-one per cent of flight attendants agreed that their refresher training covered all their safety duties, with 9% disagreeing and 10% unsure.

Flight attendants were asked to suggest ways in which their safety training could be improved. Their most frequent proposals were:

- more practical training in aircraft evacuations, preferably conducting practice evacuations from cabin simulators using people;
- more practical training in handling in-flight emergencies, for example by using emergency equipment such as fire extinguishers and personal breathing equipment;
- more practical first aid training, such as in cardiopulmonary resuscitation;
- more training in emergency handling by the whole crew; and
- a longer initial training course.

The fact that 26% of flight attendants felt that their initial safety training did not adequately prepare them for in-flight emergencies and that a majority of respondents commented on the need for more practical emergency training, suggested that safety training could be improved.

Civil Aviation Orders specify the following aspects of flight attendants' training and duties:

- the number of flight attendants required on a aircraft;
- the practical and theoretical extent of their proficiency test on general emergency procedures;
- training requirements on an aircraft type; and
- minimum requirements for proficiency testing, including who could conduct the test, how long the result remained valid, and the maintenance of test results.

The proficiency test requirements published in CAO 20.11 appendix 4 are brief and no other guides on safety training are published. At the time of this study, CASA did not have in place a detailed syllabus of training for flight attendants, nor a requirement for flight attendants to be licensed in the same way that flight crew and maintenance personnel must

be licensed. Anecdotal evidence suggests that flight attendant training courses differ considerably between regional airlines. Standardisation and quality of mandatory training for flight attendants could be improved if there was a detailed syllabus. The present regulations on flight attendant safety training and the amount of practical training for flight attendants in emergency procedures were found to be safety deficiencies.

4.8.2 General cabin safety questions

The flight attendant survey asked respondents to assess the importance of the following potential safety hazards, based on their experience. However, for the reasons outlined in section 3.4.2, responses to the questions were considered unreliable and no conclusions were drawn from those results alone. The nine hazards identified during the preliminary phases of the study were:

- long flight-duty times;
- amount of rest between flight duty periods;
- use of illegal drugs by flight attendants;
- alcohol abuse by flight attendants;
- the number of unaccompanied children on board;
- the number of medical-case passengers on board;
- allocation of disabled people to seats in emergency exit rows;
- dangerous goods in carry-on luggage; and
- amount and size of carry-on luggage.

Flight attendants were also asked to nominate and rate any other safety hazard. When considering cabin safety hazards, the 'amount and size of carry-on luggage' was identified as a deficiency by 97% of respondents. Only those cabin safety issues (obtained from any part of the survey) with the highest frequency of being rated as a major safety problem, are discussed.

4.8.3 Cabin baggage

As well as being the most frequently rated hazard, 'excess cabin baggage' was commonly cited as a major safety problem in other answers. No other hazard in the area of cabin safety was mentioned as frequently.

Excess cabin baggage is a particular problem for regional airlines as the types of aircraft operated have considerably less baggage storage space in the cabin than the aircraft used by high-capacity airlines. Passengers familiar with cabin baggage limits on high-capacity aircraft often expect to bring the same amount of baggage into the cabin of regional airline aircraft. Many aircraft designed to the 'normal' category standard and some designed to the 'transport' category standard do not have any overhead lockers or underseat stowage for cabin luggage. Navajo and Metroliner aircraft, two of the most common aircraft operated by regional airlines, have almost no space in the cabin for storing baggage.

As excess cabin baggage was raised as the most common cabin safety problem in two different areas of the survey, it was concluded that it was a safety deficiency in regional airline operations.

> The lack of policing of cabin baggage for both the regional and major airlines. The size, weight and number of cabin bags need to be better regulated. If an aircraft has to abort a takeoff or lands heavily there will be someone hurt when the overhead lockers fail to support the weight. The second point is how much overweight is the average airline flight when each passenger brings on a 10-kg brief case. (Pilot, respondent 167)

4.8.4 Intoxicated passengers

In addition to the list of nine specific hazards, respondents were asked to nominate and rate any other safety hazards. Although there were only a small number of answers to this question, the most frequently nominated hazard was 'intoxicated passengers'. That result was supported by answers to other questions in the survey, when incidents involving intoxicated passengers were reported as some of the most common safety incidents. It was concluded that in some airlines, the procedures for preventing intoxicated passengers from boarding were inadequate and were a safety deficiency.

4.8.5 Passengers on the tarmac

The type of incident most frequently reported by flight attendants involved the control of passengers on the tarmac. Incidents cited included passengers walking near turning propellers, passengers being blown over by propeller or jet blast, and passengers smoking on the tarmac. Passenger control on the tarmac was frequently identified as a safety problem by pilots, flight attendants, maintenance staff and ground staff. Given the potential for a serious incident, passenger control on the tarmac was considered a safety deficiency.

> During the early hours of the morning, a passenger was running towards an aircraft that he thought was his. This aircraft was not his, and it had both propellers moving. This passenger could not see the propellers due to their rate of rotation. This passenger was only about one or two metres away from this active propeller, before ground staff pulled him away. (Flight attendant, respondent 260)

> Passengers who are running late are being let out onto… tarmac after the bulk of the passengers and their flight attendants have boarded the aircraft. In their panic/hurry to catch the flight they are seen sometimes to scurry around aircraft unescorted and in some instances, a parked aircraft will have one engine running. (Pilot, respondent 412)

4.8.6 Personal electronic devices

Personal electronic devices (PEDs) include mobile telephones, radios, cassette players, video cameras, electronic games and laptop computers. Radiation emissions from those devices can interfere with aircraft electronic equipment.

Thirty-two respondents described incidents involving PEDs interfering with aircraft equipment. The aircraft involved were operated by all three groups of airlines used in this survey. The most common PEDs causing incidents were mobile phones. Laptop computers and CD players were also cited. The aircraft equipment most frequently affected were intercoms and radios. Radio navigation receivers, flight instruments and engine instruments were affected less frequently. In one incident, the aircraft deviated 5 NM off-track before the offending PED was located and switched off. The reported incidents are consistent with reports received from high-capacity and overseas airlines.

> During cruise at flight level 160 with the autopilot tracking a Trimble GPS via the electronic flight instrument system (EFIS), the aircraft started to roll 3 to 4 degrees left and right. The flight attendant was asked to check the cabin for a mobile phone being used but advised that one passenger was using a laptop computer. The aircraft had to be navigated in heading mode until the computer was switched off and the CDI flickering ceased. (Pilot, respondent 586)

4.8.7 Crew resource management

Historically, a significant proportion of accidents involving multi-crew aircraft have been attributed, at least in part, to the failure of the aircrew to perform as an effective team, or

to manage the available resources effectively. Aircrew receive extensive training in the technical skills needed to operate aircraft, but crew resource management skills have not been uniformly taught.

Crew resource management (CRM) has been defined as the effective use of all available resources including equipment, procedures and people to achieve safe and efficient flight operations. CRM concepts and training have gained increasing acceptance worldwide. Most high-capacity airlines have CRM training programs to promote non-technical skills such as clear communication, task delegation and decision making.

CRM training

On 17 May 1996, a De Havilland Canada Dash 8 aircraft sustained a serious bird strike near Broome. Although the crew had received CRM training and utilised company engineers to assist with the problem solving of the technical aspects, the flight attendant was not utilised to visually inspect the landing gear or to prepare the cabin for a non-normal landing. She was instructed that her assistance was not required. In addition, the flight attendant, who had not received CRM training, did not understand the contribution she could make to the crew's handling of the occurrence. She remained seated throughout the occurrence (BASI, 1996b).

As most flight attendants with regional airlines operate as solo flight attendants, the only other crew members they can approach for advice during emergencies are the pilots. Therefore, effective communication and teamwork between the flight crew and cabin crew has a special significance on regional airline aircraft. Past experience has shown that CRM training promotes communication and teamwork, particularly when pilots and flight attendants train together.

Although CRM training had its first applications in multi-crew aircraft, it is relevant to members of both multi-pilot and single-pilot aircraft. In an emergency, pilots of single-pilot aircraft face similar resource management problems as pilots of multi-crew aircraft. Resources such as Air Traffic Services, other company staff, technical publications, and flight management systems must be managed effectively if all the information available is to be used effectively.

Fifteen per cent of pilots flying single-pilot aircraft and 66% of pilots flying two-pilot aircraft advised that they had completed CRM training. Thirty-nine per cent of flight attendants answered that they had received CRM training, and 80% of those had completed joint training with pilots.

The fact that a significant proportion of pilots and flight attendants had not completed CRM training indicated that a safety deficiency existed in this area. However, as the majority of flight attendants reported that their CRM training was done in conjunction with pilots, the value of joint training was being recognised.

The survey asked for general comments on the safety problems faced by regional airlines. A common answer to those questions was that the lack of adequate CRM training was considered a safety problem. Those comments supported the conclusion that more aircrew needed training in CRM.

> Most pilots come from single-pilot backgrounds so we have an inherent 'do it myself' approach to situations. We need training and simulation to rely on and be confident of each other's abilities. The captain-first officer distinction needs to be diluted so more of a team approach exists to most crews. The flight attendant is often left out of the situational loop. More attention needs to be given to including them, and they need to seek more information. (Pilot, respondent 421)

Overall, there appeared to be a strong awareness among regional airline aircrew of the importance of CRM to safe flight operations. However, the large proportion of aircrew members who had not completed CRM training represented a safety deficiency.

Crew resource management training is mandated in several countries including the UK and USA for aircrew involved in low-capacity and high-capacity airline operations. In July 1995, BASI released Interim Recommendation 950101, which recommended that the CAA (now CASA) require operators involved in multi-crew air transport operations to ensure that their pilots and flight attendants received training in CRM principles. In February 1997, CASA advised BASI that it intended to introduce regulations to that effect. At the time of this report, CRM training had not been mandated in Australia.

CRM and crew communication

A number of overseas accident investigations have highlighted the importance of communication between crew members. For example, in the investigation of the crash of a Fokker F-28 at Dryden, Canada, it was found that concerns expressed by two experienced airline pilots who were travelling as passengers were not passed by the flight attendants to the pilot in command (Wiener et al, 1993). In an accident on 8 January 1989, the flight crew of a Boeing 737 incorrectly identified the right engine as the source of vibration and smoke, and shut it down. The information that three flight attendants had seen fire coming from the left engine was not passed to the flight crew. The left engine subsequently lost power and the aircraft crashed near Kegworth, Leicestershire (AAIB, 1990). Thus, effective communication between crew members is an important aspect of CRM, particularly during an emergency.

All flight attendants in the survey indicated that they would tell the pilot if they were concerned about the safety of the flight, and most (91%) believed that their concerns would be taken seriously. While 74% of pilots thought that a flight attendant who was concerned about safety would tell the pilot, 24% were unsure and 2% thought the flight attendant would not.

From those responses, it could be concluded that most aircrew were aware of the need for effective communication between all members of the crew and would attempt to communicate effectively in an emergency. However, without adequate CRM training, some of those attempts could be ineffective.

4.8.8 Flight and duty time limitations for flight attendants

The performance of both cabin crew and flight crew deteriorates with increasing fatigue. Hence a failure to manage fatigue is as much a safety issue for flight attendants as it is for technical crew. Currently there are no regulations governing flight and duty time limits for flight attendants.

Fifty-two per cent of flight attendants reported that, on occasions, they felt so tired that they were unable to do their flight duties properly. While that information is subjective, it does suggest that fatigue in flight attendants exists in regional airline operations. The absence of regulations specifying flight and duty time limits for flight attendants was regarded as a safety deficiency.

4.9 Maintenance

4.9.1 Introduction

Sixty-five responses to the survey were received from employees involved in aircraft maintenance (LAMES, AMES, apprentices, maintenance controllers or a combination of those positions). Most of the respondents (45) worked for Group 3 airlines.

Respondents were asked to report examples of incidents involving human error which had occurred during the maintenance of regional airline aircraft. Twenty-eight respondents provided a total of 32 reports. The most frequent incidents resulting from human error were incomplete installation of components, access panels not closed, improper rigging or adjustment of components, and improper installations. Memory lapses were the most frequent form of human error reported, although errors due to lack of knowledge and unsafe practices were also reported.

4.9.2 Questions on general maintenance problems

Respondents were asked to assess the importance of the following ten issues that had the potential to be safety hazards, based on their experience. However, for the reasons outlined in section 3.4.2, responses to those questions were considered unreliable and no conclusions were drawn from the results alone. The list was compiled following industry discussion during the preliminary phases of the project:

- rushed work;
- lack of appropriately licensed personnel;
- night work;
- excessive workload;
- qualifications of maintenance controllers;
- lack of duty time limits;
- oordination of shift handovers;
- communication with flight crew;
- alcohol abuse by maintenance staff; and
- use of illegal drugs by maintenance staff.

The survey also asked for information on any other potential safety hazard. Only those maintenance issues, obtained from any part of the survey, with the highest frequency of being rated as a major safety problem, are discussed.

4.9.3 Maintenance workload

Of the ten potential hazards, the most frequently reported as a major safety problem was ‘rushed work’ followed by ‘excessive workload’. The first of those hazards was rated as a major safety problem by 50% of respondents, particularly by those working for Group 3 airlines.

The results suggested that there was a lack of maintenance resources appropriate to the workload and schedules. In addition, when all respondents were asked in the general section of the survey to nominate the greatest safety problem facing the regional airline industry, the two most commonly mentioned safety problems were ‘poor maintenance procedures or schedules’ and ‘poor maintenance standards’. Poor maintenance standards may have been related to pressure to complete maintenance in the minimum time.

In addition, many of the safety incidents described by respondents were examples of poor maintenance completed under time pressures. Eight of the maintenance-error incidents described were related to haste or high workload. Although the sample of incidents was not large, the results suggested that in some regional airlines, insufficient numbers of maintenance staff was a safety deficiency.

> [I have seen] fuel leaking out of the airframe area around the refuelling point/valve whilst refuelling. This area is directly under and close to the engine exhaust area. No parts to fix the system, no time to fix the system and it has been like it for months. (LAME, respondent 398)

> An air pump [on an engine was] changed with limited time and no engine run was carried out to ensure all OK and no missed oil leaks. The aircraft lost many litres of oil in [its first flight]. [This incident was caused by us] trying to do a 60-minute job in 30. (LAME, respondent 209)

> A wrongly installed door hinge bracket on a [twin engine turboprop, caused] a left main gear extension failure, resulting in a wheels-up landing. [This was caused by] trying to short cut repair to save time and costs. (LAME, respondent 259)

4.9.4 Lack of duty time limitations

There are currently no legal restrictions on the hours that can be worked by aircraft maintenance engineers. While fatigue was not reported as a problem by the majority of maintenance personnel, it was cited as a factor in six of the incidents reported by maintenance engineers. Twenty-nine per cent of respondents reported that they were sometimes so tired at the end of a long work period that they could not perform their tasks properly.

Half of the maintenance respondents reported that in the previous twelve months they had been called upon to work a duty period longer than fourteen hours, and a third of the respondents had worked for a period of 18 hours or longer in the previous year.

The analysis of the survey responses indicated that some regional airline maintenance staff were, on occasions, affected by fatigue while working on aircraft. Fatigue detrimentally affects work performance and research has equated the effects of long periods of wakefulness with those produced by alcohol consumption (Dawson & Reid, 1997), yet there are no regulations to prevent severely fatigued staff carrying out maintenance.

It was concluded that some maintenance workers were affected by fatigue related to long periods of duty and that the absence of regulations limiting the maximum duty period of maintenance staff was a safety deficiency.

> Due to company pressure, lack of personnel and a lack of a legal duty period, I worked approximately 29 hours straight. The last job I had to do was a simple engine component change, one I had done many times before. Following the fitment of the component, I could not focus on the correct rigging procedure for the component. My concentration had lapsed to a point where I could not conduct a simple task… Companies adopt the 'you will stay until the job is finished' attitude. (LAME, respondent 487)

> I find it hard to understand. I am limited to time worked so fatigue does not interfere with safety but the flying machine which we all rely on, may have been worked on by tired and fatigued engineers with no time limits on work periods and rest periods. (Pilot, respondent 420)

> It's basically up to the individual to call it quits when tired; however, this can lead to pressure being put to the individual by the company to do the right thing i.e. work a bit longer to get the aircraft out. This could mean a work day in excess of 16 hours. Tiredness now becomes a major safety deficiency, either for yourself or the passengers and aircrew. (LAME, respondent 428)

4.9.5 Equipment and parts

The general section of the survey asked respondents to nominate the greatest safety problem they faced. A lack of spare parts was mentioned more frequently than any other maintenance related issue.

Maintenance staff were specifically asked if the tools and equipment needed to perform their jobs were readily available. A majority of respondents who worked for Group 1 or Group 2 airlines were satisfied with the availability of tools and equipment. However, approximately half of those who worked for Group 3 airlines (23 respondents) were dissatisfied with the availability of tools and equipment. The lack of ready access to tools, equipment and parts by some maintenance workers was found to be a safety deficiency.

> [The greatest safety problem we face is that] the increasing maintenance costs, availability of spares, etc, creates scheduling difficulties and puts pressure on crews to fly aircraft with unserviceable items. (Pilot, respondent 552)

> [The greatest safety problem we face is] unserviceable aircraft being put back on line due to lack of parts (LAME, respondent 409)

4.9.6 Training of maintenance personnel

While most of the maintenance respondents were satisfied with the training on their most recent aircraft type, 28% of maintenance personnel expressed some dissatisfaction with the training they had received. Respondents who worked for Group 3 airlines tended to be less satisfied with their training than the respondents who worked for Group 1 or Group 2 airlines.

Inadequate training or lack of knowledge was nominated as a factor in seven of the reported maintenance incidents from the survey. A theme which emerged from the incident reports was of mistakes being made by new workers and the need for careful supervision and training by more experienced workers. Inadequate technical training was also mentioned in the free response section of the survey by five of the maintenance respondents. The fact that some aircraft maintenance personnel had not received adequate training and knowledge was considered a safety deficiency.

> I have had no training whatsoever in the last 5 years. (LAME, respondent 384)

> [I witnessed the] incorrect rigging of a [propeller] primary blade angle. [This incident was caused by the worker's] misunderstanding of the particular type of installation and lack of detailed training by the company on the type of aircraft operated. (LAME, respondent 300)

> An incorrect rig pin hole was used to rig a stabilator, causing the pilot to have very little control on the test flight. [This incident was caused by] lack of training and supervision by licensed personnel. (Maintenance supervisor, respondent 365)

4.9.7 Aircraft serviceability issues

For the purposes of this study, aircraft serviceability issues included:

- use of the maintenance release and maintenance log to record hours flown, aircraft unserviceabilities and maintenance work conducted;
- communications between maintenance staff and flight crew concerning the serviceability of the aircraft; and
- decisions made by both maintenance staff and flight crew concerning the serviceability of the aircraft.

Clear communication between maintenance staff and flight crew on the serviceability of aircraft is critical to operational safety. The correct use of the maintenance release or maintenance log is essential and is the primary means of that communication.

Use of maintenance release/log

The procedure for recording significant aircraft unserviceabilities on the maintenance release or log was examined by questions addressed to maintenance staff and flight crew.

In general, significant unserviceabilities were recorded in the maintenance release or log, although maintenance staff saw this being done less frequently than flight crew. Ninety-three per cent of flight crew and 84% of maintenance staff reported that unserviceabilities were 'always' or 'frequently' recorded. However 6% of flight crew and 17% of maintenance staff felt that unserviceabilities were only 'sometimes' or 'rarely' recorded in the maintenance release/log, suggesting that in some cases unserviceabilities went unrecorded.

The survey also sought to determine how unserviceabilities were communicated between flight crews other than by the use of the maintenance release/log. For example, on a loose piece of paper, or by being passed verbally to other crews without recording the unserviceability in a log or other appropriate document.

Thirty-one per cent of pilots reported that they verbally passed on unserviceabilities 'sometimes' or 'frequently', suggesting that this practice may have been sufficiently common to be a safety deficiency. Fourteen per cent reported that information about unserviceabilities was 'sometimes' or 'frequently' recorded on a loose piece of paper.

Flight crew were asked if they had 'commenced a flight unaware of a significant unserviceability which maintenance staff or the previous crew were aware of'. The majority of pilots (68%) said they had not been in that situation but a significant proportion (19%) reported that this had occurred.

When asked to describe a safety incident they had witnessed, three maintenance engineers reported incidents that involved incomplete documentation. One respondent stated:

> Aircraft arrived on Friday midday, and no time was stated when it had to be serviceable by. A job was started on an engine magneto which had been verbal but not written in the maintenance release. At 5.00 p.m., no-one had asked for the aircraft to be completed so the cowls were fitted and the aircraft placed outside without the maintenance being finished. On Sunday I was at the airport and a pilot was doing a daily check before departure. I was able to finish the timing and refit the cowls and sign for the job. The aircraft could have been operated unserviceable. (LAME, respondent 315)

Anecdotal evidence suggested that there was a misconception in the industry that placing any unserviceability on the maintenance release grounds the aircraft until that unserviceability has been rectified. This belief may have been the reason for some flight crews' reluctance to write an unserviceability on the maintenance release. For example, one respondent reported:

> I have seen aircraft depart for an RPT flight with what I consider to be unpermissible unserviceability. Current defects are not recorded in the maintenance release, which means that the pilot may or may not be aware of the aircraft's current defects. The unspoken company policy is not to record defects on the maintenance release. Pressure is applied to new pilots to conform. This policy avoids grounding the aircraft or having to fix it away from base. (LAME, respondent 248)

The survey results indicated that in some airlines at least, significant unserviceabilities were not always written on the maintenance release with the result that they may not have been reported to the next operational crew. That was confirmed by the number of pilots

who had commenced a flight unaware of an existing problem with the aircraft, although that had been known to the previous crew or maintenance personnel. This lack of adherence to maintenance release procedures was considered to be a safety deficiency.

Description of unserviceabilities

Maintenance personnel were asked if the description of an unserviceability given by the flight crew made it easy to identify the problem. Only 3% of respondents answered that this was 'always' the case, 39% said that it was 'frequently' the case and 54% indicated that it was 'sometimes' easy to identify the problem on the basis of the flight crew's description.

Overall, the responses indicated that descriptions of unserviceabilities given by flight crew were not always adequate, making it difficult for maintenance staff to identify and rectify the defect.

Recording of flying hours

Anecdotal evidence suggested that the under-recording of flying hours had been a problem in the past but that tighter surveillance by CASA had greatly reduced the frequency of that practice. The survey asked pilots how often they recorded on the maintenance release the number of hours that were actually flown. Almost all pilots (97%) answered that they always recorded flying hours accurately. Thus the survey results suggested that the inaccurate recording of flying hours was not a safety deficiency in the industry.

Decisions concerning serviceability

Maintenance staff and flight crew are required to regularly make decisions on the serviceability of the aircraft. When commercial factors are allowed to influence the decision to declare an aircraft unserviceable, passengers and crews can be put at risk.

Pilots were asked how often they operated aircraft with serious unserviceabilities, and how often they were pressured to operate with serious unserviceabilities. The survey did not define 'serious unserviceabilities' but it was assumed that this term would be understood to mean unserviceabilities that could have affected the safety of the flight.

Nine per cent of pilots said that they were 'sometimes' or 'frequently' pressured to fly with serious unserviceabilities, and 6% indicated that they did in fact fly at times with serious unserviceabilities. Pilots who reported that they were sometimes pressured to fly unserviceable aircraft were employed by airlines from each of the three groups.

When asked for the greatest safety problem faced by regional airlines, pilots commonly mentioned the pressure on pilots to continue to operate unserviceable aircraft. Maintenance staff similarly reported that they were often under pressure to 'cut corners' in maintenance so that the aircraft could be released for flying. The responses indicated that the pressure on some flight crew, on occasions, to fly aircraft with serious unserviceabilities was a safety deficiency. Similarly, the pressure on some maintenance staff to allow aircraft with serious unserviceabilities to fly was also a safety deficiency.

> [The greatest safety problem we face is] unserviceabilities which are either deferred or signed off, but have not been rectified. CASA issues Permitted Unserviceabilities for an aircraft without full regard to the unserviceability concerned. (Pilot, respondent 293)
>
> [The greatest safety problem we face is] company pressures to take aircraft with defects not repaired. Maintenance pressures, no time to repair aircraft. (Pilot, respondent 497)
>
> [The greatest safety problem we face is] the pressure placed on LAMEs (and pilots to a lesser extent) by the company to 'pen' off the snag or defect so as to get the aircraft flying. (LAME, respondent 361)

4.10 CASA surveillance and regulation

This safety study did not comprehensively investigate the complex issues of surveillance and regulation. However, information relating to CASA surveillance and regulation was gathered from two questions asked of maintenance personnel, three questions asked of pilots and comments from the open response sections of the survey.

4.10.1 Flight operations surveillance

Observation flights permit CASA inspectors to gather first-hand information about an airline and to foster personal contact between CASA personnel and airline employees. In the early 1990s it appeared that the then CAA was not achieving its surveillance targets due to its limited resources (BASI, 1994) and BASI recommended that the CAA review the rates of surveillance of airlines and the adequacy of its annual inspection program (IR930244). The inspection program was subsequently updated to become the Aviation Safety Surveillance Program, that detailed national surveillance priorities. In normal circumstances, CASA required flight operations inspectors to conduct en route inspections of 0.5% of the revenue hours flown by regional airline operators, as detailed in the Civil Aviation Authority's Aviation Safety Surveillance Program Manual (CAA, 1994, p. 47).

Most pilot respondents (67%) reported that a CASA inspector had observed one or more of their flights in the previous 12 months. There were no significant differences between airlines from the three airline groups. Those results suggested that the level of flight operations surveillance by CASA of the regional airline industry had increased significantly since the early 1990s.

Forty-eight per cent of pilots thought that the current level of flight operations surveillance by CASA needed to be increased and 40% felt that the level of surveillance was adequate. Only 1% thought that there should be less surveillance. The results indicated that pilots working for Group 3 airlines wanted a greater level of surveillance than those of the other two groups.

4.10.2 Airworthiness surveillance

CASA carries out an annual program of airworthiness surveillance of air operators. Airworthiness surveillance encompasses issues such as the management structure of the operator, maintenance documentation, facilities, training and procedures. An important aspect of a surveillance program is the ramp check, where CASA personnel assess the airworthiness status of an aircraft and the standard of operational documentation during the turnaround period between flights. Forty-seven per cent of respondents had experienced at least one ramp check on their aircraft in the previous 12 months.

Fifty per cent of the 64 maintenance personnel surveyed indicated that they would like to see more CASA surveillance of maintenance. Twenty-two per cent did not want more surveillance. Those maintenance personnel in larger airlines tended to be in favour of more surveillance, while those employed in Airline Groups 1 and 2 were not.

Approximately 29% of maintenance personnel respondents employed in Groups 1 and 2 thought that CASA airworthiness surveillance was effective, while 47% thought that it was not effective.

4.10.3 Specific comments related to CASA surveillance and regulation

A frequent comment was that CASA inspectors did not always have the necessary knowledge and training to conduct effective surveillance.

Another frequent comment was that surveillance would be more effective if it were in greater depth, going beyond the first level of documentation to check if the documents reflected the actual situation. Surveillance based purely on checks of documents may have resulted in falsification of those documents by less scrupulous operators.

> [The greatest safety problem we face is]…CASA surveyors not knowing where to look to find the shortcuts that some companies take. (Pilot, respondent 442)

> [CASA] do not look in complementary areas to see what is really happening, i.e. logbook checks need to be checked against trip records for aircraft and flight and duty sheets. The same with maintenance. When 20 MELs appear the day the aircraft is due for maintenance, you would think CASA would start to wonder why. (Pilot, respondent 331)

> The inspector did not find any problems even though I was aware that there was a number of them. Defects not allowed under the minimum equipment list but which the operator considered safe, were not recorded on the maintenance release. Load sheets, baggage and fuel figures were reduced to make the aircraft appear below maximum takeoff weight. A feeling amongst pilots that CASA inspectors did not want to rock the boat but wanted to be seen to be doing the right thing. (Pilot, respondent 218)

4.10.4 Application of regulations

Frequent comments from the survey concerning regulation of the industry were that regulations were not consistently enforced by CASA. Several recent airline accidents in Australia have been linked to inconsistent application of regulations. BASI recommended to CASA that it ensure its regulatory staff are adequately trained to apply legislation, regulation and administrative procedures (R960074). CASA accepted that recommendation.

> [The greatest safety problem we face] is charter operators who operate RPT schedules day in day out [using lower safety standards] and CASA look the other way. (Pilot, respondent 540)

> [The greatest safety problem we face is] too many operators, most of whom have very limited resources, competing for relatively little business. As a consequence of this, safety in all aspects of operations must remain a negotiable item in the eyes of misguided small operators in order for them to survive. CASA as regulator, continually demonstrating reluctance to withdraw the AOCs of marginal operators, large and small, and failing to ensure prosecution of owners, operators and managers. (Pilot, respondent 267)

The need for surveillance by the regulator was generally accepted by the industry. The survey results suggested that the frequency of surveillance of the regional industry appeared to have increased significantly in recent years. The comments on the need for more in-depth surveillance were consistent across the different professional groups of the respondents.

The lack of in-depth surveillance inspections and the inconsistent enforcement of regulations by CASA were considered safety deficiencies.

4.11 Safety reporting

4.11.1 Acknowledgment of air safety incident reports (ASIRs)

BASI does not acknowledge the receipt of air safety incident reports (ASIRs) unless the reporter specifically requests an acknowledgment. However, the survey showed that 77% of pilot respondents expected to receive an acknowledgment after submitting an ASIR. The lack of automatic acknowledgment by BASI of report forms may have wrongly given the

impression that BASI was not interested in the report and that may have discouraged reporting of safety incidents.

The Bureau is introducing a system that will permit ASIRs to be submitted via the BASI internet site. Automatic acknowledgement of the receipt of an ASIR will be a feature of the new system.

4.11.2 Submission of safety reports by flight attendants

Forty-four per cent of flight attendant respondents said that they would submit a report to BASI if they were concerned about a safety incident. A further 44% were unsure and the remaining 12% would not submit a report to BASI. However, most flight attendants (96%) reported that they would inform their supervisor if they had a safety concern.

While good communication with supervisors may reduce the need for flight attendants to rely on BASI's air safety incident reporting system, there is a legal obligation to report to BASI. Although respondents were not asked to elaborate on their answer, it was possible that many flight attendants were unaware of how to use the air safety incident reporting system and had little knowledge of BASI's role in air safety. That indicated a possible shortcoming in BASI's industry education program.

4.11.3 Safety officers

There is no regulatory requirement for regional airlines to have a safety officer. However, some airlines have appointed a safety officer and there is a growing awareness of the importance of that role. In small organisations, the safety officer may be a part-time position. One role of a safety officer is to receive reports of safety concerns and coordinate the company response to such concerns. In August 1996, BASI recommended that CASA consider whether airlines should be required to have a safety officer and/or a safety department (IR960037). CASA accepted that recommendation but had not yet implemented it at the time of this report.

A significant minority of respondents (37%) reported that they would be more inclined to report a safety concern to a company safety officer than to their supervisor. That finding suggested that the communication of safety concerns within regional airlines could be improved by the appointment of a safety officer. The absence of an appointed safety officer within a regional airline was regarded as a safety deficiency.

4.12 Airline safety culture

Poor safety culture has been cited as a factor in a number of serious accidents such as the Air Ontario Fokker F28 accident at Dryden, Canada (Moshansky, 1992), the Clapham Junction railway disaster in London, United Kingdom (Hidden, 1990) and the Herald of Free Enterprise ferry capsize at Zeebrugge, Belgium (Department of Transport, 1987).

The safety culture of an airline can be assessed by employees' perceptions of the importance of safety and how it is maintained within the workplace. A good safety culture can be characterised by employees sharing similar positive behaviours and attitudes about organisational safety. Turner, Pidgeon, Blockley and Toft (1989) (cited in Pidgeon & O'Leary, 1994) provide the following definition of safety culture:

> A set of beliefs, norms, attitudes, roles and social and technical practices within an organisation which are concerned with minimising the exposure of individuals, both within and outside the organisation, to conditions considered to be dangerous. (p. 23)

Assessing the safety culture of an operator can be an important predictor of an organisation's safety performance. According to ICAO (1993), a good safety culture has the following attributes:

- senior management placing a strong emphasis on safety;
- staff having an understanding of hazards within the workplace;
- senior management's willingness to accept criticism and an openness to opposing views;
- senior management fostering a climate that encourages feedback;
- emphasising the importance of communicating relevant safety information;
- the promotion of realistic and workable safety rules; and
- ensuring staff are educated and trained to understand the consequences of unsafe acts.

The questionnaire used in the survey included a section to measure safety culture using the short form of the Airline Safety Culture Index. The Airline Safety Culture Index was developed by Edkins and Coakes (1998) to measure safety culture in the Australian regional airline industry as part of the BASI-INDICATE project (BASI, 1996d; 1997c).

The mean safety culture scores for airlines from each of the three airline groups all fell within the 'average' range. However, within that range, there was a significant difference between the safety cultures of airlines from the three groups. Group 1 airlines (aircraft with less than 10 seats) rated best on safety culture, followed by Group 2 airlines (10 to 19 seats), and finally by Group 3 airlines (more than 20 seats).

Smaller operators may have had a better safety culture because it is easier to distribute, manage and communicate safety information within a smaller group of people. Also it is easier to form and maintain close links with management and to be aware of all the safety activities within a smaller organisation. To achieve an effective safety culture in a larger organisation may require more elaborate strategies and systems, such as safety newsletters and regular safety briefings.

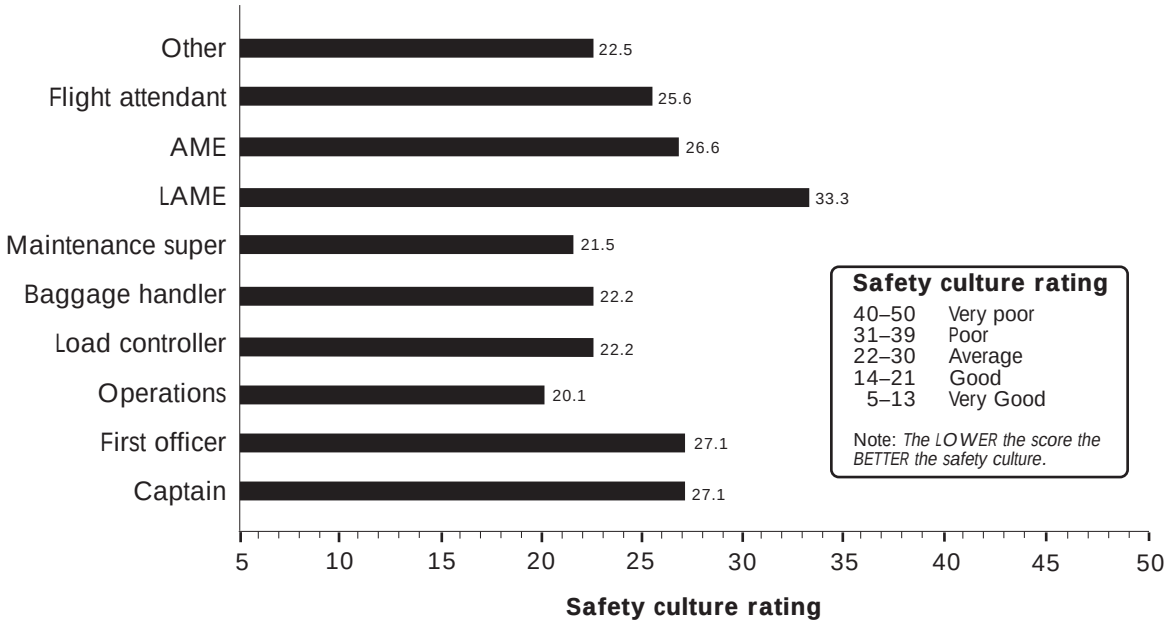
The results indicated that respondents generally agreed that within the company they worked for:

- managers regarded safety to be important;
- managers were involved in safety activities;
- managers often discussed safety issues with employees;
- employees were kept informed of safety changes;
- new employees were provided with sufficient safety training;
- managers did all they could to prevent accidents;
- safety hazards and problems were rectified quickly;
- unsafe activities were generally stopped by management; and
- safety was generally well controlled within the company.

However, respondents agreed that more feedback could be given regarding their company's safety performance.

Safety culture scores were also compared by professional group and again significant differences were found (see Figure 4).

Figure 4: Safety culture differences by professional group



Licensed Aircraft Maintenance Engineers (LAMEs) gave the poorest ratings on the safety culture scale. That may have been due to the relative neglect of this staff group in terms of human factors and safety awareness training (Taggert, 1990). LAMEs also tended to receive less safety-related feedback and were given less information and fewer prompts to encourage safety compliance than other occupational groups (BASI, 1997b). Therefore, more effort may need to be directed at that group so that they are provided with greater opportunities to participate in safety activities.

4.12.1 Improving safety culture

Edkins and Coakes (1998) identified safety information as a dominant factor in safety culture. That suggests that the best strategies for improving company safety culture should focus on ensuring that employees are given sufficient safety training and information so that they are more clearly aware of their safety responsibilities.

Most authorities agree that safety culture begins at the top level of the organisation and permeates downwards to those at the 'sharp end' (Williams, 1991). Therefore, identifying and shaping safety culture is dependent upon senior management commitment. Lautman and Gallimore (1987) found that top management commitment to safety was crucial in the operations of those airlines with exceptional safety records.

The results of this survey showed that overall there was a good awareness of the importance of safety culture, and that many operators had a good safety culture. However there was the need for better feedback in regard to safety performance, particularly with regard to staff employed in aircraft maintenance.

These results may not be representative of all operators in the regional airlines industry. A positive consequence of a good safety culture is an awareness by employees of safety issues, and their encouragement by management to be involved in safety related activities. It is possible, therefore, that the results of the survey may be biased towards operators with a good safety culture.

4.13 Perception of safety of the regional airline industry

4.13.1 Safety of employees' own airline

Respondents were asked to consider the general safety standards of the regional airline industry.

Twenty-six per cent of respondents felt that the safety of the industry had improved over the last year while 59% felt that it had stayed the same. When the same comparison was made over the previous five years, 48% of respondents felt that the safety of the industry had improved and 15% felt that it had stayed the same. While that was a comparative assessment, and not a finite guide to the safety level of the industry, it did show that there was a perception of an improvement in the safety of regional airline operators.

Survey respondents were asked for their rating of the overall safety of the airline for whom they worked. Over 92% replied that their airline had 'adequate', 'good' or 'excellent' safety standards, while only 6.6% answered 'poor' or 'very poor'. When considered with the results of the question on comparative movements in safety standards, the results showed that, in general, the employees perceived the regional airline industry as having an acceptable safety standard.

4.13.2 Safety of other regional airlines

In order to prompt respondents to consider the factors which can reduce the safety of regional airlines, respondents were asked to reflect on the advice that they would give to a family member planning to travel on regional airlines. Fifty-seven per cent of respondents said they would advise family to avoid some airlines. The reasons for avoiding certain airlines are shown in Table 6.

Table 6: Reasons for Avoiding a Specific Regional Airline

Response Category	Frequency	(%)
Quality of employees (experience, qualifications, attitude)	138	32%
Poor maintenance	123	29%
Reputation of the airline in the industry	61	14%
Safety record of airline (previous accidents)	41	10%
General standards (cleanliness, well-kept aircraft)	23	5%
Size of the airline	22	5%
Known breaches of regulations	13	3%
Miscellaneous	10	2%

> After working in the industry, I now realise that regional airlines operate on a tight budget and operate on the idea of getting the aircraft on line and away at all costs. Some airlines have less money and support than others and these must suffer in all areas – maintenance and safety. (LAME, respondent 384)

> I have worked for two commuter airlines and had close association with two or three others. I would not let my family travel on any of them because of their maintenance and/or pilot standards. (Pilot, respondent 408)

> Having done several audits on other airlines for my company, I note that although many operators are well intentioned, commercial pressures occasionally force them into taking short-cuts. (Pilot, respondent 057)
>
> Some airlines are not interested in flight standards. Their management resists efforts by pilots and engineers to raise standards. In fact, people who pressure their fellow employees to violate [the flight time limits regulations], fly overweight or with unserviceable aircraft, bust minimas etc., are rewarded by management with promotions. (Pilot, respondent 569)

Over 92% of regional airline employees rated the safety of their airline as 'adequate' or better, while more than 63% of those who held an opinion said that the safety of the industry as a whole had remained the same or improved over the last 5 years.

4.14 General safety questions

4.14.1 Specific safety incidents

Respondents were asked to describe a safety incident that they had observed. The responses were grouped into various types of incidents and are listed in order of decreasing frequency:

- near-collision with another aircraft;
- aircraft being operated above maximum take-off weight;
- passengers near a hazard (turning engines, etc.) on tarmac;
- failure of an aircraft component;
- pilots violating instrument flight rules;
- examples of poor maintenance;
- poor airmanship by general aviation pilots;
- poor airmanship by regional airline pilots;
- pressure on crews to operate in unsuitable weather or into unsafe airfields;
- dangerous turbulence; and
- intoxicated passengers.

Those safety hazards are discussed in the relevant sections of this report.

4.14.2 Reported safety problems

In addition to safety incidents which had been observed, respondents were asked to nominate the greatest safety problem faced by regional airlines. The intent of those questions was to gather comments on any issue that had not been raised in specific questions in the survey, or to provide further information on any previous answers.

The 541 responses covered all aspects of regional airline operations, ranging from airspace management to passenger baggage. The issues were grouped into categories and the most frequent safety problems were identified.

The most frequently raised safety issues were, in order of decreasing frequency:

- commercial pressures;
- excessive cost-cutting in airlines;
- long, high-workload duty-periods for aircrew;

- lack of traffic information about VFR aircraft;
- inadequate training and procedures of VFR pilots;
- old aircraft;
- traffic density in some MBZs and CTAFs;
- the Airspace 2000 proposal;
- inadequate radio procedures in MBZ/CTAFs;
- inadequate continuation/emergency training for pilots;
- lack of CRM training;
- overloading aircraft/aircraft with poor performance;
- airlines with inadequate financial resources;
- lack of spare parts;
- pressure on pilots to take short cuts with safety;
- the reduction in air traffic services and number of radio navigation aids;
- excess cabin baggage;
- inconsistent enforcement of regulations by CASA;
- poor maintenance standards;
- poor attitude to safety by airline management;
- lack of expertise/experience in airline managers;
- short turnarounds;
- inadequate initial training for pilots on aircraft type;
- short overnight rest periods for aircrew;
- pressure on maintenance staff to take short cuts;
- inadequate training and knowledge of CASA inspectors;
- CTAF/MBZ frequencies overlapping;
- inadequate surveillance by CASA;
- the adequacy of 'see-and-avoid' as a means of separating high speed turboprop aircraft;
- poor maintenance procedures and scheduling;
- passenger control on tarmac.

The above issues are discussed in the appropriate areas of the report, with the exception of 'commercial pressures'. Because the effect of commercial pressure on safety is an ongoing issue which can affect all areas of operations, it is analysed in the following paragraph.

4.14.3 Effect of commercial pressure

The 'greatest safety problem facing regional airlines' was considered to be 'commercial pressure' by the largest number of respondents. Many examples were given of commercial considerations which resulted in unsafe acts, such as releasing an aircraft for flight with dubious serviceability, taking off at weights that exceeded the aircraft limits or continuing flight in unsuitable conditions.

Several of the safety issues identified by the respondents could also be considered as a group relating to commercial pressure, including:

- airlines with inadequate financial resources;
- lack of aircraft spare parts;
- excessive cost-cutting;
- pressure on flight and maintenance crews to take 'short cuts'; and
- inadequate training.

The investigation of recent accidents in Australia has determined that commercial pressures were factors leading to those accidents. For example, one of the findings of the BASI investigation into the 1993 accident at Young was 'management priorities which placed the continuation of revenue operations ahead of safety considerations' (BASI, 1994). Similarly, the investigation of the 1994 Rockwell Commander accident concluded that 'the aircraft … departed in excess of the maximum allowable take-off weight. 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.' (BASI, 1996a).

> [The greatest hazard we face is] increasing commercial pressure as a result of competition which results in diminished profits whereby 'encouraging' companies to cut costs in the areas of maintenance and staffing levels. (Pilot, respondent 200)
>
> The greatest problem for an operator is price wars from fly-by-night competition leading to reduction in training and maintenance standards. (Pilot, respondent 485)
>
> Throughout the last 13 years, [I have] seen endless examples of overloading aircraft or operating with less than the required instruments or equipment, etc. Owners/operators/managers were trying to maximise profits in a difficult industry with job-desperate pilots prepared to take the risks to get ahead. (Pilot, respondent 117)
>
> Commercial pressure from the boss – carry all possible payload. If you refuse, he finds someone who will. (Pilot, respondent 120)

Following the accident at Young, BASI recommended that the CAA take into account the financial situation of airlines as part of its surveillance program (R940181). The CAA accepted that recommendation and have since incorporated requirements for financial position statements by both the operator, and an accountant/auditor, in the Air Operator's Certification Manual. Those statements are assessed by CASA prior to the granting of an AOC.

However, it was apparent from this survey, that commercial pressures continued to have a significant impact on safety in some regional airlines.

5 SUMMARY OF FINDINGS

The following list represents the safety deficiencies identified by this safety study. The order in which the deficiencies are displayed does not reflect the order of significance of each of the safety issues:

5.1 Aircraft operations safety deficiencies

- Procedures used by some regional airlines to update operational information in flight may not be effective.
- Some unlicensed airfields used by some regional airlines may not be suitable for airline operations.
- Reliable information on some unlicensed airfields may not always be available.
- Some regional airline aircraft are flown at weights above their prescribed maximum take-off weight.

5.2 Instrument flying safety deficiencies

- Training requirements for the initial issue of co-pilot instrument ratings are inadequate and currency requirements for co-pilot instrument ratings are not clearly defined.
- Some pilots were using GPS for flying instrument approaches which were not yet approved for use in instrument meteorological conditions.
- Some pilots were using GPS for instrument procedures before completing training on the equipment.
- Some GPS training courses do not adequately prepare pilots for using GPS equipment.
- Some pilots are intentionally descending below published safety altitudes in conditions under which terrain clearance cannot be assured.
- Circling instrument approaches are a high-risk phase of flight.
- Loss of situational awareness by regional airline pilots is frequent enough to be a safety hazard.
- Some instrument approach procedures require an aircraft to fly a missed approach toward high terrain when an alternative track is available that would provide greater terrain clearance.
- Although meeting all design criteria, some pilots consider that the intercept of the localiser from the 9-NM arc (using distance measuring equipment) for the runway 21 instrument landing system (ILS) approach at Perth, is difficult to fly under some conditions and may lead to unstabilised approaches.
- The lights in the railway yards near Gladstone airfield may provide pilots with visual cues which create a false perception of the alignment of the runway.

5.3 Flight training safety deficiencies

- Some asymmetric training is being conducted in a manner or under conditions where the risk involved is not commensurate with the training value.
- Some check-and-training captains may not have the skills and experience necessary to safely carry out their role.
- Regulation and surveillance of regional airline emergency flight training has been inadequate.

5.4 Aircrew rostering and fatigue safety deficiencies

- Some regional airlines do not always comply with the limitations on flight and duty times.
- The time scheduled for some turnarounds may not be sufficient for flight crews to efficiently and safely complete all required duties and inspections.
- The minimum rest periods specified in CAO 48.1 are inadequate for an overnight rest period unless accommodation close to the airport is provided.
- Progress towards a new system of flight and duty time limitations has been slow and some dispensations to the present limitations have been granted without evaluating their impact on pilots.

5.5 Airspace management safety deficiencies

- The combining of air traffic service operator positions during busy traffic periods can limit the ability of flight crew to exchange essential position, emergency or traffic information.
- The density and mix of traffic at some uncontrolled airfields—including Bathurst, Dubbo, Lismore, Port Macquarie, Wagga Wagga (NSW); Bundaberg, Gladstone, Hervey Bay (Qld); Devonport, Wynyard (Tas.); Kingscote (SA); and Ayers Rock (NT)—make it difficult, at times, for pilots to maintain safe separation from all other aircraft.
- The allocation of the same frequency (126.7 MHz) to most CTAF airfields often results in ambiguous traffic information and frequency congestion.
- The design of primary control zones could result in some aircraft being unable to remain in controlled airspace during a normal descent profile.
- Current procedures for maintaining separation between IFR regional airline aircraft and VFR aircraft in MBZ/CTAF airfields are inadequate and a significant collision risk exists.
- Some pilots are experiencing difficulty understanding NOTAMs due to the abbreviations they contain.
- Significant numbers of pilots reported that meteorological forecasts for Dubbo, Emerald, Armidale, Broken Hill, Lismore, Merimbula, Moruya and Mt Gambier were unreliable on some occasions.

5.6 Cabin safety deficiencies

- The present regulations on the safety training required for flight attendants are minimal and lacking in detail.
- The safety training conducted for flight attendants provides insufficient practice in emergency procedures and use of emergency equipment.
- The current procedures for preventing passengers from bringing excessive amounts of cabin baggage onto regional airline aircraft are inadequate.
- Procedures for preventing intoxicated passengers from boarding aircraft in some regional airlines are inadequate.
- Current procedures at some locations for controlling passengers on the tarmac are exposing passengers to unacceptable risks from turning propellers, taxiing aircraft and moving vehicles.
- Incidents involving PEDs interfering with aircraft equipment are occurring in regional airlines.
- A significant proportion of regional airline pilots and flight attendants have not completed crew resource management training.
- There are no regulations specifying flight and duty time limitations for flight attendants.

5.7 Maintenance safety deficiencies

- Maintenance staff numbers in some airlines do not adequately meet the demands of maintenance schedules and workload.
- There are no regulations specifying acceptable duty periods for aircraft maintenance workers.
- Some aircraft maintenance workers are affected by fatigue related to long periods of duty.
- Some maintenance engineers do not have ready access to all the tools, equipment and parts needed to perform their duties.
- Some aircraft maintenance workers are not sufficiently prepared for working on their current aircraft as a result of inadequate training.
- Procedures for the recording of aircraft unserviceabilities in the maintenance release/log are not always being followed and may not be fully understood.
- Descriptions of unserviceabilities given by flight crew in the maintenance release/log are not always adequate for maintenance staff to readily action.
- Some flight crew, on occasions, are pressured to fly aircraft with serious unserviceabilities.
- Some maintenance staff are, on occasions, pressured to release aircraft with unserviceabilities.

5.8 CASA surveillance and regulation safety deficiencies

- Some CASA surveillance inspections lack depth by not going beyond the first line of documentation.
- Some existing safety regulations are not being consistently enforced by CASA.

5.9 Reporting of safety deficiencies

- The lack of acknowledgment of ASIRs by BASI may have the effect of discouraging the reporting of some safety incidents.
- Many flight attendants are not using the BASI air safety incident reporting system to the fullest extent.
- The communication of safety-related information may be impaired in airlines without a nominated safety officer.

5.10 General safety deficiency

- In some companies, managers and employees allow commercial considerations to have a higher priority than the safety of the passengers.

6 SAFETY ACTION

The following pages contain the formal safety outputs issued by the Bureau in response to the findings of the regional airlines safety study.

Whilst a number of the identified safety deficiencies have been addressed by the Bureau in the form of Interim Recommendations, Recommendations and Safety Advisory Notices, other deficiencies are still under review for formal output at a later date or are currently being monitored by the Bureau. Some safety deficiencies have been combined and dealt with collectively because of the similarity of subject matter. Other safety deficiencies were considered to be regulatory matters best dealt with by airline management and/or appropriate regulatory authorities. No safety deficiency has been omitted from the findings even though the study may have provided limited evidence of the deficiency. The Bureau encourages the use of this information to stimulate thoughtful discussion and action, where appropriate, on any safety deficiency that a company may consider relevant to its operational safety.

Interim Recommendations and Recommendations that have been directed to the Civil Aviation Safety Authority (CASA) and/or Airservices Australia (AA) require formal responses in accordance with Memorandums of Understanding between the Bureau and the respective agencies. Safety Advisory Notices do not currently require formal responses from CASA or AA. However, the safety outcomes of Safety Advisory Notices have often been very positive and the Bureau has received many constructive responses and commitment to safety action from both agencies as a result of Safety Advisory Notices.

6.1 Definitions

Interim Recommendations have been developed and released prior to the release of the final report. They reflect the Bureau's concern that the identified safety deficiency has had, is having, or has the potential to have, a significant impact on the safety of flight operations, in particular, those operations that affect fare-paying passengers. Any responses the Bureau has already received in relation to those Interim Recommendations have been included in this report.

Recommendations have been developed and issued concurrently with the release of this report and also reflect the Bureau's concern about the impact on the safety of flight operations of identified safety deficiencies.

Safety Advisory Notices are issued where there is insufficient evidence to support a Recommendation at that time and/or where the Bureau considers that the impact on the safety of flight operations is not significant enough to warrant such action. Any responses the Bureau has received in relation to the Safety Advisory Notices issued prior to the release of this report have been included.

6.2 Aircraft operations safety deficiencies

6.2.1 Formal safety outputs

Safety deficiency generating Safety Advisory Notice SAN980092

Procedures used by some pilots of regional airlines to update operational information in flight, may not be effective.

Factual information

Survey results

Operational information, such as meteorological forecasts and the status of airfields and navigation aids, is critical to flight safety. Knowledge of this information is the basis for many operational decisions made by flight crews, such as whether to continue the flight to the planned destination or to divert to another airfield. Operational information obtained prior to a flight should be updated in flight, where necessary, so that decisions are based on the most current information.

With regard to this issue, the study indicated that 72% of pilots considered that their procedures for updating operational information in flight were adequate. However, 18% said they were not, while 10% were unsure. The pilots who felt that their procedures were not effective came from airlines of all three airline groups. These results suggest the need for regional airlines to review their procedures and training for the provision of in-flight operational information to flight crews.

Background

In January 1992, the operational control service functions of the then Civil Aviation Authority (CAA) were withdrawn. The responsibility for ensuring the safe conduct of a flight became a shared function between the pilot in command and the operator, without the oversight previously provided by the Operational Control Service. These changes have resulted in crews being forced to seek more pre-flight and in-flight information for themselves and to act upon this information without the same degree of assistance from Air Traffic Services (ATS) that many were previously used to.

ATS in-flight information

ATS currently provides an in-flight information service enabling flight crews to obtain information on which to base operational decisions for the continuation or diversion of a flight. Knowledge of this information, and decision-making based upon it, assists crews to ensure the continued safe flight of their aircraft.

A hazard alert service provides flight crews with information on meteorological phenomena and aeronautical facilities where this information is considered to be of a critical or unforeseen nature. This information is either broadcast, or directed specifically to flight crews, depending on the circumstances.

Additionally, pilots can request weather and notices to airmen (NOTAM) information at any time during flight by using the Flightwatch facility available on the appropriate airways frequency. A note in the Aeronautical Information Publication (AIP-RAC-11), states that pilots are responsible for requesting information necessary to make operational decisions.

Crews are required to obtain an updated briefing in those instances where an aircraft may be required to wait on the ground for extended periods, as can occur on multi-stage flights. This should be accomplished by accessing the electronic briefing system or by contacting a briefing office by telephone. If crews do not observe this procedure there may be an unnecessary delay in receiving critical information about a destination aerodrome.

Company in-flight information

The Commercial Review of Operational Control by Captain M. Terrell (June 1989), inquired into the feasibility of a company operational control service as an alternative to the service provided by the then CAA. The report acknowledged that this would incur a significant cost to operators in terms of both communications equipment and personnel, and that it represented a considerable duplication of effort. However, the report recommended that operators requiring an operational control system should be identified prior to the withdrawal of the operational control service.

This recommendation was not adopted and the subsequent closure of the operational control service went ahead with only a requirement for operators to review the adequacy of the provision of in-flight information to crews. In almost every instance, except for the major domestic carriers, this was assumed to be the sole responsibility of the flight crews.

In both Canada and the USA, the regulatory authorities require commuter and domestic carriers to provide a dispatch and flight-following service. The dispatcher must be appropriately trained and qualified, depending on the type of operation, to fulfil a function similar to that of a former CAA operations controller. The current Regulatory Review Program is considering the adoption of Federal Aviation Regulations (FAR) parts 121 and 135 from the USA. A decision has not yet been made as to whether all or part of these regulations will be adopted for Australian regional airline operations, including those aspects related to dispatch and flight-following.

Impact of proposed ATS changes

The introduction of 'Airspace 2000' will result in the withdrawal of the directed traffic service and search-and-rescue component, currently provided by ATS, to all flights operating in designated 'G' airspace. This will further diminish the amount of information provided to flight crews and place an even greater workload on them. For example, to obtain traffic information, flight crews will be required to listen to all aircraft broadcasts and to evaluate each to determine its relevance to traffic separation criteria instead of a third-party only providing relevant traffic.

Company messages of an operational nature may be communicated to crews through the ATS communications network but only on a workload-permitting basis. There is no obligation on ATS to ensure receipt or acknowledgment of these company messages. This would preclude ATS involvement in any company flight-following arrangement.

CASA is currently trialling a requirement for all operators of Regular Public Transport aircraft with more than 10 passenger seats to provide a third-party communication service at uncontrolled aerodromes. The role of the proposed certified air/ground operator would satisfy this requirement and, in part, restore some of the functions currently provided by ATS at those locations. In addition, this facility could provide limited operational and company information to flight crews. Regional airline operators may find that, following the introduction of 'Airspace 2000', the provision of this type of service enhances their ability to monitor progress of flights and maintain a greater level of search-and-rescue protection in 'G' airspace.

Analysis

The changes explained in this document have meant that flight crews must be more diligent in obtaining their in-flight information. Instead of being routinely provided with updated weather and NOTAM information by an operational control service, the flight crews themselves must now actively seek this information from Flightwatch. Flight crews who have been slow to adapt to these changes may not have received crucial in-flight information.

Some flight crews trained under the previous system could be labouring under the misapprehension that updated operational information is still automatically passed to them. On those occasions when information has not been automatically passed to a flight crew, it may have been perceived as a failure by ATS to provide an in-flight update of operational information, or that the information was not available.

Shortcomings in flight crews' knowledge of procedures for updating in-flight information may need to be reviewed and addressed through company training and checking programs.

Regional airline operators, whether required by legislation or not, may wish to consider the provision of some form of dispatch and flight-following function for their flight operations. Such a service would complement pre-flight planning and be an additional in-flight resource for flight crews, especially for single-pilot operations where there is already a high pilot workload.

> **Safety Advisory Notice SAN980092 issued to operators of regional airlines on 29 June 1998:**
>
> **Operators of regional airlines should note the safety deficiency identified in this document and take appropriate action.**

Note: CASA has subsequently proposed an amendment to Section 82.0, 82.3 and 82.5 of the Civil Aviation Orders.

> The amendment places a condition on Air Operator Certificate holders who operate aircraft of 10 or more passengers capacity into non-controlled aerodromes to provide a third part communications service for those operations. (CASA–October 1998–Regulation Impact Statement on Provision of Third Party Air/Ground Communication Services at Non-Controlled Aerodromes as a condition of an Air Operator's Certificate)

The amendments became effective on 1 February 1999.

Safety deficiency generating Safety Advisory Notice SAN980104 and SAN980105

Some unlicensed aerodromes used by some regional airlines may not be suitable for airline operations. In addition, reliable information on some unlicensed aerodromes may not always be available.

Factual information

Survey results

A licensed aerodrome is required to meet all the appropriate requirements in Civil Aviation Regulations (CARs) and has its details published in Aeronautical Information Publications (AIPs). Any changes to the published status of a licensed aerodrome will be published in Notices to Airmen (NOTAMs). However, when using unlicensed aerodromes, it is the responsibility of flight crews to obtain information on the state of the aerodrome

from its owner/operator. As not all pilots use unlicensed aerodromes, only 60% of pilots completing the survey answered the questions pertaining to unlicensed aerodromes.

Twenty-two per cent of pilots responding to the question in the survey relating to unlicensed aerodromes, agreed that the condition of some unlicensed aerodromes they used was hazardous. The same proportion of pilots answered that they could not always get reliable information on the condition of the unlicensed aerodromes they used.

Background

Airline operations into unlicensed aerodromes are permitted, provided the aerodromes meet minimum prescribed standards and are maintained to those standards. Unlicensed aerodromes of smaller dimensions are permitted to be used by aircraft of lower operating weights; however, such aircraft operating into these aerodromes must be flown in visual, daylight conditions (Appendix 3 Civil Aviation Order Part 82.3).

Many unlicensed aerodromes used by regional airlines were previously licensed and established to aerodrome standards. The main reason for de-licensing, provided by aerodrome owners and operators, was the administrative cost of maintaining the aerodrome licence. Some financial benefit to the aerodrome owner may have resulted by adopting the smaller dimensions of an unlicensed aerodrome.

Reporting procedures

Use of an unlicensed aerodrome by regular public transport (RPT) flights requires airline operators to establish a reporting system (Civil Aviation Order Part 82.3). As part of this reporting system, the airline operator must nominate a reporting officer to conduct the aerodrome inspection and report on its status. The condition of the aerodrome must be conveyed to the airline operator before the arrival of each scheduled flight.

Many regional airlines use a ‘negative’ reporting system whereby only unserviceable conditions are reported. It is assumed that the aerodrome is serviceable when a report is not received.

Responsibility for ensuring the serviceability of unlicensed aerodromes used by RPT flights, lies with the airline and not the aerodrome owner or operator. However, reporting officers are charged with the responsibility of ensuring the aerodrome serviceability is accurately reported to the airline.

CASA only approves the airline operator’s reporting system. It is the airline’s responsibility to ensure reporting officers are fully conversant with the standards and have been appropriately trained, as required by CAR 89V.

Related occurrences

A search of occurrences over a 3-year period revealed only a small number of reported occurrences, the majority of which resulted from the presence of people, animals or equipment on the movement area during an aircraft’s approach to land or following takeoff. However, one occurrence resulted in serious damage to an aircraft.

Towards the end of the landing roll the aircraft encountered a soft wet area on the runway, resulting in mud and stones being thrown up over the aircraft, causing stone damage to all propeller blades, the right side fuselage panels, and right side cockpit, and cabin windows. This soft area was not discernible from the air. The NOTAMs obtained by the pilot prior to the flight indicated that none were current for that aerodrome. Rain had fallen earlier at the aerodrome, but not at the homestead, therefore, the property owner was not aware of the soft wet areas on the runway. (BASI Report 9601565)

Surveillance

As part of CASA's scheduled surveillance of an airline operator, any unlicensed aerodrome serving as a destination on that operator's Air Operators Certificate (AOC) requires annual inspection by an aerodromes inspector. The airline operator is advised in advance of these inspections. In addition, and as a courtesy, the aerodrome owner is also advised. Despite being forewarned of an inspection, a number of unlicensed aerodromes did not meet the required standards.

Aerodrome inspectors found large stones, sink holes, washouts, ruts, sand drifts, overgrown vegetation, tussocks and soft patches to be the main physical shortcomings of these aerodromes. They were concerned that these conditions had not been reported to the airline operator, as required, or that the reports were ignored by flight crews.

Despite these reported conditions, only one aerodrome in the last three years was considered to be in such poor repair as to warrant having this destination removed from the operator's AOC.

Non-compliance notices

A non-compliance notice (NCN) is a formal notification from CASA to an AOC holder, advising that a safety deficiency exists. NCNs are issued to airline operators against deficiencies in airfield reporting procedures and unlicensed aerodrome standards.

Aerodrome inspectors estimated that the majority of NCNs (approximately 70%) were related to sub-standard physical characteristics of the aerodrome. Aerodrome markings and inadequate fencing were other significant deficiencies. Records show that many NCNs that were issued following each inspection for some aerodromes, were for similar reasons. Inspectors cited ignorance of published standards and inadequate maintenance as the main reason for the reissue of some NCNs.

Aerodrome maintenance

Maintenance of aerodromes owned by municipalities is mostly funded by rates. Some of the community aerodromes have access to funding through government grants or subsidies but the majority of the unlicensed aerodromes are owned and maintained privately. Revenue raising measures, such as landing fees to cover the cost of aerodrome maintenance, are not feasible because of the limited number of aircraft movements. Likewise, low passenger numbers preclude the raising of funds from ticket taxes.

It was reported that maintaining an unlicensed aerodrome to airline standards was difficult to justify when the average utilisation by airline aircraft is only one or two movements per week. Difficulty in obtaining access to suitable equipment such as graders and heavy rollers for maintaining these airfields, was cited by aerodrome inspectors as a major obstacle to the continued upkeep of natural surface runways.

Analysis

Aerodrome maintenance and adherence to published standards is important to the safety of fare-paying passengers. Acceptance of lower standards jeopardises that safety. In order that airline flight crews can make informed decisions about the use of unlicensed aerodromes, aerodrome owners and operators have a responsibility to ensure that reporting officers are adequately trained to perform their inspections and that they report aerodrome conditions consistently and accurately.

Reporting procedures used by some regional airlines may not be adequate to allow flight crews to make informed decisions about the use of unlicensed aerodromes. 'Negative' reporting systems can create uncertainty in the minds of flight crews. When the serviceability of an aerodrome is not communicated, flight crews have no way of knowing whether an aerodrome inspection has been carried out, or that the inspection report was not passed to them. This lack of communication between airline operators and aerodrome reporting officers appears to be the cause of much misunderstanding about aerodrome serviceability.

Airline operators using unlicensed aerodromes should evaluate the adequacy of the training given to reporting officers and consider certification of that training as a means of establishing quality control and standardisation. The lack of reported incidents does not make an argument for the relaxation of the existing aerodrome standards.

Safety Advisory Notice SAN980104 issued to owners and operators of unlicensed aerodromes on 18 September 1998:

Owners and operators of unlicensed aerodromes used by regional airlines should take note of the safety deficiency identified in this document and take appropriate action.

As a result of the investigation into this safety deficiency, the Bureau simultaneously issued Safety Advisory Notice SAN980105, alerting operators of regional airlines to this safety deficiency.

Note: Subsequent to the issue of SAN 980104 and SAN980105, CASA has published *Proposed Changes to the Regulation of Aerodromes on Australia (DP9801RP)*, issued for public comment on 20 April 1998. Policy is now being established. This will be followed by a Notice of Proposed Rule Making (NPRM).

Safety deficiency generating Recommendation R980106 and R980107

Some regional airline aircraft are flown at weights above their prescribed maximum take-off weight.

Factual information

Survey results

Pilots were asked whether they operated their aircraft at weights above the maximum take-off weight (MTOW). To this question, 85% of pilots answered 'never', while 15% replied that on some occasions they did operate above MTOW. Pilots answering that they sometimes operated their aircraft over its prescribed maximum take-off weight were predominantly from Group 1 or Group 2 airlines.

When asked to describe a safety incident, flight crews described aircraft operation above MTOW as the second most common incident. In response to the question asking respondents to state what they thought was the greatest safety issue facing regional airlines, two common answers given by flight crews were 'overloaded aircraft' and 'aircraft with poor or doubtful climb performance'. These two issues are different aspects of the same safety problem.

The survey indicated that overloading of aircraft was not isolated to individual acts of wilful behaviour. Anecdotal evidence suggested that overloading can sometimes occur when adverse weather conditions require additional fuel. On those occasions when there is a full passenger load, the addition of extra fuel without offloading passengers or cargo has resulted in maximum weight limits being exceeded.

> Overloading is a recurring problem despite recent Civil Aviation Safety Authority (CASA) initiatives. The problem is mainly with low-capacity regular public transport (RPT) aircraft where pilots, although instructed not to overload, are presented with situations beyond their control by the airline booking system. Additionally, there is no explicit company policy on load rejection, for example, 'last booked, first off'. Bookings are predicated on the maximum seat capacity for the type and often no allowance is made for passengers carrying the maximum baggage allowance, or for those circumstances where weather conditions exist that require a flight plan to an alternate aerodrome and where additional fuel must be uplifted for the diversion or holding. (Pilot, respondent 552)

Commercial pressures were also cited as directly contributing to instances of aircraft overloading.

Aircraft weight issues

Limits are placed on aircraft take-off weights for the following reasons:

(a) so that structural limits of major aircraft components such as wings and landing gear are not exceeded; and

(b) so that aircraft are able to climb clear of obstacles (particularly following takeoff), in accordance with prescribed regulations, and can maintain a safe altitude in the event of an engine failure.

Aircraft performance

Climb performance is degraded in overloaded aircraft, to the extent that safe clearance from terrain may not be able to be maintained. This is a particular safety concern in many twin-engine aircraft that have experienced an engine failure.

Many smaller twin-engine aircraft operated by regional airlines, do not have to meet the 'one-engine inoperative' performance requirements that must be met for certification of larger transport-category aircraft. This effectively means that there is an accepted period of risk during the takeoff and the initial climb phase of flight. If an engine failure were to occur during this phase of flight, climb performance would not be guaranteed.

Responsibility for correct loading

Responsibility for ensuring that an aircraft is not overloaded rests with both the airline and the flight crew. As part of the compliance statement for the issue of an Air Operators Certificate, CASA requires an applicant to produce weight and balance documents and loading instructions in the company's operations manual.

Civil Aviation Regulation (CAR 235) requires that aircraft weight and loading is within permissible limits prior to takeoff. To comply, flight crews must complete a trim sheet or load statement that includes all items of load. A copy of this document must be left at the point of departure and another copy must be kept by the airline for three months. These documents have to be made available for inspection by CASA staff on request.

Pressure to overload

Despite the considerable penalties imposed on both airline operators and flight crews when aircraft are found to be overloaded, the commercial pressure to meet contractual obligations has been great enough in some circumstances, and the risk of detection sufficiently unlikely, to result in the occasional breach of regulations.

Evidence provided in the commission of inquiry into the relations between the Civil Aviation Authority and Seaview Air, known as the 'Staunton Report', supports this view:

The problem was, for example, that as I might have eight passengers from Sydney who had booked some time before and were excited about going on their holiday and there were perishables sitting there to be taken to Lord Howe, what do I leave behind? Even though the aircraft could physically carry the passengers and freight, it would still be overloaded.

Lack of alternative travel options may make it awkward for the smaller regional airline operator to offload booked passengers or cargo. Anecdotal evidence suggests that airline operators have exploited this situation, resulting in enormous pressure being exerted on flight crews to overload their aircraft.

Comments from some of the surveyed flight crews suggested that in certain circumstances, company pressure was applied to accept the extra load and falsify the load documentation.

> Before this particular flight, I knew a full load of passengers were booked. I asked the managing director the company's policy regarding offloading should all the passengers arrive with their allocated 12 kg of baggage, as this places the aircraft well above MTOW. His response was 'are you telling me something we've done for years, we can no longer do?'. It was made very clear that my decision should not be made with regard to aircraft safety but to continued employment with the organisation. (Pilot, respondent 404)

> Overloading. Often the load on the aircraft does not match the paperwork given to me by the traffic officer in charge of loading the aircraft. Management tend to turn a blind eye to overloading. (Pilot, respondent 178)

Surveillance

Ramp checks are carried out as part of CASA's Aviation Safety Surveillance Program of airline operations. Unscheduled surveillance is used as one means of assessing an airline's 'safety health'. Each district office manager determines the frequency and focus of these inspections, depending on a number of 'trigger' factors such as incidents, reports, complaints and other safety intelligence information.

Analysis

Airline operators and flight crews have overall responsibility for ensuring that aircraft are not overloaded. Overloading aircraft, by even small margins, may expose flight crews and passengers to risks of unacceptable proportions, particularly during the critical phases of takeoff and initial climb. CASA's role is to check the adequacy of any loading procedures and ensure that these procedures comply with prescribed requirements. In the conclusions to chapter 6 ('Pressure to Overload') of the Staunton Report, the comment is made that:

> some reliance must be placed on the operator to develop appropriate procedures and adherence to those procedures.

A load rejection policy is one way of achieving this. Such a policy would provide flight crews with a published procedure that would contain explicit and unambiguous directions as to the manner and priority for offloading passengers or cargo, when circumstances require such action. The development and application of such a procedure would provide unequivocal management support to a flight crew's decision to offload passengers or cargo, in order to avoid overloading aircraft. Subsequently, real and/or perceived pressure on crews to overload aircraft may be reduced.

A 'load rejection' policy should be contained in the company's operations manual and be part of an AOC approval.

In view of the number of respondents to the survey who alleged overweight operations, the frequency and depth of surveillance may be insufficient to prevent repeated occurrences of overloading.

Recommendation R980106 issued to the Civil Aviation Safety Authority on 22 September 1998:

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority consider the incorporation of a requirement for a load rejection policy into the Air Operators Certification Manual (AOCM) for regional airlines.

In addition, as a result of the investigation of the above safety deficiency, the Bureau simultaneously issued Recommendation R980107 to operators of regional airlines:

The Bureau of Air Safety Investigation recommends that regional airline operators develop and implement a load rejection policy in order to avoid overloading aircraft.

The following response was received from CASA on 3 February 1999:

> CASA has considered the above BASI recommendations which stem from a study into the safety of Australian regional airlines conducted by BASI between October 1995 and July 1997.
>
> The recommendations are fully supported, and administrative action will be taken by CASA to require operators of both charter and regular public transport aircraft to develop and incorporate into their operations manuals load rejection policies.

Response classification: CLOSED-ACCEPTED

6.3 Instrument flying safety deficiencies

6.3.1 Formal safety outputs

Safety deficiency generating Interim Recommendation IR980176

Training requirements for the initial issue of co-pilot instrument ratings are inadequate and currency requirements for co-pilot instrument ratings are not clearly defined.

Factual information

Survey results

Sixty-seven pilots (17%) reported that they held a co-pilot instrument rating, rather than a command instrument rating, on multi-engine aircraft. Seventy-four per cent of the pilots holding a co-pilot instrument rating only were flying Group 3 aircraft while 26% flew Group 2 aircraft. Aircraft from both Group 2 and Group 3 were, in general, high-performance, complex aircraft.

Regulations

Pilots may obtain and exercise the privileges of a co-pilot instrument rating. Candidates for co-pilot instrument ratings need only satisfy the aeronautical experience requirements of the pilot licence held. A co-pilot employed by a regional airline operator would, as a minimum, require only the aeronautical experience of a commercial pilot licence. Co-pilot candidates would then be required to pass the CASA instrument rating exam in addition to

an instrument rating flight test. The instrument rating flight test must cover the same test components as that of a command instrument rating test except that the requirement to demonstrate proficiency in asymmetric flight is limited to performance in the cruise phase of flight.

Note: It is also possible for a pilot who holds a command grade of instrument rating for single-engine aircraft only, to act as a co-pilot while the aircraft is flying in instrument flight conditions.

Civil Aviation Order (CAO) 40.2.1 contains detailed recent experience requirements that must be complied with in order to exercise the privileges of an instrument rating. However, references are only made to the pilot in command. Discussions with CASA personnel indicated that while co-pilot recency requirements were not specifically mentioned in CAO 40.2.1, the intention was that co-pilot requirements are equivalent to pilot in command requirements and are therefore implied within the CAO. Notwithstanding, CASA staff agreed that this aspect of CAO 40.2.1 was ambiguous.

Current Australian regulations allow for co-pilot endorsements on multi-engine aircraft that require multi-crew operations. The syllabus of training for co-pilot aircraft endorsements, as outlined in appendix V of CAO 40.1.0, does not require an element of instrument flying. Civil Aviation Advisory Publication (CAAP) 5.23-1 (0), issued in September 1996, provides supplemental guidance to the CAOs on the conduct of training for the initial issue of a multi-engine endorsement (rating). The CAAP includes a 1-hour flight training exercise on instrument flying (where the candidate holds an instrument rating) as part of the 8-hour flight training section of the syllabus. As this information provides advice only as to the preferred method for complying with Civil Aviation Regulations, instrument flight training is therefore not a mandatory element for the issue of a co-pilot endorsement.

Current multi-crew practices

In the past, co-pilots did not participate in flight deck duties in the same way as the pilot in command. Co-pilots were employed principally in a support or ancillary role with the majority of flying duties, particularly critical phases of flight such as takeoff, landing and instrument approaches, being undertaken by the pilot in command. The current practice has changed considerably and co-pilots are now expected to fly ‘leg-for-leg’ during any one period of flying duty. Whilst the pilot in command has ultimate responsibility for the safety of the flight, the co-pilot participates fully as the ‘flying pilot’ in all phases of flight including takeoff, landing and instrument approaches. Partly in recognition of these increased responsibilities, many operators now require applicants for co-pilot positions to hold a command instrument rating and be eligible, pending accumulation of relevant aeronautical experience, for an airline transport pilot licence. Many co-pilots are now also expected to demonstrate proficiency in all the elements of instrument flight including asymmetric operations during critical phases of flight.

Proposed changes to co-pilot training requirements

Discussions with CASA personnel revealed that some consideration is being given to the removal of co-pilot endorsements, and therefore co-pilot instrument ratings, from current domestic regulations. The Bureau was advised that one of the reasons for this proposed change was so that domestic practice reflected overseas practice. Co-pilot endorsements and co-pilot instrument ratings are not available in many other countries.

Analysis

Although there is no evidence to suggest that incidents or accidents have resulted from this situation, the current limited training requirements and the lack of definition of currency requirements for co-pilot instrument ratings, have the potential to impact on safety.

The current aeronautical experience requirements for co-pilots may mean that some co-pilots would have limited background experience to draw upon, particularly in asymmetric operations, and would therefore be exposed to a greater risk of making skill- and knowledge based-errors. As co-pilots are not expected to demonstrate proficiency in asymmetric flight during an instrument rating test in anything other than the cruise, and are not required to undertake specific instrument flying exercises during co-pilot aircraft endorsements, it is possible that deficiencies in co-pilots' instrument flying skills during critical flight phases such as takeoff, landing and instrument approaches, may remain undetected. These potential deficiencies in experience and proficiency may not be subsequently addressed in those cases where an operator or individual has interpreted the CAOs such that they do not consider that co-pilots need to meet the recency requirements of the instrument rating. With little initial training and limited ongoing practice, co-pilots' instrument rating skill levels are not likely to be consolidated. Additionally, it is possible that some co-pilots' experience in instrument flight conditions, including instrument approaches, is likely to be gained only on fare-paying, passenger-carrying flights and when the co-pilot is not legally 'current' in accordance with the intention of CAO 40.2.1.

Given the current practice in both Australian and international airlines regarding the participation of co-pilots in 'leg-for-leg' flying, it would seem more appropriate from a safety perspective for co-pilots to be required to undertake the same instrument rating training as that specified for a pilot in command.

Interim Recommendation IR980176 issued to the Civil Aviation Safety Authority on 2 November 1998:

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority give consideration to the removal or amendment of the current co-pilot instrument rating requirements. Notwithstanding, whilst the current regulations are in force, the ambiguity in relation to recency requirements for co-pilot instrument ratings should be addressed.

The following response was received from CASA on 26 February 1999:

> I am writing in response to your letter addressed to [name supplied] in which you requested advice on the Authority's proposed action with respect to Air Safety Interim recommendation IR980176. Please accept my apologies for this belated reply.
>
> While it is noted that there is no direct evidence of safety deficiencies resulting from the training specified in Civil Aviation Orders for the holders of a co-pilot's Instrument Rating, the Authority acknowledges the changed role of co-pilots in the years since these regulations were first conceived.
>
> In view of these changed circumstances, a review of the applicability of the co-pilot Instrument Rating in the current environment will be undertaken as part of the total review of the flight crew licensing structure. This review will be the pre-cursor to detailed work on the new Part 61 of Civil Aviation Safety Regulations. The same review will also look at the applicability of the co-pilot aircraft endorsement.
>
> The licensing review has a high priority but, as you will appreciate, it is a large undertaking involving many other complex issues. Because no direct safety deficiency has been identified, the review of the co-pilot requirement will proceed in the context of the overall review. It is intended that a decision on the licensing structure, including the need for specific co-pilot qualifications will be made in the coming year.

With regard to the stated ambiguity of current recency requirements, CASA does not agree that any ambiguity exists. CAO 40.2.1 clearly states that recency requirements only apply to the pilot in command. The Authority's flight crew licensing section is not aware that any other requirement was ever intended. Overseas practice does not require recency for co-pilots in instrument procedures as part of the licensing requirements, even where these pilots are required to hold the equivalent of a command instrument rating.

It would be difficult to justify a unique licensing requirement for formalised recency for co-pilots because an instrument approach procedure flown by a co-pilot will always be monitored by a pilot in command who is recent. Also, under the regulations which apply to operators, co-pilots are required to undertake flight proficiency and rating renewal tests at regular intervals which, combined with the common practice of leg for leg flying by co-pilots, ought to be adequate to maintain proficiency. Again, I note that no specific safety deficiency has been identified in this regard.

It may be that co-pilots' proficiency in asymmetric flight is a matter which requires consideration and this will be taken into account in the review of the co-pilot qualification.

Response classification: CLOSED-PARTIALLY ACCEPTED

Safety deficiency generating Safety Advisory Notice SAN980023

Some pilots are intentionally descending below published safety altitudes in conditions under which terrain clearance cannot be assured.

Factual information

Survey results

When respondents were asked to describe a safety incident, occurrences of pilots breaking instrument flight rules (IFR) constituted one of the most common types of incident described. Pilots were asked to agree or disagree with the statement that their company flies strictly by the IFR. The large majority of pilots (94.7%) agreed with this statement, while 4.1% disagreed. When the responses to this question were analysed by airline group, there was no significant difference between the answers from pilots from the three airline groups.

Pilots were also asked to describe any deviations from the IFR.

Descent Below Safety Altitudes

From the survey responses, some of the deviations involving descent below a published safety altitude included:

1. descent below the steps during a Distance Measuring Equipment (DME) or Global Positioning System (GPS) arrival while in instrument meteorological conditions (IMC);
2. descent to circuit altitude at night outside the instrument approach circling area;
3. descent below instrument approach minimum descent altitude (MDA) while in IMC; and
4. diversion off-track to descend in IMC over water to an altitude lower than the destination MDA.

For the purpose of this study, 'safety altitude' is a generic term meaning 'lowest safe altitude', 'minimum safe altitude', 'minimum altitude' for a given DME/GPS distance in an arrival procedure or 'minimum descent altitude' in an instrument approach.

> When breaking clear of cloud, [there is a] tendency to adopt visual procedures with little or no forward visibility in rain. If not visual upon reaching minimum altitude, a large number of captains immediately descend further. [This is caused by] lazy, undisciplined captains and a perceived 'uncoolness' in just missing an approach. (Pilot, respondent 85)

> [A common deviation from IFR is] descent below the lowest safe altitude on route sectors to aerodromes without a navigation aid in conditions that are non-VMC. [This is done] to enable the flight to get into an aerodrome where conditions are marginal but is not surrounded by terrain or obstacles. (Pilot, respondent 178)

> One or two management pilots have a willingness to push the minimums i.e. they suffer from get-in-at-all-costs. Old habits die hard. One suffers tunnel vision and talks himself into continuing, for example, 'it is only a couple of hundred feet', 'you've done it before', 'one must be flexible' and 'the rules are only a guide'. (Pilot, respondent 568)

Analysis

Descent below the published safety altitude has been a factor in many accidents, including the crash of the Monarch Airlines Piper Chieftain at Young, NSW in June 1993. Any descent below the safety altitude, in conditions under which terrain clearance cannot be assured, increases the risk of a controlled flight into terrain accident, and represents a significant safety issue.

> **Safety Advisory Notice SAN980023 issued to operators of regional airlines on 8 July 1998:**
>
> **Operators of regional airlines should note the deficiency identified in this document and take appropriate action.**

Safety deficiency generating Safety Advisory Notice SAN980115

Some instrument approach procedures require an aircraft to fly a missed approach toward high terrain when an alternative track is available that would provide greater terrain clearance.

Factual information

Survey results

In their answers to questions related to instrument approach procedures, six respondents stated that the missed approach track for specific approaches was towards high terrain and that alternative tracks would provide greater terrain clearance. The airfields mentioned were Ballina, Lismore, Mt Gambier and Port Lincoln.

> The missed approach paths [from the NDB and VOR approaches at Mt Gambier take you towards the only hill in the area – Mt Gambier! For guaranteed performance (i.e. turbine aircraft) this is not a problem, but what about piston twins? (Pilot, respondent 371)

Analysis

The four airports that were identified by survey respondents as having missed approach tracks directed towards high terrain are all serviced by small- or medium-piston or turbo-propeller engine aircraft. Generally, the performance capability of these aircraft is limited,

particularly during single-engine operations. The missed approach is one of the more hazardous phases of flight as aircraft are likely to be in close proximity to terrain and operating in instrument meteorological conditions. In addition, the crew may also be dealing with an emergency such as an engine failure. A redesigned missed approach track at Ballina, Lismore and Mt Gambier would provide maximum terrain clearance during the missed approach for both normal and emergency operations.

Note: The Port Lincoln instrument approach chart was amended on 21 May 1998. This amendment revised the procedure so that the missed approach track is now directed away from high terrain.

Safety Advisory Notice SAN980115 issued to Airservices Australia on 28 July 1998:

Airservices Australia should note the safety deficiency identified in this document and take appropriate action.

The following response was received from Airservices Australia on 17 August 1998:

I refer to your letter SAN980115 (B98/092) dated 28 July 1998.

The suggested changes to the missed approach paths for the instrument approach procedures into Ballina, Lismore and Mount Gambier airports have been examined by our procedure design staff and their comments are outlined below.

BALLINA: The published NDB procedure calls for a right turning missed approach onto a heading of 060 degrees. The reason a right hand turn was chosen was because a left turn would have infringed R 622, Evans Head Bombing Range. It should be noted that the published circling minima of 800 FT for Cat A&B aircraft will ensure a minimum of 300 FT of obstacle clearance in the turn area.

LISMORE: The straight ahead missed approach provides for the lowest circling minima. A turning missed approach would require an increase in the circling minima in view of the increased obstacle clearance requirement for obstacles in the turn areas. It should be noted that the published circling minima is already very high at 1180 FT or 1145 FT above the airport and any increase of that minima would make IMC operations into Lismore airport marginal. Also, because the airport is surrounded by terrain, a straight missed approach up the valley was considered the best and safest option.

MOUNT GAMBIER: Although the published missed approach meets all of the PANS OPS missed approach design criteria, it is agreed that a slightly turning missed approach away from the terrain to the south of the airport would improve the procedure. Accordingly, the missed approach paths will be redesigned and the revised procedures published at the earliest opportunity.

You can be assured that all of the factors identified in your safety study are taken into consideration during the development of these procedures. If you have any further questions on this topic or on the responses given above, please don't hesitate to contact the Procedure Design Section Manager, [name supplied].

Response classification: CLOSED-ACCEPTED

Safety deficiency generating Safety Advisory Notice SAN980116

Although meeting all design criteria, some pilots consider that the intercept of the localiser from the 9-NM arc (using distance measuring equipment) for the runway 21 instrument landing system (ILS) approach at Perth, is difficult to fly under some conditions and may lead to unstabilised approaches.

Factual information

Survey results

The ILS approach for runway 21 at Perth contains a procedure for intercepting the localiser from the 9-NM arc (using distance measuring equipment). Four of the survey respondents commented that attempting to intercept the localiser from this arc is difficult, and may result in the aircraft flying well above glidepath before being established on the localiser. They stated that flying a stabilised approach from this position is difficult.

> [When flying the runway 21 ILS approach at Perth from the 9 DME arc, if we start turning] inbound at the [lead bearing from Caversham locater], the localiser will not be captured. As we cannot begin descent until established on the localiser, it is easy to get hung up at 2,000 ft, particularly if a strong sea breeze is blowing, which in winter is common. Move the arc out to a minimum of 10 miles. (Pilot, respondent 523)

Stabilised approach

A stabilised approach is a recognised method of conducting a final approach and landing so that flight crew can minimise the hazards associated with this critical stage of flight. The approach is flown so that certain flight parameters, such as rate of descent and pitch attitude, do not exceed defined safe limits. As the number of variables that need monitoring is reduced to a minimum, the crew can maintain complete awareness of the situation and environment that the aircraft is operating in. The stabilised approach also enables the crew to conduct standard pre-landing checks, thus ensuring that the aircraft is correctly configured for a successful landing. Any situation that leads to aircraft flying unstabilised approaches is a hazard as it can lead to an aircraft being incorrectly configured for landing or, in some cases, to the crew losing control of the aircraft.

As part of the approval procedure, all Australian instrument approaches are subject to flight validation prior to being published in the Departure and Approach Procedures handbook. Flight validations are normally carried out by the calibration aircraft currently contracted by Airservices Australia.

Analysis

Survey respondents were concerned that any delay in commencement of the approach due to difficulties in establishing the aircraft on the localiser required unacceptably high rates of descent in order to correctly establish the aircraft on the glideslope. This difficulty appears to be common in certain, but well known, local conditions and increases the risk of an unstabilised approach.

Despite the calibration aircraft conducting a flight validation of all approach procedures before they are approved, this testing will not normally cover all seasonal variations in local conditions. Subsequently, difficulties in flying an approach, such as those described in the above example, may not be known to Airservices at the time the approach is published. The response to the Regional Airlines survey indicates that the runway 21 ILS approach at Perth is subject to seasonal variations which can make it difficult to fly. Therefore, a review of this approach should be conducted in order to fully assess, the impact on safety of the strong sea breezes which are common in Perth during winter.

> **Safety Advisory Notice SAN980116 issued to Airservices Australia on 30 July 1998:**
>
> **Airservices Australia should note the safety deficiency identified in this document and take appropriate action.**

The following response was received from Airservices Australia on 24 August 1998:

> I refer to your letter SAN980116(B98/092) dated 30 July 1998, in which you raised the problem being experienced by some aircraft joining the Perth Runway 21 ILS or ILS/DNE instrument approach procedure off a 9 DME arc.
>
> As you rightly point out in your Safety Advisory Notice, the procedure in question meets all of the procedure design criteria. Whilst under PANS OPS a 7 DME arc may be used, the norm for Australian procedures is a 10 DME arc. However at Perth, due to the requirement to contain the procedure within the Perth CTR, a 9 DME arc had to be settled on. A 10 DME arc will infringe the RAAF Pearce military control zone; a situation which is unacceptable to the military.
>
> A copy of the Safety Advisory Notice has been forwarded to our Perth ATS Centre. They will raise this issue within the appropriate local airspace consultative forum. As soon as additional airspace for the Perth CTR becomes available or alternative air traffic management procedures with the military are agreed to, the procedure will be redesigned with the aim of moving the approach arcs to 10 DME.

Response classification: CLOSED-ACCEPTED

Safety deficiency generating Safety Advisory Notice SAN980117 and SAN980118

The lights in the railway yards near Gladstone airfield may provide pilots with visual cues which create a false perception of the alignment of the runway.

Factual information

Survey results

In their survey answers, four respondents stated that the Callemondah marshalling yard lights could 'drown out' the runway lights and create the illusion of a false runway. The railway yard was reported as being illuminated by bright lights, which were adjacent to the final approach path for runway 10 at Gladstone. In addition, the final approach track for the instrument approach to runway 10 is slightly offset to the alignment of the runway due to terrain considerations. As no respondents mentioned any safety concerns about lights near other airfields, the comments regarding Gladstone airfield were considered significant.

> At night in poor weather, the runway lighting is totally overpowered by the adjacent (and almost parallel) railway yards with very bright flood lighting. More than one aircraft has lined up on the finals for the railway yards in these conditions when landing on runway 10. (Pilot, respondent 472)

The four respondents to this question operated group 3 aircraft and each had accrued more than 13,000 hours total flying experience.

Discussion with the chief pilots of the two major regional airlines that service Gladstone airfield revealed that they were both aware of the problem, and that the training program for each company was structured to impart sound local knowledge of the area.

Discussions with representatives of Queensland Rail revealed that it could be possible for more shielding to be added to the lights and that they would be willing to investigate the problem. By invoking Civil Aviation Regulation 94, the CASA could require the removal or shielding of any light likely to endanger the safety of aircraft.

Related Incident

Poor visibility and a night approach were two of the factors contributing to an incident in 1989, when a Boeing 737 attempted to land on a main road at Mackay. The air traffic controller alerted the pilots that they were not aligned with the runway; however, the aircraft descended to 168 ft AGL, before it was established in a go-around. The crew had misidentified a main road near the Mackay airfield as runway 14.

Analysis

The lights in the Callemondah marshalling yards, adjacent to the runway 10 threshold at Gladstone, cause the greatest potential for harm when a pilot is unfamiliar with the area and/or operating at night or in poor visibility. The recent publication of runway approaches may help to alleviate the problem to some extent, as aircraft should be reasonably well aligned with the runway when approaching the minimum descent altitude. However, as the yard lights have been reported as being more visible than the runway lights, they have the potential to influence the pilot's selection of a final approach path. This is of particular concern if the pilot is not accurately maintaining the correct final approach track. Additionally, as the final approach track for the instrument approach to runway 10 is slightly offset to the alignment of the runway, there is an increased potential for pilots to misidentify the correct location of the runway.

Safety Advisory Notice SAN980117 issued to the Civil Aviation Safety Authority on1 September 1998:

The Civil Aviation Safety Authority should note the safety deficiency identified in this document and take appropriate action.

As a result of the investigation into this safety deficiency, the Bureau simultaneously issued Safety Advisory Notice SAN980118, alerting Queensland Rail to this safety deficiency.

The following response was received from Queensland Rail on 19 March 1999:

> Your reference BS/970091 refers to a Safety Advisory Notice No. SAN 980118 concerning lights near Gladstone Airfield.
>
> Discussions have been held with [name supplied] of your Bureau, representatives of Sunstate Airlines and Flight West Airlines in an attempt to identify safety deficiencies highlighted in your Bureau study. A meeting was convened with the Technical Services Engineer of the Gladstone City Council who is a technical representative of the Gladstone Aerodrome Authority.
>
> This organisation was advised that approximately six light towers in the Callemondah Rail Complex have been identified as having the potential to interfere with aircraft approaching from a northerly direction. Advice was also given that plans are being produced to extend the runway towards the railway to allow for altered flight paths and this may have a further impact on Queensland Rail yard lighting. This organisation was unaware of these plans.
>
> The Technical Engineer agreed that no action should be taken at this point in time until new airport plans are available so that a proper assessment can be made of any lighting alterations required to meet airport requirements and ensure the needs of Queensland Rail in providing a safe workplace for its workers in what is a major rail terminal supporting export coal facilities at Gladstone are addressed.
>
> Trusting the action proposed meets your requirements, should require any further clarification, please do not hesitate to contact this organisation.

Response classification: CLOSED-ACCEPTED

6.3.2 Other safety action

Safety deficiencies that are considered to be regulatory matters

- Some pilots were using GPS for flying instrument approaches which were not yet approved for use in instrument meteorological conditions.
- Some pilots were using GPS for instrument procedures before completing training on the equipment.

Safety deficiencies currently being monitored by the Bureau

- Circling instrument approaches are a high-risk phase of flight.
- Loss of situational awareness by regional airline pilots is frequent enough to be a safety hazard.

Comment – With the advent of GPS, several aerodromes throughout Australia are being approved for GPS approaches as an alternative to other published instrument approaches. GPS approaches are normally runway aligned and usually preclude the need to conduct any 'circling'. The Bureau participates in the GPS Implementation Team and continues to monitor the progress of the introduction of GPS in Australian aviation. Pilots and operators who consider that specific aerodromes require priority for GPS approaches should contact their local Regional Airspace Users Advisory Committee (RAPAC).

- Some GPS training courses do not adequately prepare pilots for using GPS equipment.

6.4 Flight training safety deficiencies

6.4.1 Formal safety outputs

Safety deficiency generating Safety Advisory Notice SAN980212

Some asymmetric training is being conducted in a manner or under conditions where the risk involved is not commensurate with the training value gained.

Factual information

Survey results

Pilots were asked to outline any flying training exercises that caused them concern. Sixty-nine pilots (18%) responded to this question. The most common responses were as follows:

Forty-seven pilots (68% of those answering this question) were concerned about the dangers of asymmetric training in general. The most common concern was that simulated asymmetric flight (flight with one engine set at or near a zero-power setting) was being conducted close to the ground, or in aircraft configurations or flight conditions that increased the risk of an accident.

Twenty-three of the respondents who commented on the danger of asymmetric training, said that 'V_1 cuts' (simulated failure of an engine at V_1 speed) were excessively dangerous due to the marginal performance of the aircraft on one engine, or due to the manner in which this exercise was practised. Five respondents cited examples of V_1 cuts, being practiced at night and one described a V_1 cut while the pilot was wearing 'foggles' (devices to restrict the pilot's view to the instrument panel). Many pilots felt that V_1 cuts should only be practised in flight simulators.

> During a twin engine, full flap go-around, [the training captain simulated] an engine failure when power [was coming] up, leaving the aircraft hanging on one engine low to the ground. With or without the [landing] gear, the aircraft will not climb [on one engine] with full flap selected. (Pilot, respondent 465)
>
> I am concerned about] Vinc demonstrations and practice. [They are] all very dubious demonstrations at this level of operation and definitely a safety hazard in practice for no gain in safety. (Pilot, respondent 472)
>
> [I am concerned about simulated] engine failures at Vr (rotate speed) at night. Besides being a breech of the operations manual and CAOs, there is no margin for error in such an exercise. (Pilot, respondent 493)

Asymmetric training and checking requirements

Asymmetric training is a significant aspect of the multi-engine training syllabus and flight test. Pilots are also required to undergo training and demonstrate proficiency in asymmetric flight to obtain and renew multi-engine instrument ratings in addition to other required periodical flight checks.

Aircraft performance

Many of the aircraft types used by regional airline operators demonstrate limited performance during asymmetric operations and do not have to meet the 'one engine inoperative' performance requirements that must be met for certification of larger transport-category aircraft. This effectively means that there is an accepted period of risk during the take off and the initial climb phases of flight. If an engine failure were to occur during this phase of flight, climb performance would not be guaranteed. Notwithstanding, and as part of training and checking activities, pilots are expected to demonstrate proficiency in asymmetric operations during all phases of flight, including takeoff and initial climb.

Related occurrence and safety action

An accident, in which two pilots were killed in a Fairchild Metro II during a night training exercise at Tamworth, highlighted the hazards associated with the conduct of some asymmetric training exercises, particularly V_1 cuts below 1,500 ft AGL at night. The Bureau issued two interim recommendations as a result of that accident which highlighted similar safety concerns that have emerged from the Regional Airlines Safety Study.

Interim Recommendation 950224, issued on 29 April 1996, stated that CASA should amend the Civil Aviation Regulations and Civil Aviation Orders to ensure that:

> when a provision of the Aeronautical Information Publication specifically prohibits certain manoeuvres and procedures, then the prohibition has legal force which is reflected in relevant Civil Aviation Regulations and Civil Aviation Orders.

BASI also recommended that CASA:

> take appropriate steps to inform and educate the industry on the hazards involved in asymmetric training operations in conditions of low visibility and at night.

CASA indicated that the Regulatory Structure Validation Project would rectify the problems identified in the BASI recommendation and that an article would be produced and included in the CASA *Flight Safety Australia* magazine. To date, BASI has not been notified of any action taken in response to this recommendation.

Interim Recommendation 960035, issued on 29 July 1996, stated that CASA should:

> address the issue of endorsement training requirements for aircraft above 5,700 kg MTOW where a simulator is not available.

BASI also recommended that the review of the multi-engine training syllabus should cover the possible difference in flight training when a simulator is used for training and for the conduct of emergency procedures. CASA has since issued Civil Aviation Advisory Publication 511-(0) which provides detailed guidance on the conduct of multi-engine endorsement training and reiterates that multi-engine training at night should be conducted in accordance with Aeronautical Information Publication OPS-77. In its response to the interim recommendation, CASA stated that while it had no legislative power to mandate the use of simulators, the new syllabus encouraged the use of an approved type simulator for the conduct of endorsement training. CASA added that the need for different training requirements, depending on the availability of a simulator, was currently under review. However, CASA indicated that it would prefer to have a generic syllabus, for multi-engine training.

Analysis

Most asymmetric training conducted by regional airline operators must be undertaken in aircraft as flight simulators are currently available for only a few of the regional airline aircraft types. In addition, many regional airline aircraft demonstrate limited asymmetric performance, even at training weights. Therefore, asymmetric training can be a potentially hazardous activity if it is not conducted in accordance with accepted safe practices that are reflected in Australian and international regulations and guidance material.

While there is some benefit in presenting a realistic scenario when conducting asymmetric training, the risks must be weighed up against the training benefits. There may also be insufficient allowance being made for the difference between flight manual performance expectations and the aircraft's actual performance. Consideration should be given to conducting the same training at a height above ground level that would provide a greater margin for error in those cases when aircraft may be operated inappropriately or when aircraft performance does not meet expectations.

The reports provided in the survey suggest that some training and checking pilots may be presenting unrealistic asymmetric scenarios during training and checking exercises. Such an approach further diminishes the safety margins available as well as the capacity of training and check pilots to recognise and recover from developing unsafe situations.

Safety Advisory Notice SAN980212 issued to operators of regional airlines on 2 November 1998:

Operators of regional airlines should note the safety deficiency identified in this document and take appropriate action.

6.4.2 Other safety action

Safety deficiencies currently being researched by the Bureau with a view to formal safety output at a later date.

- Regulation and surveillance of regional airline emergency flight training has been inadequate.

Comment – Refer to comments at 6.9.1 – *Other safety action*, regarding regulation and surveillance issues.

Safety deficiencies currently being monitored by the Bureau.

- Regulation and surveillance of regional airline emergency flight training has been inadequate.

Comment – Refer to comments at 6.9.1 – *Other safety action*, regarding regulation and surveillance issues.

- Some check-and-training captains may not have the skills and experience necessary to safely carry out their role.

Comment – Since the completion of this study the Civil Aviation Safety Authority has developed detailed requirements for check-and-training personnel including required skills and experience. Those requirements are included in the Authority's Aviation Safety Surveillance Program manual. The Bureau has also been advised that further guidelines for check-and-training personnel are currently being developed to ensure that operators of regional airlines, amongst others, appropriately select and adequately prepare personnel to fulfil the important check-and-training role.

6.5 Aircrew rostering and fatigue deficiencies

6.5.1 Formal safety outputs

Safety deficiency generating Safety Advisory Notice SAN980171

The time scheduled for some turnarounds may not be sufficient for flight crews to efficiently and safely complete all required duties and inspections.

Factual information

Survey results

Pilots and flight attendants were asked if they considered that they had sufficient time during turnarounds to complete all their required duties. Forty-four per cent of pilots replied that they always had sufficient time and 33% frequently had sufficient time. However, 23% of respondents reported that they had sufficient time only 'sometimes', 'rarely' or 'never'. These proportions were the same for pilots from all three airline groups. Forty-two per cent of flight attendants agreed with the statement that they had sufficient time during turnarounds, while 43% disagreed. In addition, a frequent comment made in response to general questions posed in another part of the survey was that turnaround times were too short.

> Pressure to complete checks on turnarounds quickly (rushed) is very high. Little fat in schedules unduly increases workload and can lead to rushed turnarounds with the possibility of missed items (in checklists). (Pilot, respondent 579)

> Flight attendants are responsible for moving disabled passengers from exit seat rows, taking excess baggage from passengers, ensuring seatbelts tightened, making announcements, doing headcounts and giving safety briefings to elderly/disabled passengers. There's just too much for them to do that, a lot of flight attendants just 'give up' and become more and more lax. There is just not enough time to do everything properly. (Flight attendant, respondent 123)

Background

A turnaround refers to that part of a scheduled flight between an aircraft's arrival at an airport and its subsequent departure to another destination. Many tasks must be performed in the turnaround period between flights.

The following two paragraphs contain an extract of flight crew comments from the BASI report *An Evaluation of the BASI-INDICATE Safety Program*. These comments support those made by flight crews in the regional airlines safety study and suggest that flight crews are required to accomplish more tasks than just those essential to the safe operation of the aircraft.

> Overloading of flight crews with duties which are not expected to be performed at other bases during turnarounds. In 15-minute turnarounds crews are expected to unload passengers, unload baggage, clean aircraft, supervise correct refuelling, do trim sheet, reload passengers and baggage. This also includes elderly and handicapped persons and the supervision of minors. To expect the highest performance in the case of an engine failure after takeoff is questionable. Checks are rushed with aircraft often lined up on runways waiting for them to be finished. Adequate lookouts outside aircraft are rarely performed by both crew.
>
> There are short turnarounds with very high workloads. This mainly involves baggage handling where the captain and first officer are required to off load and load large amounts of baggage in a very short time frame (quite regularly 500–900 kg of baggage per sector). The captain and first officer are then expected to be fully alert for takeoff and any associated emergencies. This is becoming more of a problem with the increasing amount of crew members being unable to handle baggage due to back problems, the full burden then being placed on the other crew member. Having been in this position on many occasions I can readily vouch that after four to six sectors (particularly on hot days) my ability to deal with emergency situations and even the normal operation of the aircraft has been severely impaired.

Determination of turnaround times

Inquiries suggested that the time operators allow for turnarounds generally reflect the absolute minimum time to accomplish the procedure.

Airline operators determine the turnaround times for an airport when establishing a timetable for a route structure. As part of the approval procedure for the inclusion of an airport into a company's Air Operators Certificate, the turnaround time is reviewed by the Flying Operations inspector (FOI) assigned to that operator. FOIs assess the allowed turnaround time against the time taken for crews to reasonably accomplish the tasks allocated to them and to meet all the statutory obligations in relation to air safety.

FOIs assessments are based on their particular knowledge of operators' procedures, and any local conditions. Considerations such as the likely need for an instrument approach at that location, the need to uplift fuel and the manner of refuelling (i.e. hand pumped from drums by the pilot or delivery 'into-aircraft' by a refueller), and the compilation of loading data are also taken into account.

The Air Operators Certification Manual does not specify any criteria for the determination of turnaround times and refers only to the *adjustment of the schedules to accommodate delays due to Air Traffic Control, weather or aircraft unserviceabilities.* Other actions associated with a turnaround, such as baggage loading, passenger handling, aircraft refuelling and documentation, are assessed against checklist items in the Air Operators Certification Manual, but not specifically in relation to a turnaround.

A further assessment is made during scheduled route inspections when FOIs observe turnarounds in practice and note any conditions that could justify a change to the allowed turnaround times.

Pressure to rush turnarounds

Comments made in the survey by flight crews suggested that times for turnarounds were adequate only under ideal conditions:

> Many crews feel that turnaround times between flights are too short, and that although most tasks are accomplished, they are rushed or brushed over, or operational tasks are given second priority to passenger/cosmetic concerns such as cabin tidiness. Company response is 'don't go until you're ready' but scheduling is often such that this would result in every flight departing late, and there is still the subtle pressure to achieve on-time departures. (Pilot, respondent 594)

Analysis

Commercial pressure to obtain maximum utilisation of aircraft and limitations on crew duty times, are likely to influence schedules and may take precedence over the time required for crews to adequately and safely perform their duties during turnarounds. Flight crews who are unfamiliar with port procedures, particularly those under training, are likely to experience the most difficulty performing turnaround duties within the allotted time. Incomplete checks, incorrect calculations of aircraft loading, and poor handling of aircraft during arrival and departure, may be manifestations of such pressure and have the potential to directly affect the safety of flights.

In a schedule without any allowance for contingencies, late departure may result in a 'domino' effect on other intermediate stops and create pressure to rush the turnarounds in an attempt to regain the schedule.

> **Safety Advisory Notice SAN980171 issued to operators of regional airlines on 21 September 1998:**
>
> **Operators of regional airlines should note the safety deficiency identified in this document and take appropriate action.**

6.5.2 Other safety action

Safety deficiencies currently being researched by the Bureau with a view to a formal safety output at a later date.

- The minimum rest periods specified in CAO 48.1 are inadequate for an overnight rest period unless accommodation close to the airport is provided.
- Progress towards a new system of flight and duty time limitations has been slow and some dispensations to the present limitations have been granted without evaluating their impact on pilots.

Comment – The issue of aircrew fatigue has received considerable attention over recent years and has been determined to be a contributing factor in many serious accidents and incidents both within Australia and overseas. CASA is currently reviewing its position on the matter of flight and duty time regulations. Many overseas agencies are also trying to address the issue with new approaches to the problem. The Bureau continues to actively pursue this issue and considers that other groups such as flight attendants and maintenance staff should be included in any future flight and duty regulations as they play a vital role in the operational safety of every flight.

Safety deficiencies that are considered to be regulatory matters:

- Some regional airlines do not always comply with the limitations on flight and duty times.

6.6 Airspace management safety deficiencies

6.6.1 Formal safety outputs

Safety deficiency generating Interim recommendation IR980059

The combining of air traffic service operator positions during busy traffic periods can limit the ability of flight crew to exchange essential position, emergency or traffic information.

Factual information

Survey results

The results of the Regional Airlines Safety Study revealed that 72% of respondents had experienced delays of more than two minutes due to frequency congestion while using flight service area frequencies.

The study noted that frequency congestion appeared to be a problem at a large number of locations across Australia, suggesting that the problem was not isolated to one particular region. Pilots' comments from the study indicated that congestion was worse when frequencies were combined and particularly at weekends (when a number a frequencies were usually combined and allocated to a single operator position).

Related occurrences

B09702957

A De Havilland Dash 8 and a Lockheed C130, travelling in opposite directions on the same route, passed within 400 m of each other while at the same level. Pilots of other aircraft transmitting on the area frequency prevented the flight crews of the Dash 8 and the C130 from communicating with each other in adequate time to arrange separation. Two flight service positions were combined at one console and there were reported to be 21 aircraft using the two area frequencies, which were linked via a retransmission facility.

B09703696

The pilot in command (PIC) of a Beech B200 taxied at Smithton for an IFR flight to Launceston. On departure he was unsuccessful in establishing communications on 122.6 Mhz to obtain traffic information due to the volume of traffic on the frequency. The PIC reported that the communications problem was due to the increased traffic calls by aircraft taxiing at King and Flinders Islands, VFR and IFR aircraft position reports and traffic requests for descent. The problem was further exacerbated by the retransmit facility which rebroadcast all transmissions on eight separate frequencies. The pilot advised that he made six attempts before contacting Melbourne to advise his departure, obtain traffic and obtain a clearance to enter controlled airspace.

Discussions with other pilots who operate in the same area and air traffic service personnel in Melbourne, revealed that the frequency congestion problems were most critical at weekends when frequencies were combined.

B09800106

At approximately 100 ft AGL, after takeoff at Williamtown, the left engine on a Beech 1900D failed. The crew conducted emergency checks and returned to the aerodrome and landed without further incident. An emergency call to Sydney Flight Service was not possible due to the large number of other pilots operating on the area frequency.

Reports since 1996

Reports since the study indicate that the problem of frequency congestion is still occurring. However, it is now being experienced on air traffic control frequencies since the transfer of some flight service functions to air traffic control.

Equipment limitation

Aeronautical Information Circular H34/97 – Flight Information Service Retransmission Facility, (December 1997) from Airservices Australia, detailed an equipment limitation which can inhibit the provision of services by air traffic services. The limitation was a function of the retransmit facility used to network a number of radio frequencies at an operator position. Airservices Australia acknowledged the limitation and provided advice to assist pilots operating on frequencies that may be retransmitted.

Analysis

Although Airservices Australia has endeavoured to address the limitation inherent in the current equipment by issuing Aeronautical Information Circular H34197, more consideration of the possible impact of the combining of air traffic service positions is required.

Ready access to, and use of, the area frequency is essential for crews of IFR flights to obtain traffic information from the air traffic service operator. Ready access to the area frequency is also essential for the exchange of position information between the crews of IFR and VFR flights, in order for an assessment of potential conflict to be made. The combining of two or more area frequencies using retransmission may create a hazard for aircraft operations.

Airservices Australia should develop procedures to assist operators in evaluating the advantages of combining air traffic service positions against the consequent potential for frequency congestion and the possibility of a degradation of safety in the aviation system.

Interim Recommendation IR980059 issued to Airservices Australia on 23 April 1998:

The Bureau of Air Safety Investigation recommends that Airservices Australia review air traffic service procedures relating to the combining of a number of operator positions and/or frequencies with a view to reducing the impact of frequency congestion.

The following response was received from Airservices Australia on 4 June 1998:

> Reference is made to BASI's Air Safety Interim Recommendation No: IR 980059 regarding the use of ATS frequencies.
>
> In addition to AIC H34/97, Airservices provides direction to ATS staff regarding the use of retransmit facilities in MATS 12-4-2 which shows 'To reduce frequency congestion and

interference on pilot broadcasts or other pilot-to-pilot communications being used for self separation, the retransinit facility should be operated in the OFF mode whenever practicable.'

A number of other factors, in the context of the Airspace 2000 initiatives, relating to the provision of services are currently being discussed with CASA. Implementation of aspects of these initiatives would affect not only the way services are provided but the way in which ATS frequencies are used.

Airservices will continue to monitor the effects of retransmit facilities pending resolution of a number of issues associated with the implementation of CASA's Airspace 2000 initiatives.

Response classification: OPEN

6.6.2 Other safety action

Safety deficiencies currently being monitored by the Bureau

- The density and mix of traffic at some uncontrolled airfields—including Bathurst, Dubbo, Lismore, Port Macquarie, Wagga Wagga (NSW); Bundaberg, Gladstone, Hervey Bay (Qld); Devonport, Wynyard (Tas.); Kingscote (SA); and Ayers Rock (NT)—makes it difficult, at times, for pilots to maintain safe separation from all other aircraft.

Comment – Refer to comments below regarding the safety deficiency: *Current procedures for maintaining separation between IFR regional airline aircraft and VFR aircraft in MBZ/CTAF airfields are inadequate and a significant collision risk exists.*

- The allocation of the same frequency (126.7 MHz) to most CTAF airfields often results in ambiguous traffic information and frequency congestion.

Comment – Airservices Australia has changed the MBZ frequency at Gove and Ayers Rock to 126.9 MHz with effect from the 26 February 1998. A proposal to change a number of other CTAF/MBZ frequencies are currently being actioned through the Regional Airspace Users Advisory Committee (RAPAC) and Airservices Australia. RAPACs are the forum for discussion of all matters relating to airspace and procedures in Australia. Membership is open to all significant airspace users and through the major industry associations and organisations. Any concerns relating to airspace or procedures, in the first instance, should be raised and actioned through the appropriate RAPAC.

- The design of primary control zones could result in some aircraft being unable to remain in controlled airspace during a normal descent profile.

Comment – Minor changes to a number of CTA steps have been made to better accommodate the climb/descent profiles of non-pressurised aircraft. Those changes came into effect on 26 February 1998. This is another issue that can be actioned through the relevant RAPAC to the appropriate agency or authority.

- Current procedures for maintaining separation between IFR regional airline aircraft and VFR aircraft in MBZ/CTAF airfields are inadequate and a significant collision risk exists.

Comment – As a result of a number of occurrences in MBZ/CTAF and Class G airspace, the Bureau made the following Interim Recommendations:

IR970112 issued to Airservices Australia on 14 July 1997:

The Bureau of Air Safety Investigation recommends that Airservices Australia review the provision of air traffic services to maximise the use of the currently available radar coverage particularly on routes used by regular public transport aircraft.

The following response was received from Airservices Australia on 21 October 1997:

Airservices Australia is reviewing the provision of air traffic services with regard to maximising the use of radar services both within and outside controlled airspace.

As you are aware, the Airspace 2000 proposal which Airservices planned to introduce on the 26th February 1998, comprehensively addresses the extension of radar services. These radar enhanced services include:

Radar Class E airspace from Cairns to Melbourne above 8500 feet. A Radar Information Service (RIS) in Class G airspace within radar coverage.

The Board of the Civil Aviation Safety Authority (CASA) has deferred making a decision on the proposal.

Regardless of the outcome of the Airspace 2000 review by CASA, Airservices intends proceeding with three initiatives to enhance radar services on the 26th of February 1998:

1. Radar Class E airspace will be introduced between 8500 feet and FL125 outside existing Class C airspace from Grafton to Canberra within radar coverage.
2. Brisbane Enroute will provide radar services within the Class C control area steps over Coffs Harbour down to 4500 feet.
3. Sydney Terminal Control Unit will provide radar services to 45nm Sydney in non controlled airspace on a discrete frequency.

These initiatives will increase Airservices use of existing radar coverage for air traffic services. Further expansion of radar services is limited pending decisions on Airspace 2000 by CASA.

Response classification: CLOSED-ACCEPTED

IR970110 issued to Airservices Australia and the Civil Aviation Safety Authority on 4 July 1997:

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

1. implement methods for the timely dissemination of the MBZ or CTAF frequency to pilots;
2. implement methods of providing to pilots confirmation of the correct selection and operation of an MBZ or CTAF frequency;
3. examine the requirement for the establishment and operation of traffic alerting services at all aerodromes
4. examine the provision of additional radar coverage in the Bundaberg area; and
5. examine the provision of surveillance for other locations serviced by RPT operations.

The following response was received on the 11 September 1997 from Airservices Australia:

Reference is made to the Bureau's Air Safety Interim Recommendation No IR970110 which relates to communications procedures for MBZ and CTAF.

With regard to Interim Recommendation 1, Airservices have issued a NOTAM instructing pilots to report the frequency to which they are changing as part of the 'Changing To' call. The frequency quoted is, whenever practicable, recorded by ATS for the information of other pilots. Airservices do not intend providing the MBZ or CTAF frequency to pilots on

an individual basis as a matter of routine. Other methods of disseminating the MBZ or CTAF frequency, e.g. via AWIB broadcast will be taken into consideration.

It should be noted however, that the longevity of this procedure is not great, given the likely directions of Airspace 2000 and introduction of the National Advisory Frequency (NAF) in Class G airspace.

Interim Recommendations 2 and 3 fall within the CASA areas of responsibility for a response.

Interim Recommendations 4 and 5 relating to the provision of additional surveillance in the Bundaberg area and for other locations serviced by RPT will be considered by Airservices.

Response classification: CLOSED-ACCEPTED

The following response was received on 13 November 1997 from the Civil Aviation Safety Authority:

I refer to your letter of 4 July in relation to BASI Occurrence 9701646 generating Air Safety Interim Recommendation IR 970110. The occurrence resulted from incorrect frequency usage in the Bundaberg MBZ.

The following are the CASA responses to the individual parts of the Interim Recommendation:

IR Part 1

The normal AIS process is designed to ensure that pilots have the correct information pre-flight. This is supported by CAR 233(1)(h) which requires pilots, before commencing a flight, to have the latest editions of maps, charts and other aeronautical information.

IR Part 2

A NOTAM was issued requiring pilots to advise the frequency changing to; this was complemented with an instruction to ATS staff to record this frequency for advice to subsequent aircraft as required. CASA is awaiting a response from BASI as to the reduction in the number of incidents since this procedure was implemented.

IR Part 3

As part of the 'third party communications' legislative initiative mentioned above, CASA will examine the requirement for the operation of traffic alerting services at aerodromes during RPT operations. This would need to be integrated with Airspace 2000 initiatives and policy issues such as classification of operations.

IR Parts 4 and 5

CASA does not have specific standards for the provision of radar services, but has encouraged use of existing radar coverage to enhance safety. While it may prove to be a significant safety enhancement to provide additional radar coverage in the Bundaberg area, it would not seem practical or cost efficient to require radar surveillance of all terminal areas serviced by RPT operations.

Response classification: CLOSED- ACCEPTED

Note: The Civil Aviation Safety Authority has subsequently proposed an amendment to Section 82.0, 82.3 and 82.5 of the Civil Aviation Orders.

The amendment places a condition on the Air Operator Certificate holders who operate aircraft of 10 or more passengers capacity into non-controlled aerodromes to provide a third-party communications service for those operations. (CASA – October 1998 –

Regulation Impact Statement on Provision of Third Party Air/Ground Communication Services at Non-Controlled Aerodromes as a condition of an Air Operator's Certificate).

The amendments are expected to become effective on 1 February 1999.

- Some pilots are experiencing difficulty understanding NOTAMs due to the abbreviations they contain.

Comment – Following a number of occurrences in which similar issues were a factor the Bureau commissioned a preliminary study to identify the main issues with the current NOTAM system. The study was undertaken by the University of Newcastle in October 1997. The resulting report, *The Clarity and Accessibility of NOTAM Information for the Aviation Industry* by R.F. Potter and M.D. Nendick, was released in February 1998. The Bureau's intention is to conduct further studies of some of these issues in conjunction with Airservices Australia.

- Significant numbers of pilots reported that meteorological forecasts for Dubbo, Emerald, Armidale, Broken Hill, Lismore, Merimbula, Moruya and Mt Gambier were unreliable on some occasions.

Comment – The aviation services provided by the Bureau of Meteorology (BUMET) can be enhanced by the addition of airborne reports from aircrew. The Bureau would appreciate in-flight meteorological reports (AIRREP) formatted in accordance with the AIP OPS SPEC – 17. Aircrew are encouraged to participate and provide AIRREPs when possible.

In relation to the problem of inaccurate forecasts it is worth noting the Manual of Air Traffic Services (MATS) Meteorology and Altimetry section, which states in part:

> The value of the elements given in a forecast must be taken as approximate. Some elements vary over very short intervals of space and time, or may appear to be different according to the vantage point of the observer, and some elements do not lend themselves to precise definition, and, because of difficulties of expression or measurement, may be capable of wide interpretation. Forecasting techniques are in many ways inadequate. The value of elements given in a forecast must therefore be interpreted as representing the most probable mean of a range of values which the element may assume during the period of the forecast concerned, and over the area or in the airspace concerned. Similarly, the time of occurrence or change of an element should be interpreted as representing the most probable mean.

The problems outlined in the study could have been referred to either the appropriate RAPAC or the BUMET Regional Forecasting Centres (RFCs). If inaccuracies in forecasts persist after providing feedback to the appropriate RFC then these should be directed to the BUMET State Regional Aviation Manager for action. Within the NSW region, BUMET plans to install automatic weather information broadcast facilities at Ballina, Taree, Port Macquarie and Bankstown in response to requests from the aviation industry.

6.7 Cabin safety deficiencies

6.7.1 Formal safety outputs generating Interim Recommendation IR980080

Safety deficiency

The present regulations on the safety training required for flight attendants are minimal and lacking in detail. Anecdotal evidence suggests that considerable differences exist between the various flight attendant training courses run by

the regional airline operators. In part, these differences may be attributed to the lack of a standard, comprehensive syllabus of training.

Factual information

Survey results

Flight attendants were asked to suggest ways in which they considered that their safety training could be improved. The most frequent comments were:

(a) more practical training in aircraft evacuations, with a preference for conducting practice evacuations from cabin simulators;

(b) more practical training in handling in-flight emergencies, for example, by using emergency equipment such as fire extinguishers and personal breathing equipment;

(c) more practical first-aid training, such as in cardiopulmonary resuscitation;

(d) more training in emergency handling by the whole crew; and

(e) a longer initial training course.

The fact that more than one-quarter of the flight attendants felt that their initial safety training did not adequately prepare them for in-flight emergencies and that 54% of respondents commented on the need for more practical emergency training, suggested that the initial training conducted by some airlines was inadequate.

Australian regulations

Australian civil aviation requirements for cabin crew training specify the following aspects of flight attendants' training and duties:

(a) numbers of flight attendants required on an aircraft;

(b) the practical and theoretical extent of their proficiency test on general emergency procedures;

(c) training requirements on an aircraft type; and

(d) minimum requirements for proficiency testing, including who can conduct the test, how long the result is valid for and the maintenance of test records. (Civil Aviation Order (CAO) 20.16.3 subsection 6.1, CAO 20. 11 subsections 12.142.6, 13.3, and appendix 4)

The Cabin Safety and Carriage of Persons Group, assigned to the CASA Regulatory Review, has recommended comprehensive upgrading of those standards, including the need for 'hands on' training and joint cabin crew/flight crew resource management (CRM) training.

International perspective

A number of aviation safety bodies such as the US National Transportation Safety Board (NTSB), Transport Canada and the International Civil Aviation Organisation (ICAO), have addressed the upgrading of flight attendant training standards. Recommendations from these organisations include the provision of joint flight crew/cabin crew CRM training and advocate the importance of practical 'hands on' training.

The introduction to the ICAO Cabin Attendants Safety Training Manual states:

> Cabin attendants' training is about safety. Their primary duties and responsibilities in air transport operation are safety related, which should be clearly reflected in their training. There is reason to believe that, in many places, cabin attendants may not have been given enough information about, or practice with, equipment and situations to master the skills they need during an emergency.
>
> As the structural strength of transport category aeroplanes improves and accidents become more survivable, cabin attendants are assuming a more critical role for ensuring passenger safety. Cabin attendants are an important part of the operational safety system, both in the prevention of accidents and in the assistance they give to survivors in the event of an accident. Because of these changes, civil aviation authorities should ensure that operators implement a training system for cabin attendants which consistently results in no less than a minimum level of proficiency so that cabin attendants can perform their duties and undertake their responsibilities in the most efficient and effective manner.

ICAO also recommends joint flight crew in crew emergency training exercises and considers that such training should be held at least once during initial training and as often as possible throughout recurrent training programs. This training would help to instil a one-crew concept among all crew members and ensure coordination of cabin and flight crew procedures as a synchronised team, with a sound appreciation of each other's contribution toward successful management of an emergency situation.

Flight attendant performance during emergencies

The NTSB conducted a special investigation on flight attendant training and performance during emergency situations. The study revealed that some flight attendants did not demonstrate adequate knowledge of exit operations, use and location of equipment, use of checklists during an emergency, and some were unable to follow established or standard operating procedures. Crew communication was also cited as being deficient in some cases.

At the conclusion of the report, the NTSB stated:

> Identification of these deficiencies indicate that flight attendants' safety training has been seriously neglected.
>
> The Safety Board strongly believes that the ability of flight attendants to perform their duties successfully during emergency situations is directly related to the quality of their emergency training. (NTSB/SIR-92102 Washington, DC. 'Flight Attendant Training and Performance During Emergency Situations').

The survey responses made by Australian flight attendants support this view.

The 'solo' flight attendant

Of special significance to regional airlines are 'solo' flight attendant operations. In general, aircraft carrying between 20 and 36 passengers are required to carry one flight attendant (CAO 20.16.3). As this size aircraft is commonly operated by regional airlines, many flight attendants employed by them operate as 'solo' flight attendants. Any in-flight cabin emergencies which occur, such as a medical emergency or a cabin fire, are dealt with by the flight attendant, usually without assistance from the flight crew. Anything they fail to learn in training they are unlikely to learn on the job. Regional airline flight attendants, therefore, have a special need for comprehensive standards for training.

Analysis

The need for flight attendants to call upon their safety training in an emergency situation is rare but often sudden and may be life-threatening. Flight attendants, therefore, must be provided with the knowledge and skills to perform efficiently and effectively. It is imperative that they are practised and familiar with all onboard emergency equipment and procedures to enable them to perform adequately in the event of an emergency.

In order to ensure that cabin attendants are practised and familiar with all emergency procedures and equipment, minimum cabin crew training standards must indicate the desired degree of expertise to be achieved during initial training, and to be maintained during recurrent training. The training syllabus should include:

(a) requirements for joint cabin/flight crew training in the principles and practice of CRM;

(b) emphasis on the need for practical, 'hands-on' training in the use of all emergency equipment;

(c) practical recurrent training drills for both land and water evacuations; and

(d) comprehensive fire-fighting training, including requirements for communications between the cabin and flight deck during fire-fighting activities.

CASA should approve and monitor airline training programs on a regular basis, recognising the special needs associated with 'solo' flight attendant operations, and those operations which carry fare-paying passengers without a flight attendant.

Interim Recommendation IR980080 issued to the Civil Aviation Safety Authority on 21 October 1998:

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority review the current standards and training syllabus requirements for cabin attendants operating on fare-paying, passenger-carrying aircraft, with a view to widening the scope of those requirements to ensure that all airline operators develop a standard, comprehensive syllabus of training for cabin attendants.

In reviewing and widening the scope of the current standards and training requirements, the Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority recognises the special needs and specifies the unique training requirements of the 'solo' flight attendant, and those operations which carry fare-paying passengers without a flight attendant.

Comments on the subject of 'Solo' flight attendants, training and trainers

'Solo' flight attendant

> The fact that we operate as a single flight attendant can be difficult in some situations. I feel confident to handle aircraft emergencies on my own, but 1 know from experience that it is very difficult for one flight attendant to handle an emergency and continue to carry out normal safety procedures. In several cases where one passenger requires all your attention, it becomes very difficult to manage. (Flight attendant, respondent 092)
>
> I really do feel that my (safety) training was inadequate. It is a big responsibility when you work on your own. (Flight attendant, respondent 464)

Training

> If we could use all of the emergency equipment in a hands-on situation and part of our emergency training, ie, fire extinguishers, PBE, parachute flares, day and night flares, etc. 1

also think we should train in the simulator with the pilots . The more scenarios, hands-on training with equipment, the easier it is to remember how to use them, rather than from the manual (Flight attendant, respondent 034)

More hands on experience. During our emergency procedures only two or three went through 'walking through cabin preparing for emergency landing'-not all of us. (Flight attendant, respondent 071)

More regular practice with equipment, e.g. PBE, BCF. (Flight attendant, respondent 410)

Trainers

Training itself should be run by professionals, unfortunately it is not in our company. (Flight attendant, respondent 492)

We need to have training flight attendants that are trained how to train. (Flight attendant, respondent 509)

The person teaching the course should demonstrate her/himself the correct way in which a flight attendant should evacuate an aircraft, not let a trainee figure it out for himself/herself from the book and become confused. (Flight attendant, respondent 469)

Specific, less rushed (safety training), more qualified trainers. (Flight attendant, respondent 627)

Note: Whilst CASA has not yet formally responded to this recommendation, a Notice of Proposed Rulemaking (NPRM) titled Proposed Regulations Relating to Passengers and Crew Member Safety, was issued in November 1998. This NPRM outlines training and checking requirements in more detail than previously referred to in Australian CAOs, for such aspects as emergency procedures and CRM.

Safety deficiency generating Interim Recommendation IR980094 and IR980096

Some flight attendant safety training conducted by regional airlines provides insufficient practical experience in emergency procedures and use of emergency equipment, and lacks crew resource management (CRM) training.

Factual information

Survey results

Flight attendants were asked to suggest ways in which their safety training could be improved. The most frequent comments were:

1. more practical training in aircraft evacuations, with a preference for conducting practice evacuations from cabin simulators;
2. more practical training in handling in-flight emergencies, for example, by using emergency equipment such as fire extinguishers and personal breathing equipment;
3. more practical first-aid training, such as in cardiopulmonary resuscitation;
4. more training in emergency handling by the whole crew; and
5. longer initial training courses.

The fact that more than one-quarter of the flight attendants felt that their initial safety training did not adequately prepare them for in-flight emergencies, and that 54% of respondents commented on the need for more practical emergency training, suggests that the initial training conducted by some airlines is inadequate.

Australian regulations

The current Australian regulatory requirements for cabin crew training are contained in Civil Aviation Order CAO 20.11, subsection 13.3 and appendix 4. The Cabin Safety and Carriage of Persons Group, assigned to the CASA Regulatory Review, has recommended comprehensive upgrading of the training standards, including the need for practical 'hands-on' training and joint cabin crew/flight crew, crew resource management training.

International perspective

A number of aviation safety bodies such as the US National Transportation Safety Board (NTSB), Transport Canada and the International Civil Aviation Organisation (ICAO), have addressed the upgrading of flight attendant training standards. Recommendations from these organisations also include joint flight crew/cabin crew, CRM training and advocate the importance of practical, 'hands-on' training.

The introduction to the ICAO Cabin Attendants' Safety Training Manual states:

> Cabin attendants' training is about safety. Their primary duties and responsibilities in air transport operation are safety related, which should be clearly reflected in their training. There is reason to believe that, in many places, cabin attendants may not have been given enough information about, or practice with, equipment and situations to master the skills they need during an emergency.
>
> As the structural strength of transport category aeroplanes improves and accidents become more survivable, cabin attendants are assuming a more critical role for ensuring passenger safety. Cabin attendants are an important part of the operational safety system, both in the prevention of accidents and in the assistance they give to survivors, in the event of an accident. Because of these changes, civil aviation authorities should ensure that operators implement a training system for cabin attendants which consistently results in no less than a minimum level of proficiency so that cabin attendants can perform their duties and undertake their responsibilities in the most efficient and effective manner.

ICAO also recommends joint flight crew/cabin crew emergency training exercises and considers that such training should be held at least once during initial training and as often as possible throughout recurrent training programs. This training would help to instil a one-crew concept among crew members and ensure coordination of cabin and flight crew procedures as a synchronised team, with a sound appreciation of each other's contribution toward successful management of an emergency situation.

On the subject of crew resource management, the ICAO Cabin Attendants' Safety Training Manual states:

> The training should focus on the functioning of crew members as a team, not simply as a collection of technically competent individuals, and should provide opportunities for crew members to practise their skills together in the roles they normally perform in flight. The program should teach crew members how to use their interpersonal and leadership styles in ways that foster crew effectiveness. The program should also teach crew members that their behaviour during normal, routine circumstances can have a powerful impact on how well the crew as a whole function during high-workload, stressful situations. Similar situations experienced in training increase the probability that a crew will handle actual stressful situations more competently.

A special NTSB investigation on flight attendant training and performance during emergency situations, revealed that some flight attendants did not demonstrate adequate

knowledge of exit operations, use and location of equipment or the use of checklists during an emergency, and some were unable to follow established or standard operating procedures. Crew communication was also cited as being deficient in some cases.

The NTSB study stated:

> Identification of these deficiencies indicates that flight attendants' safety training has been seriously neglected. A training system which consistently results in no less than a minimum level of proficiency should be made available to enable flight attendants to perform their duties and undertake their responsibilities in the most efficient and effective manner.
>
> The Safety Board strongly believes that the ability of flight attendants to perform their duties successfully during emergency situations is directly related to the quality of their emergency training.

(NTSB/SIR-92102 'Flight Attendant Training and Performance During Emergency Situations').

Survey responses made by Australian flight attendants support this view.

The 'solo' flight attendant

Of special significance to regional airlines are 'solo' flight attendant operations. In general, aircraft carrying between 20 and 36 passengers are required to carry one flight attendant (CAO 20.16.3 subsection 6.1). Aircraft of this size are commonly operated by regional airlines, many flight attendants operate as 'solo' flight attendants. From the day they complete their training, the flight attendants work without the supervision of a more experienced flight attendant. Any in-flight cabin emergencies which occur, such as a medical emergency or a cabin fire, are dealt with by the flight attendant, usually without assistance from the flight crew. Anything they fail to learn in training they are unlikely to learn on the job. Regional airline flight attendants, therefore, have a special need for comprehensive standards of training.

Analysis

The need for flight attendants to call upon their safety training in an emergency situation is rare but often sudden, and may be life-threatening. Flight attendants, therefore, must be provided with the knowledge and skills to perform efficiently and effectively. It is imperative that they are practised and familiar with all on-board emergency equipment and procedures to enable them to perform adequately in the event of an emergency.

Airline management and airline training departments must recognise the special needs associated with 'solo' flight attendant operations and provide a level of training which will adequately prepare those flight attendants to confidently and effectively handle in-flight emergencies.

To promote an understanding of each other's duties and responsibilities, and to enable effective communication and coordination in abnormal situations, joint flight crew/cabin crew crew resource management training should be provided.

> **Interim Recommendation IR980094 issued to management and training departments of regional airline operators on 29 October 1998:**
>
> **The Bureau of Air Safety Investigation recommends that management and training departments of regional airline operators ensure that flight attendant emergency training programs include joint flight crew/cabin crew training in the principles and practice of crew resource management.**

In addition, as a result of the investigation into the above safety deficiency, the Bureau simultaneously issued to management and training departments of regional airline operators Interim Recommendation IR980096:

The Bureau of Air Safety Investigation recommends that management and training departments of regional airline operators ensure that all flight attendant training programs provide practical proficiency exercises for training in:

(i) aircraft emergency evacuations, for both land and water operations;

(ii) the operation of each type of aircraft emergency exit;

(iii) the use of all aircraft emergency equipment; and

(iv) first aid and cardiopulmonary resuscitation.

Note: Whilst CASA has not yet formally responded to this recommendation, a Notice of Proposed Rulemaking (NPRM) titled Proposed Regulations Relating to Passengers and Crew Member Safety, was issued in November 1998. This NPRM outlines training and checking requirements in more detail than previously referred to in Australian CAOs, for such aspects as emergency procedures and CRM.

Safety deficiency generating Interim Recommendation IR980098 and IR980099

The current procedures for preventing passengers from bringing excessive amounts of cabin baggage onto regional airline aircraft are inadequate.

Factual information

Survey results

Flight attendants were asked to rate, in terms of 'major', 'minor' or 'no problem', potential safety hazards, based on their experience. The hazard of 'amount and size of carry-on luggage' was ranked highest, being scored as a minor or major issue by 97% of respondents. In addition, 'excess cabin baggage' was commonly cited as a major safety problem in answers to the other general questions posed in the survey. No other hazard in the area of cabin safety was mentioned as frequently.

As the survey indicated that excess cabin baggage was raised as the most common cabin safety problem, it is considered to be a major safety issue in regional airline operations.

Background

Australian cabin baggage regulation is broad in its application and lacks the detail necessary to ensure that excess and inappropriate cabin baggage is not accepted into the cabin area of aircraft (Civil Aviation Regulation 20.16.3, subsection 9).

Australian domestic and international accident and incident records and studies have identified the following hazards as being associated with the carriage of cabin baggage:

(a) injury to passengers or crew members and/or blockage of exit routes, resulting from cabin baggage falling from failed overhead lockers during an accident sequence;

(b) cabin baggage being incorrectly stowed, or dislodged from stowage positions thereby obstructing aisles or exit ways and impeding evacuation;

(c) injury to passengers carrying baggage onto evacuation slides or through emergency exits during evacuation;

(d) aircraft weight limitations being exceeded because cabin baggage has not been incorporated into aircraft load computations;

(e) individual cabin baggage pieces exceeding the design limitation of the stowage compartment; and

(f) the speed of evacuation being slowed by passengers attempting to collect cabin baggage before evacuation.

Regional airline aircraft

Although most accident studies have been conducted on large-capacity aircraft, the hazards referred to apply equally to Group 1 and Group 2 aircraft. For example, aircraft of any size can experience in-flight turbulence. This may result in injury to passengers or crew, or damage to the aircraft caused by movement of cabin baggage. Passengers and crew may be injured if struck by baggage falling from overhead lockers.

Blocked emergency exits and passenger behavioural problems during evacuation are not unique to large-capacity aircraft types. Incorrectly stowed cabin baggage and spillage of luggage from stowage areas during an accident are as much a problem in smaller regional aircraft as in the higher-capacity aircraft types.

Excess cabin baggage is a particular problem for regional airlines as the types of aircraft typically used have considerably less stowage space in the cabin than aircraft used by high-capacity airlines. Passengers familiar with cabin baggage limits on high-capacity aircraft often expect to bring the same amount of baggage into the cabin of regional airline aircraft. Many aircraft designed to the 'normal' category standard, and some designed to the 'transport' category standard, do not have any overhead lockers or underseat stowage for cabin luggage. Piper Navajo and Fairchild Metroliner aircraft, two of the most common aircraft operated by regional airlines, have almost no space in the cabin for storing baggage.

Under-seat stowage compartments are approved for solid articles if they meet the restraint requirements of CAO part 103, section 10. The design of passenger seats in many of the smaller regional airline aircraft does not incorporate such under-seat stowage restraint.

International perspective

Transport Canada and the US Federal Aviation Administration (FAA) considered that their original regulations were not specific enough to ensure compliance. Both agencies have expanded their regulations for stowage of cabin baggage (Transport Canada Rule 705.42; FAA Rule 121.589 and AC-121-29, and proposed AC-121-29A).

In the introduction to the 'Carry-On Baggage Program Rule', which requires United States airlines to develop and use approved carry-on baggage programs, the FAA stated that:

> excessive carry-on baggage can endanger passengers and crew members in a number of ways: carry-on bags that block aisles or the spaces between seats can slow evacuation of the airplane in an emergency; improperly stowed carry-on bags can block access to emergency equipment and to the under-the-seat lifevests; carry-on bags that fall from overhead racks or bins can injure passengers and flight crew members and hinder evacuation

(FAA Supplementary Information: Amendment 121-194, Federal Aviation Regulation 121.589).

The Cabin Safety and Carriage of Persons Group, assigned to the Civil Aviation Safety Authority (CASA) Regulatory Review, has recommended to CASA that Transport Canada Rule 705.42 be adopted as a model for Australian regulation and program requirements.

Analysis

Severe limitations on stowage space in some regional aircraft make it imperative that effective procedures be in place to prevent passengers from bringing excess cabin baggage onto aircraft. CASA should develop standards and implement regulations which require Australian airline operators to develop cabin baggage control programs. These programs, approved and monitored by CASA, should control the size, quantity and weight, and correct on-board stowage, of cabin baggage on all Australian passenger-carrying aircraft.

Interim Recommendation IR980098 issued to the Civil Aviation Safety Authority on6 July 1998:

CASA develop standards and implement regulations which:

(i) require Australian airlines to develop industry-consistent cabin baggage control programs that will prevent passengers from bringing inappropriate cabin baggage onto aircraft; and

(ii) ensure correct on-board stowage of approved cabin baggage. Such programs should be approved and monitored by CASA.

In addition, as a result of the investigation into the above safety deficiency, the Bureau simultaneously issued interim recommendation IR980099 to operators of regional airlines:

The Bureau of Air Safety Investigation recommends that operators of regional airlines develop cabin baggage control programs that will prevent passengers from bringing inappropriate cabin baggage onto aircraft and ensure correct on-board stowage of cabin baggage.

Comments by respondents to the regional airlines survey

Lack of policing of cabin baggage for both the regional and major airlines. The size, weight and number of bags need to be better regulated. If an aircraft has to abort a takeoff or lands heavily, there will be someone hurt when the overhead lockers fail to support the weight. The second point is, how much overweight is the average airline flight when each passenger brings on a 10 kg brief case? (Pilot, respondent 167)

In-cabin hand luggage far exceeds safety standards every day of the week. Passengers and ground staff are ignorant of cabin baggage issues. Our baggage limitations allow one piece of cabin baggage but usually passengers turn up with two or three pieces. The less the better. I feel check-in staff should be aware of the safety issues here, especially with emergency exits. Maybe they should receive some training on this, and see some of the videos on airline disasters and what cabin baggage can do. (Flight attendant, respondent 034)

In the position of a flight attendant on a single cabin crew operation, I feel the greatest issue is the amount and size of carry-on and the time given to secure the cabin before takeoff. (Flight attendant, respondent 519)

Cabin baggage – too big, too much. (Flight attendant, respondent 489)

Cabin baggage hazards

The following are examples of hazards associated with cabin baggage, that have been identified in a number of accident and incident reports and safety studies.

Hazard:

Injury to passengers or crew members and/or or blockage of exit routes, resulting from cabin baggage falling from failed overhead lockers during an accident sequence.

In the cases examined, the basic designs or failures of overhead racks or bins allowed items stored there to become missiles during the crash sequence: these items inflict injuries, in some cases incapacitating ones. Emergency evacuation was also hampered when items stored in overhead compartments were released. Even items, such as blankets, pillows and coats, which are unlikely to cause injury when they become loose were thrown into the aisles or against bulkheads adjacent to the exits, creating barriers to exits.

(Special Study – Cabin Safety in Large Transport Aircraft, AAS-81-2, NTSB).

It was estimated that evacuation was interfered with by various events in the cabin such as the fall-down ceiling panels, a flow-out of carts, ovens and containers from the galleys, dropping of luggage from the overhead bins, cracks in the fuselage and the cabin filling with smoke due to fire, resulting from the impacts until the aircraft came to rest.

The forward cabin: Luggage came out of the overhead bins.

The middle cabin: A screen in front of them fell down and luggage dropped down.

The right side of the aft cabin: Luggage came out of the overhead bins. (Accident investigation report: DC-10, Fukuoka Airport, Japan. June 13,1996, Aircraft Accident Investigation Commission, Ministry of Transport, Japan)

About 70% of the bin doors had damaged latch lock plates (striker plates) or plates that were missing from their attachments points on the bin doors. Passengers stated that the carry on luggage in the overhead bins was thrown throughout the cabin during the impact sequence (Safety Recommendation arising from accident investigation: Scandinavian Airlines System. 1VID-80, Stockholm International Airport, Sweden. December 1992, NTSB).

Carry on baggage, pillows and blankets were thrown into the aisles, hampering passenger access to the 1 R and 41, exits (Accident investigation report: DC10 JFK. Jamaica, New York, 1975, NTSB).

Hazard:

Injury to passengers carrying baggage onto evacuation slides or through emergency exits during evacuation.

It is estimated that the reason why two passengers who evacuated through the 3L door (Door 3, Left Side) and jumped to the ground from the left wing suffered lumbar vertebra oppression fracture and/or calcaneal bone fracture was that they lost balance when they landed on the ground because they jumped from the wing from a height of approximately 1.3 meters above the ground with luggage. (Accident investigation report: DC-10, Fukuoka Airport, Japan. June 13, 1996, Japan Accident Investigation Commission, Ministry of Transport)

She reported having difficulty because she was carrying her personal computer which got in the way while she was trying to exit the window emergency exit.(Survival Factors Group, Factual report of Investigation MD-82, La Guardia Airport, New York, April 1994, NTSB)

Hazard:

Aircraft weight limitations being exceeded because cabin baggage has not been incorporated into aircraft load computations.

Accelerated to full power, 10 degrees flaps, and rotated at 70 knots. Pulled gear up approximately 10–15 feet in the air. Sank into the ground at full power, in effect a gear-up landing. After the incident, the aircraft contents were weighed, and actual weight was such that the aircraft was 150 lb over gross. I had previously removed the two rear seats, and had estimated the weights. Clearly, I should have weighed each of my passengers and their bags. Also, I only guessed about the amount of weight savings that removing the two rear seats would produce.

Callback magazine comment: Pilots sometimes take weight and balance matters for granted, especially with a familiar aircraft or an 'average' payload. A general aviation pilot, overestimating the aircraft's performance and underestimating the passenger load, reports on the effects of an overweight take-off in a six-place airplane (*Callback* magazine, December 1997, NASA Aviation Safety Reporting System).

The aircraft papers indicated that the aircraft would be just 1001bs or so below its maximum structural gross weight for takeoff. Takeoff was done with an abnormally long ground roll, and climb performance was marginal both dirty and cleaned up. Flight was planned for FL 310. At about FL 260, rate of climb was less than 500 feet per minute. The aircraft could not make it to FL 310 and stayed at FL 260. When I rechecked the weight and balance, I saw that we had 100 passengers, and that 'normal' passenger-plus-carry-on weight of 212 lb was used to calculate the cabin weight. I watched these guys disembark: they are gigantic, and all carried very large equipment duffel bags. I think the aircraft was a good 8,000–10,000 lb over planned weight and far in excess of structural gross weight. Abnormal passenger loads – troops, football teams, sumo wrestlers etc. should require actual weights for dispatch.

Callback magazine comment: The reporter's point is relevant to both the previous report and this incident: the use of 'average' weights for passengers, luggage, and carry-on items can lead to gross inaccuracies in calculating gross weight. (*Callback* magazine, December 1997, NASA Aviation Safety Reporting System)

Hazard:

The speed of evacuation being slowed by passengers attempting to collect cabin baggage before evacuation.

Many passengers tried to exit with hand baggage and the flight attendant was forced to speak to them aggressively to ensure that the hand luggage was not brought to the front of the aircraft where it could impede the evacuation (Aircraft accident report on SAAB 340, Devonport Tasmania, 1 July 1992, BASI).

After being told to leave everything behind, the majority of passengers took all or part of their hand luggage, which was then taken from them by the crew before they exited the aircraft. The hand baggage was piled up in the forward galley against the right front door. This door, which could have been used as an exit, was not required for the evacuation.

The right exit could have been used only after removing the hand baggage which was piled up against it.

There were nine occurrences in which passengers stopped to retrieve carry-on baggage and attempted to take it with them as they exited the aircraft. This was despite having been specifically told not to by the cabin attendants (Safety Study of Evacuations of Large Passenger Carrying Aircraft, Report SA 9501, Transportation Safety Board of Canada).

The following response was received from the Civil Aviation Safety Authority on 11 August 1998:

> I refer to your letter of 2 July 1998 relating to interim recommendation IR980098 generated through the Regional Airlines Safety Study.
>
> As acknowledged in the BASI document, the recommendation made by the Cabin Safety and Carriage of Persons project team to adopt the Canadian rule 705.42 for carry-on baggage is intended to be implemented by CASA.
>
> A Notice of Proposed Rule Making (NPRM) is currently being prepared in CASA's Regulatory Framework Program office for publication by September 1998. The proposed new rule for carry-on baggage expands CAO 20.16.3 Subsection 9, adopts Canadian rule 705.42 and similarly covers the requirements for FAR 1211589, and responds directly to the safety deficiency identified by BASI.

Response classification: CLOSED-ACCEPTED

6.7.2 Other safety action

Safety deficiencies currently being researched by the Bureau with a view to a formal safety output at a later date:

- Procedures for preventing intoxicated passengers from boarding aircraft in some regional airlines are inadequate.
- A significant proportion of regional airline pilots and flight attendants have not completed crew resource management training.
- There are no regulations specifying flight and duty time limitations for flight attendants.

Comment – Refer to comments at 6.5.2 *Other safety action*, regarding flight and duty time issues.

- Current procedures at some locations for controlling passengers on the tarmac are exposing passengers to unacceptable risks from turning propellers, taxiing aircraft and moving vehicles.

Safety deficiencies currently being monitored by the Bureau:

- Incidents involving PEDs interfering with aircraft equipment are occurring in regional airlines.

Comment – The Bureau receives notification of PED-related incidents that have occurred within Australian territory and those that have affected Australian registered aircraft overseas. Developments in this area are being closely monitored and research is being undertaken by a number of international agencies.

6.8 Maintenance safety deficiencies

6.8.1 Formal safety outputs

Safety deficiency generating Interim Recommendation IR980232 and IR980233

Maintenance staff numbers in some airlines do not adequately meet the demands of maintenance schedules and workload.

Factual information

Survey results

Forty-eight per cent of respondents rated 'rushed work', followed by 'excessive workload' as a major safety problem. Respondents working for Group 3 airlines nominated these issues as major problems more so than their counterparts working for Group 1 and Group 2 airlines. These two issues appeared to indicate a lack of appropriate maintenance resources commensurate with the demands of the maintenance workload and schedules. This was corroborated by the two most commonly mentioned safety problems of 'poor maintenance procedures or schedules' and 'poor maintenance standards' referred to in another part of the survey. Poor standards were considered to be a likely outcome of pressure to complete maintenance in minimum time.

In addition, many of the safety incidents described by respondents in the survey were examples of poor maintenance completed under time pressures. Although the sample of incidents was not large, the results support the view that personnel shortages have the potential to affect the quality of maintenance in the regional airline industry.

Examples of survey responses

> Aircraft seats were removed for carriage of freight and were subsequently refitted by someone not qualified to do so. The seats in fact were fitted incorrectly and were not secure. This incident occurred because there was no maintenance personnel available to refit the seats on a weekend and a baggage handler was instructed to do the job. (Pilot, respondent 178)
>
> On two occasions during 1996, AVTUR was used to replenish the water-methanol system [which provides extra engine power during takeoffi on a twin turboprop passenger aircraft. These maintenance errors occurred during periods of high maintenance workloads within the company and low experience/manning levels. The possible outcome of the use of the water-methanol system in this situation is at least very worrying. (Pilot, respondent 551)
>
> Lack of training on aircraft types and supervision by licensed personnel. Often an unlicensed person will perform the task and a licensed person will sign for it. Because of lack of manpower and insufficient time for the licensed person to double-check everything, some errors go unnoticed. (Maintenance supervisor, respondent 365)
>
> Unable to complete the task with few distractions. Heavy workload and tiredness - lack of staff on shift. Lack of manpower. (Licensed aircraft maintenance engineer (LAME), respondent 52)

Australian occurrence 9602602

In this occurrence, a De Havilland Dash 8 was involved in a landing accident following the failure of the nose landing gear to fully extend. The report stated:

> The operator's aircraft maintenance personnel were required to work on this aircraft as well as complete their normal maintenance activities on other company aircraft. These processes resulted in some unusually long shifts, (often 15 hours but up to 28.5 hours), and the onset of significant observed fatigue.
>
> The analysis stated that fatigue may have reduced the maintenance engineer's analytical ability and possibly contributed to the flawed decision.

International occurrence and resulting safety action

The potential hazard of a shift with reduced numbers of maintenance personnel for the same workload has been further demonstrated in the UK Air Accidents Investigation Branch aircraft incident report 3/96. This occurrence involved a B737-400 that lost engine oil pressure on both engines shortly after takeoff, necessitating an emergency landing. The investigation subsequently determined that the engine borescope inspection ports had not been closed following an inspection prior to the flight.

Pertinent comments from the analysis are reproduced below:

> In the Line Maintenance organisation, the shift supervisors were aware that their pool of available manpower was restricted although it was theoretically possible for it to be supplemented from Base Maintenance personnel if their workload permitted. With the small numbers involved, any absenteeism, whether through sickness, attendance on courses or for any other reason, led immediately to understaffing of shifts, engineers working extra shifts or a combination of the two. Whilst running a shift short-handed might not be significant when the workload was light, when there was a heavy workload it would be deleterious. Each individual would be under pressure in order to complete the tasks within the shift and those working extra shifts would be prone to fatigue.
>
> If the airline had an effective system in place to monitor functionally available manpower against planned workload, a shortfall of Line Maintenance engineers and Base Maintenance supervision would have been predicted. Such a system has become significantly more necessary in this era of minimum manning levels.
>
> The absence of any requirement for the company to maintain and supply, to the CAA, a record of the maintenance staff attendance related to workload, precludes any retrospective audit of the situation. If aircraft maintenance companies were required to implement manpower monitoring systems it would be realistic for these to be monitored by the Authorities.
>
> Whilst it must be accepted that it is the operator's responsibility for ensuring that there is adequate and suitable manpower available for the necessary tasks to be undertaken, the Regulator must have available mechanisms for detecting shortcomings, in this area as much as in any other, before these shortcomings constitute a hazard to flight safety.

Two safety recommendations were issued as a result of this occurrence:

SR96-29. The Airlines Maintenance Organisation should introduce an effective system to monitor functionally related manpower verses anticipated workload.

SR96-30. The CAA in conjunction with the JAA should review the requirements of JAR-145, relating to the monitoring of available manpower of maintenance organisations, to enable Authorities to retrospectively sample the availability of correctly qualified staff for the conduct of the aircraft maintenance performed.

Civil Aviation Safety Authority (CASA) requirements

The Civil Aviation Safety Authority (CASA), is required to know the number of appropriately qualified and/or experienced persons employed by the Certificate of Approval holder to carry out those activities to which the certificate relates at the time of application. CAR30 (2) states:

An application must be in writing and must:

(a) set out the following:

(iii) the number of appropriately qualified and experienced persons employed by the applicant who will be involved in carrying out the activities.

However, in relation to workload, little guidance is provided to CASA staff in the Aviation Safety Surveillance Program, on what should be reviewed to determine these matters.

Analysis

The findings of the Regional Airlines Safety Study indicate that rushed work and excessive workload due to inadequate staffing levels are compromising safety standards, particularly in Group 3 airlines.

With maintenance shifts moving toward minimum staffing levels, largely due to economic pressures, monitoring of available staff against workload and schedules calls for extra vigilance. Monitoring duty periods of company maintenance personnel for undesirable trends such as fatigue, and records for instances of insufficient licensed personnel and/or insufficient personnel should form an integral part of any company's quality assurance activities. This information should also be made readily available to CASA.

Interim Recommendation IR980232 issued to the Civil Aviation Safety Authority on 2 March 1999:

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority require Certificate of Approval holders maintaining Class A aircraft greater than 5,700 kg to introduce an effective system to monitor functionally related staffing versus anticipated workload, and that these records be available for CASA surveillance.

In addition, as a result of the investigation into the above safety deficiency, the Bureau simultaneously issued interim recommendation IR980233 to Certificate of Approval holders:

The Bureau of Air Safety Investigation recommends that Certificate of Approval holders maintaining Class A aircraft greater than 5,700 kg, introduce an effective system to monitor functionally related staffing versus anticipated workload.

Safety deficiency generating Safety Advisory Notice SAN980077 and SAN980078

Some maintenance engineers do not have ready access to all the tools, equipment and parts needed to perform their duties.

Factual information

Survey results

When respondents were asked to nominate the greatest safety problem they faced, a lack of spare parts was mentioned more frequently than any other maintenance issue. Twenty-three respondents (or 40 %) of the maintenance personnel who replied, considered that the tools and equipment needed to perform their job were not readily available. The majority of respondents (17 out of 19) who worked for Group 1 or Group 2 airlines, were satisfied with the availability of tools and equipment. However, approximately one-half of those (24 out of 45) who worked for Group 3 airlines, were dissatisfied with the availability of tools and equipment.

> The increasing maintenance costs, availability of spares, etc., creates scheduling difficulties and puts pressure on crews to fly aircraft with unserviceable items. (Pilot, respondent 552)
>
> The unserviceable aircraft being put back on line due to lack of parts. (LAME, respondent 409)
>
> One of them is lack of or insufficient maintenance done on an aircraft. Lack of engineering manpower often causes delays to rectify faults prior to departure. Accumulation of defects which eventually grounds the aircraft. Lack of support by management head office to supply urgently needed equipment for aircraft maintenance. (Flight attendant, respondent 109)
>
> Commercial pressures to fly with engineering problems. The lack of spare parts or aircraft mean management puts extreme pressure to continue operating and also to maintain schedule even though aircrew may well want time to analyse problems. (Pilot, respondent 509)
>
> The haste with which a job is expected to be done in. Lack of spare parts and poor tooling. (Licensed Aircraft Maintenance Engineer, respondent 147)

Workload lack of parts, tooling. (LAME, respondent 300)

Regulations

The Canadian Aviation Regulations (CAR) Commercial Air Service Standards, 726 – Air Operator Maintenance, addresses the responsibility of the operator for spare parts availability, and specifically requires sufficient supplies of spare parts to ensure the timely rectification of defects in regard to Minimum Equipment List (MEL) provisions.

The British Civil Aviation Publication (CAP) 360, Part Two, deals with Air Operator Certificates – Maintenance Support. Paragraph 15 enumerates substantial requirements of the operator regarding the provision and storage of spares. Two of these requirements are:

(a) CAP 360 15.1, which refers to sufficient spares being available to ensure defects can be promptly rectified; and

(b) CAP 360 15.2, which refers to the numbers and placement of essential spares to support the rectification of defects in systems required for operation, taking account of the operators' Minimum Equipment Lists, to ensure successive defects will be promptly addressed.

The Australian Civil Aviation Regulations do not address the responsibility of an operator with regard to spare parts.

Related occurrence

A fatal accident involving a regional airline aircraft that crashed at Young, NSW on 11 June 1993, highlighted the safety implications of a lack of, serviceable spares.

One of the findings of this report stated that 'the autopilot was inoperative, and had been for an extended period prior to the flight [73 days]'. The autopilot was a MEL item that required rectification within a period not exceeding 10 days. It was issued with Permissible Unserviceability (PUS) approvals for the extended period. During this period, another aircraft operated by the airline experienced an unserviceable autopilot. The airline manager requested approval of a PUS for the second autopilot unserviceability.

The airline operator had not provided adequate serviceable components to rectify the autopilots within the MEL period.

Analysis

The results of the regional airlines safety study, together with the safety issue highlighted by the occurrence referred to in this document, suggest that some operators may be compromising the safety of fare-paying passengers by not ensuring that adequate spare parts are available to meet the routine maintenance requirements of their fleets. The lack of appropriate domestic regulation may be a contributing factor to this safety issue. The reported lack of tools and equipment, particularly in Group 3 airlines, is also of concern.

Safety Advisory Notice SAN980077 issued to the Civil Aviation Safety Authority on 4 September 1998:

The Civil Aviation Safety Authority should note the safety deficiency identified in this document and take appropriate action.

As a result of the investigation into this safety deficiency, the Bureau simultaneously issued Safety Advisory Notice SAN980078, alerting operators of regional airlines to this safety deficiency.

Safety deficiency generating Safety Advisory Notice SAN980090

Some aircraft maintenance workers are not sufficiently prepared for working on their current aircraft as a result of inadequate training.

Factual information

Survey results

Maintenance staff were asked if the training they received on their most recent aircraft type adequately prepared them for working on that aircraft. While most respondents were satisfied with the training, 28% of maintenance personnel were dissatisfied with the training they had received. Respondents who worked for Group 3 airlines tended to be less satisfied with their training than the respondents who worked for Group 1 or Group 2 airlines.

Inadequate training or lack of knowledge was nominated as a factor in seven maintenance incidents reported to BASI in the regional airlines safety study employee survey. A theme which emerged from the incident reports was the incidence of mistakes being made by new workers and the need for careful supervision and training by more experienced workers. Inadequate technical training was also mentioned in the free response section of the survey and was nominated as a problem by five respondents.

> I have had no training whatsoever in the last 5 years. (LAME, respondent 384)
>
> [I witnessed the] incorrect rigging of a [propeller] primary blade angle. [This incident was caused by the worker's] misunderstanding of the particular type of installation and lack of detailed training by the company on the type of aircraft operated. (LAME, respondent 300)
>
> An incorrect rig pin hole was used to rig a stabilator, causing the pilot to have very little control on the test flight. [This incident was caused by] lack of training and supervision by licensed personnel. (Maintenance supervisor, respondent 365)

An incident investigated by BASI involving a regional airline, highlighted the lack of formal training on a particular aircraft type for maintenance personnel. In BASI occurrence number 9403759, a scheduled passenger service aircraft was dispatched with a rudder flight control rod incorrectly fitted to the elevator control system. The fault was only detected in flight when the flight crew noticed an abnormal control column position.

A duplicate inspection, carried out by maintenance personnel prior to the incident flight, had also failed to notice the discrepancy.

Current aviation regulations

The Civil Aviation Regulations (CAR) lay down the requirements for training of maintenance personnel by operators. The Aviation Safety Surveillance Program (ASSP) assesses an operator for compliance with the regulation for the training of maintenance staff.

The operator's responsibility with respect to training of maintenance personnel is laid down in CAR 214. This states:

An operator shall ensure that provision is made for the proper and periodic instruction of all maintenance personnel, particularly in connection with the introduction into service of new equipment or equipment with which the maintenance personnel are not familiar, and the training program shall be subject to the approval of CASA.

Additionally, CAR 30 details the conditions under which a certificate of approval is issued to allow maintenance of aircraft, aircraft components or aircraft materials. CAR 30 p.2(C) states:

A certificate of approval is subject to a condition that the holder of the certificate of approval must ensure that each person employed by, or working under an arrangement with, the holder receives adequate training in:

(i) the work performed by the person for the purposes of the activities covered by the certificate; and

(ii) the use of any equipment used in connection with that work.

The Airworthiness Surveillance Procedures contain a checklist – 'training of maintenance personnel' (ASSP362) within the system audit. Completion of the checklist allows Civil Aviation Safety Authority staff to assess an operator for compliance with CAR 214.

Procedures and guidelines for aircraft maintenance engineer (AME) training are contained in the Civil Aviation Orders part 100 and Airworthiness Advisory Circulars part 9. These orders and circulars detail the AME training required for all aircraft types operated in Australia.

Proposed aviation regulations

CASA officers are addressing training of maintenance personnel in their review of the aviation regulations. A survey of maintenance personnel conducted by CASA, highlighted similar problems with training of maintenance personnel. Rules regarding the training of maintenance personnel are contained in the new Civil Aviation Safety Regulations (CASR) part 145 – Approved Maintenance Organisations. This regulation was developed in conjunction with industry, with the latest draft regulation dated 18 February 1998.

CASR part 145.17 addresses the personnel requirements of the holder of a maintenance organisation certificate. This regulation clearly describes the requirement to provide approved training programs (initial, periodic, recurrent, and specialised) to employees. The regulation also requires maintenance organisations to provide sufficient personnel trained in the maintenance function or technique for which the organisation is rated.

CASR part 145.18 addresses the supervisory and maintenance inspection personnel requirements. This regulation clearly and prescriptively details the training required for

employees to conduct maintenance inspections, perform maintenance supervisory roles and certify work. The regulation also specifies the qualifications/training needed for supervisory tasks.

Discussions with CASA on this issue indicate that CASR part 66 – Licensing – Maintenance, and CASR part 147 – Approved Maintenance Training Organisations, complement the new part 145. These proposed regulations (due for completion in mid-1998), are meant to provide better standardisation of AME training.

Analysis

Results from the regional airlines safety study indicate that some maintenance workers (28%) have not been sufficiently prepared for working on their current aircraft as a result of inadequate training. Inadequate maintenance training is cited as responsible for a number of incidents reported in the survey. While current CASA regulations state the training responsibilities of operators and certificate of approval holders and provide guidelines and procedures for AME training, reports indicate that supervisory and inspection maintenance functions may not be carried out adequately at some regional airlines.

The review of the Civil Aviation Safety Regulations part 145, clarifies the requirements of maintenance organisations with respect to training of maintenance personnel. It also details the supervisory and maintenance inspection training requirements. CASA are striving towards clearer instructions and more standardised AME training in their review of the maintenance regulations.

If the proposed regulations are implemented by industry, the Bureau considers that this safety deficiency should be adequately addressed.

Safety Advisory Notice SAN980090 issued to operators of regional airlines, and maintenance certificate of approval holders, on 24 June 1998:

Operators of regional airlines, and maintenance certificate of approval holders, should note the safety deficiency identified in this document and take appropriate action.

Safety deficiency generating Safety Advisory Notice SAN980240, SAN980262 and SAN980263

Procedures for the recording of aircraft unserviceabilities in the maintenance release/log are not always being followed and may not be fully understood. In addition, descriptions of aircraft unserviceabilities given by flightcrew in the maintenance release/log are not always adequate for maintenance staff to readily action.

Factual information

Survey results

Use of the maintenance release log

The procedure for recording significant aircraft unserviceabilities on the maintenance release or log was examined by questions addressed to maintenance staff and flighterew.

In general, the survey results indicated that significant unserviceabilities were recorded in the maintenance release/log, although maintenance staff saw this being done less

frequently than flightcrew. Ninety-three per cent of flightcrew and 83% of maintenance staff reported that unserviceabilities were 'always' or 'frequently' recorded. However, 6% of flighterew and 17% of maintenance staff felt that unserviceabilities were only 'sometimes' or 'rarely' recorded in the maintenance release log, suggesting that in some cases unserviceabilities go unrecorded.

The survey also sought to determine how unserviceabilities were communicated between flightcrews other than by the use of the maintenance release/log, for example, on a loose piece of paper or by being passed verbally onto other crews without recording the unserviceability.

Thirty-one per cent of pilots reported that they verbally passed on unserviceabilities 'sometimes' or 'frequently' suggesting that this practice may be sufficiently common to be a safety deficiency. Fourteen per cent reported that information about unserviceabilities was 'sometimes' or 'frequently' recorded on a loose piece of paper.

Flightcrew were asked if they had commenced a flight unaware of a significant unserviceability which maintenance staff or the previous crew were aware of. The majority of pilots (68%) said they had not been in this situation but a significant proportion (19%) reported that this had occurred.

The following two reports submitted by maintenance staff provide examples of safety incidents that respondents were asked to describe:

> Aircraft arrived on Friday midday, and no time was stated when it had to be serviceable by. A job was started on an engine magneto which had been verbal but not written in the maintenance release. At 5.00 p.m., no-one had asked for the aircraft to be completed so the cowls were fitted and the aircraft placed outside without the maintenance being finished. On Sunday 1 was at the airport and a pilot was doing a daily check before departure. 1 was able to finish the timing and refit the cowls and sign for the job. The aircraft could have been operated unserviceable. (Licensed aircraft maintenance engineer, respondent 315)

> I have seen aircraft depart for an RPT flight with what 1 consider to be unpermissible unserviceability. Current defects are not recorded in the maintenance release which means that the pilot may or may not be aware of the aircraft's current defects. The unspoken company policy is not to record defects on the maintenance release. Pressure is applied to new pilots to conform. This policy avoids grounding the aircraft or having to fix it away from base. (Licensed aircraft maintenance engineer, respondent 248)

Description of aircraft unserviceabilities in the maintenance release/log

When maintenance personnel were asked if the description of unserviceability given by the flightcrew made it easy to identify the problem, only 3% of respondents answered that this was 'always' the case. A further 39% indicated that it was 'frequently' the case while 54% indicated that it was only 'sometimes' easy to identify the problem on the basis of the flightcrew's description.

The report of the Commissioner James Staunton on the Commission of Inquiry into the Relations Between the Civil Aviation Authority and Seaview Air

Volume 1, page 54 of the report addressed the issue of defects on maintenance releases:

> It was submitted that there is a widespread belief in the industry that only defects that might be regarded as serious, and therefore rendering the aircraft unfit to fly, are required to be entered on the maintenance release. In consequence, defects of a minor nature are not entered on the maintenance release, and might be overlooked as a possible indicator of a more serious defect.

It seems extraordinary that a misapprehension of the kind suggested could exist in the industry: it indicates a very poor understanding of basic requirements.

The following recommendation arising from the Inquiry was made to the Civil Aviation Safety Authority (CASA):

Recommendation 15

> While the whole area of the maintenance release system requires expert attention, it is recommended that as a first step, the Authority take steps to improve understanding in the industry about the requirements for recording defects on maintenance releases and the importance of that requirement to safety.

Civil Aviation Safety Authority action

CASA recently published an information booklet 'Aircraft Maintenance - A pilot's guide' which provides guidance on the legal requirements regarding maintenance control and details the pilot's role in ensuring the continued airworthiness of any aircraft.

Discussions with CASA staff involved with the Regulatory Framework Program indicated that CASA were aware of the safety deficiency issues raised in this document. CASA considered that these issues were being adequately addressed in the rewrite of the regulations, in particular the need to ensure that maintenance staff (part 147 - Maintenance training organisations) and flightcrew (part 61 - Pilot licensing) receive education on maintenance release procedures.

Analysis

Accurately communicating the serviceability of aircraft is considered to be critical to flight safety. The correct use of the maintenance release log by all groups who are routinely involved in using it, including flight crew and maintenance staff, ensures that this vital information is not lost. Using the correct maintenance release/log procedures ensures that the necessary airworthiness information is known to maintenance and flightcrews before the commencement of each flight in order that appropriate operational safety decisions can be made.

Regulations and information material published by CASA, relating to the use of maintenance releases, have been readily available to the industry. However, the requirements and procedures to ensure safety enhancement from their correct use do not appear to be fully understood by flightcrew and maintenance staff. There is a need for CASA to provide clear regulations on this issue in the new Civil Aviation Safety Regulations. Additionally, as highlighted by the Seaview Inquiry, there appears to be a continuing need for education by CASA, airline operators and maintenance organisations on the correct maintenance release procedures for flighterew and maintenance staff.

> **Safety Advisory Notice SAN980240 issued to the Civil Aviation Safety Authority' on 2 March 1999:**
>
> **The Civil Aviation Safety Authority should note the safety deficiency identified in this document and take appropriate action.**
>
> **As a result of the investigation into this safety deficiency, the Bureau simultaneously issues Safety Advisory Notices SAN980262 and SAN980263 to operators of regional airlines and Maintenance certificate of approval holders respectively, to alert them to this safety deficiency.**

6.8.2 Other safety action

Safety deficiencies currently being researched by the Bureau with a view to a formal safety output at a later date:

- There are no regulations specifying acceptable duty periods for aircraft maintenance workers.
- Some aircraft maintenance workers are affected by fatigue related to long periods of duty.

Comment – For comments on the above two safety deficiencies, refer to section 6.5.2. *Other safety action* regarding flight and duty time issues.

Safety deficiencies that are considered to be regulatory matters:

- Some flight crew, on occasions, are pressured to fly aircraft with serious unserviceabilities.
- Some maintenance staff are, on occasions, pressured to release aircraft with unserviceabilities.

Comment – The Bureau continues to actively pursue the issue of fatigue and considers that groups other than technical crew, such as flight attendants and maintenance staff should be included in any future flight and duty regulations as they play a vital role in the operational safety of every flight.

6.9 CASA surveillance and regulation safety deficiencies

6.9.1 Other safety action

Safety deficiencies currently being monitored by the Bureau:

- Some CASA surveillance inspections lack depth by not going beyond the first line of documentation.
- Some existing safety regulations are not being consistently enforced by CASA.

Comment – The issue of surveillance continues to be of concern to the Bureau. Inappropriate or inadequate surveillance has been identified as a contributing factor in a number of organisational aviation accidents in Australia over recent years. Submissions made in the Morris inquiry, evidence and recommendations from the Seaview Coronial inquiry, information provided to the Bureau through CAIR reports and by this and other recent studies, suggest that the quality of surveillance conducted by the Civil Aviation Safety Authority may need to be reviewed to ensure that both the aviation industry and the Civil Aviation Safety Authority are meeting their individual responsibilities and their shared objective of maintaining a safe aviation industry. The Bureau has previously issued a number of recommendations in response to safety deficiencies related to CASA surveillance. The CASA responses to interim recommendations IR930244, IR940258 and IR960127 and recommendation R960181 indicated that they had either been accepted by CASA or changes were being made to address the deficiency concerned. However, progress toward these changes has been slow in some areas. Refer to Appendix – Summary of BASI Recommendations for the text of these interim recommendations.

6.10 Reporting of safety deficiencies

6.10.1 Other safety action

Safety deficiencies currently being monitored by the Bureau:

- The lack of acknowledgment of ASIRs by BASI may have the effect of discouraging the reporting of some safety incidents.

Comment – This matter has been referred to the Director of the Bureau and Manager of the Investigation Branch for further consideration and action.

- Many flight attendants are not using the BASI air safety incident reporting system to the fullest extent.

Comment – Since the completion of the Regional Airlines Safety Study, the Bureau has appointed a cabin safety specialist who has overall responsibility for matters related to cabin safety, including survivability issues. It is hoped that this initiative will improve channels of communication between the aviation industry and the Bureau in this important area of aviation safety.

- The communication of safety-related information may be impaired in airlines without a nominated safety officer.

Comment – The Bureau issued Interim Recommendation IR960037 on 27 August 1996 (refer to *appendix – Summary of Recommendations* of this report) regarding the requirement for RPT operators to establish safety departments and/or appoint safety officers. At the time of this report, there was no regulatory requirement for regional airline operators to establish safety departments and/or appoint safety officers. However, the Civil Aviation Safety Authority has strongly encouraged this initiative and has promoted the concepts extensively throughout Australia. The Bureau has also conducted research into safety management and developed a practical and simple safety management program for operators in order that a positive safety culture is established and to facilitate a proactive approach to safety. This program is known as the BASI-INDICATE safety program.

6.11 General safety deficiency

6.11.1 Other safety action

Safety deficiencies currently being monitored by the Bureau:

- In some companies, managers and employees allow commercial considerations to have a higher priority than the safety of the passengers.

7 CONCLUSION

In conclusion, this study has made a pro-active examination of the safety of the Australian regional airline industry. It was conducted in response to the House of Representatives Standing Committee on Transport, Communications and Infrastructure's findings in the *Plane Safe* report (Morris, 1995).

Overall, the results indicate that in 1996/97 the safety health of the industry was good, although some areas for improvement have been identified.

The study identified safety deficiencies in all areas of the regional airlines operations and at all levels of the industry. Recommendations and Safety Advisory Notices to address many of those deficiencies have already been developed by BASI. Those recommendations that had been released at the time of writing have been included in this report.

The existence of a number of industry-wide safety deficiencies suggests that other safety deficiencies, specific to one or two airlines, probably exist throughout the industry but have not yet been identified. As people, procedures and equipment in the industry change, new safety problems are certain to arise. Therefore, it is strongly recommended that all regional airlines have a safety program and appoint a safety officer to continuously monitor the company's level of safety and to bring new and existing safety problems to the attention of senior management.

In conclusion, it should be emphasised that this study was conducted with the support of the industry and would not have been possible without the assistance of many managers and employees in regional airlines. The support given shows that, on the whole, the industry does value safety as important.

APPENDIX — SUMMARY OF BASI RECOMMENDATIONS

References to BASI recommendations, previously issued, relating to regional airlines have been made in this report. These recommendations are shown in full below.

Recommendation 930204 – 'RPT flights into MTAF zones'

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

1. Commit greater resources to surveillance and enforcement of procedural compliance by pilots.
2. Incorporate training in procedural compliance and traffic conflict recognition into the private pilot and student pilot (with passenger carrying privileges) licence syllabi.
3. Examine ways to ensure that all pilots have the operational documents necessary for the proposed flight. (This recommendation was previously made in the report of the Violations of Controlled Airspace study, BASI RP/92/10.)
4. Mandate pilot responses to traffic broadcasts by aircraft in the same compass quadrant of MTAF zones.

Interim Recommendation 930231 – 'Visual circling approaches at night'

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

1. the adequacy of instructions to flight crew for maintaining a safe height above terrain at night; and,
2. the phraseology used in AIP/DAPS IAL-2, 1.5 with a view to making it less susceptible to misinterpretation.

Interim Recommendation 930234 – 'Obstacle terrain guidance for other than high-capacity RPT operations'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority review the obstacle terrain guidance information provided for flight crew in 'other than high-capacity RPT' operations. This review should ensure that flight crew have adequate knowledge of the terrain associated with the route flown, including the obstacle terrain information for non-precision and circling approaches.

Interim Recommendation 930244 – 'Manual of Air Operator Certification/Policy Advisory'

It is recommended that the Civil Aviation Authority:

1. Review the current rates of surveillance to determine whether the target levels of the Annual Surveillance and Inspection Program detailed in the MAOC are being met for all RPT AOC holders; and,

2. Review the adequacy of the Annual Inspection and Surveillance Program in the MAOC for RPT AOC holders.

Interim Recommendation 940164 – 'ATC instructions to operate in CTA'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Authority develop procedures that will ensure that where an aircraft has planned flight in CTA, ATC shall issue instructions that maintain that aircraft in CTA, unless the pilot specifically requests alternative processing.

Recommendation 940181 – 'AOC holders'

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

1. develop a system for CAA officers to advise DASR of known adverse financial situations of AOC holders;
2. ensure that surveillance and inspection action responds to reported adverse financial situations of AOC holders with particular reference to their ability to conduct safe operations; and
3. develop a system to provide an ongoing assessment of the safety health of AOC holders as part of routine surveillance activities.

Recommendation 940219 – 'Human performance/ratings'

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

1. Integrate and expand human performance and limitation considerations into the Day VFR syllabus at and above the level of post-GFPT private pilot licence.
2. Review policy on the testing of human performance and limitation considerations and include this area as an examinable part of the syllabus above the level of GFPT private pilot licence.
3. Review theory requirements of the instructor, night VFR and instrument ratings, with emphasis given to the specific operational and human factors considerations that the use of these ratings require as compared to day VFR flight.
4. Review the practical requirements of the syllabus leading to an instrument rating to ensure that a candidate has experienced conditions of IMC and flight at night (including takeoffs and landings) in areas with limited lighting before being granted a rating.
5. Review the policy applicable to the renewal and recency requirement of the night VFR rating to ensure renewal and recency requirements are similar to other instrument ratings.
6. Educate pilots and operators of the effects of fatigue and the need to establish flight and duty times that are commensurate with the demands of their flight operations. In particular, the CAA should stress that the limits imposed by CAO 48.1 are maximum limits and lower limits may be appropriate to some types of operations.

Interim Recommendation 940258 – 'Remote surveillance of 'new' operator'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority ensure that the procedures of the Aviation Safety Surveillance Program are specific enough to ensure that:

1. the areas of responsibility and surveillance control between regional offices, for Certificate of Approval holders who operate interstate are defined; and
2. the responsibilities for initiating the surveillance plan and processes are conducted in a timely manner when it becomes apparent that the surveillance task for a particular Certificate of Approval holder crosses 'state or jurisdiction boundaries'.

Interim Recommendation 950063 – 'Check-and-training approval on specific aircraft types'

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.

Interim Recommendation 950101 – 'Crew resource management'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority require operators involved in multi-crew air transport operations to ensure that pilots have received effective training in crew resource management (CRM) principles. To this end, the CASA should publish a timetable for the phased introduction of CRM training to ensure that:

1. CRM principles are made an integral part of the operator's recurrent check and training program and where practicable, such training should be integrated with simulator LOFT exercises;
2. the CASA provides operators and/or CRM course providers with an approved course syllabus based on international best practice;
3. such training integrates cabin crew into appropriate aspects of the program; and
4. the effectiveness of each course is assessed to the satisfaction of the CASA.

Interim Recommendation 950117 – 'Airborne Collision Avoidance System'

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

1. mandate the fitment and use of an Airborne Collision Avoidance System (ACAS) in all aircraft engaged in Regular Public Transport (RPT) operations;
2. consider the requirement for the fitment and use of a suitable ACAS in other aircraft engaged in the carriage of passengers for hire or reward;
3. review the requirements for the carriage and activation of transponders with the objective of maximising the effectiveness of ACAS;

4. mandate the standard of ACAS equipment to be carried in each aircraft classification;

5. set a timetable for the introduction of ACAS equipment; and

6. ensure that air traffic services officers are given adequate and timely education and continuation training in the capabilities and operational impact of ACAS equipment.

Interim Recommendation 950206 – 'Instrument approach paths'

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

1. publish details of final inbound instrument approach paths at aerodromes in a format to assist VFR pilots in avoiding these areas; and,

2. highlight to VFR pilots the need for caution and vigilance when operating in the vicinity of the final instrument approach legs at aerodromes containing a published instrument approach.

Interim Recommendation 950224 – 'Circuit training operations at night'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority amend the Civil Aviation Regulations and the Civil Aviation Orders to ensure that when a provision of the Aeronautical Information Publication specifically prohibits certain manoeuvres and procedures, then this prohibition has legal force which is reflected in relevant Civil Aviation Regulations and Civil Aviation Orders.

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority take appropriate steps to inform and educate the industry on the hazards involved in asymmetric training operations in conditions of low visibility and at night.

Interim Recommendation 960027 – 'Visual circling approaches in dark night conditions'

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

1. amend AIP/DAPS IAL-2, 1.5 to clarify the intent of the instruction and differentiate between visual circling approaches conducted during the day and at night;

2. critically review the obstacle clearance height to assess whether these minimum heights are appropriate from an operational viewpoint; and

3. require pilots to demonstrate a visual circling approach at the minimum obstacle clearance height during the test for their instrument rating and at subsequent renewals.

Interim Recommendation 960034 – 'Training for check pilots'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority examine the need to publish a syllabus of training for check pilots. The syllabus

should cover all areas of training, including but not limited to, principles and methods of instruction, human factors training and crew resource management training.

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority review the current process for the approval of check pilots to ensure that candidates have undergone adequate training prior to seeking approval.

Interim Recommendation 960035 – 'Co-pilot emergency training'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority, as part of the current review of the multi-engine training syllabus, address the issue of endorsement training requirements in aircraft above 5,700 kg MTOW, where a simulator is not available. The review should cover the possible difference in flight training requirements when a simulator is used for training and for the conduct of emergency procedures.

The Civil Aviation Safety Authority should also address the issue of co-pilot training required for 'leg-for-leg' operation of aircraft above 5,700 kg on regular public transport operations.

Interim Recommendation 960037 – 'Safety officer/safety department'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority assess the benefits of mandating a requirement for safety officers and/or safety departments for Regular Public Transport operators. The assessment should take account of developments in the United States of America and Europe, and recommendations from international civil aviation organisations.

Recommendation 960040 – 'Fitment of GPWS'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority expedite the discussion with industry with the aim of implementing the changes made to ICAO annex 6 part 1, paragraph 6.15.3 prior to 1 January 1999.

Recommendation 960074 – 'Training of CASA staff'

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority review the training of their regulatory staff to ensure that they are adequately trained to apply legislation, regulation and administrative procedures relevant to their employment and delegations.

Interim Recommendation – 960127 – 'Surveillance of new AOC holders'

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

1. review the Aviation Safety Surveillance Program to ensure that new commercial operators are adequately monitored and inspected until a demonstrated history of safe operations is known;

2. align the scheduled surveillance period of the Aviation Safety Surveillance Program, to that of the validity period of the Air Operator's Certificate;

3. reconsider the flight review requirements for chief pilots with the view of bringing them into line with the current situation for chief flying instructors, as an additional method of surveillance;

4. review the adequacy of the approval and assessment requirements for chief pilots who do not have a demonstrated history in flight operations with a commercial operators; and

5. review the current situation regarding Aeroplane Flight Review, to allow for appropriate notification to the Civil Aviation Safety Authority and recording of results.

REFERENCES

AAIB (1990). Report on Accident to Boeing 737-400 *G-OBME near Kegworth, Leicestershire on 8 January 1989*. UK Department of Transport Air Accident Investigation Branch Report Number 4/90. London: HMSO.

Airservices Australia (1997). *Aeronautical Information Publication, Enroute Supplement Australia*, 11 September 1997. Canberra: Author.

Airservices Australia (1998). *Manual of Air Traffic Services*, 16 July 1998. Canberra: Author.

BASI (1991). Report *Limitations of the See-and-Avoid Principle*. Canberra: Department of Transport and Regional Development.

BASI (1994). Investigation Report 9301743, *Piper PA31-350 Chieftain, Young NSW, 11 June 1993*. Canberra: Department of Transport.

BASI (1996a). Investigation Report 9402804, *Rockwell Commander 690B VH-SVQ enroute Williamtown to Lord Howe Island NSW*, 2 October 1994. Canberra: Department of Transport.

BASI (1996b). Investigation Report 9601590, *De Havilland Canada Dash 8 VH-JSI Broome, Western Australia, 17 May 1996*. Canberra: Department of Transport.

BASI (1996c). Report *Regional Airlines Safety Project – Preliminary Information Paper*. Canberra: Department of Transport and Regional Development.

BASI (1996d). Report *Proactively Monitoring Airline Safety Performance: INDICATE (Identifying Needed Defences in the Civil Aviation Transport Environment)*. Canberra: Department of Transport and Regional Development.

BASI (1997a). Investigation Report 9503057, *Fairchild Aircraft Model SA227-AC VH-NEJ Tamworth NSW 16 September 1995*. Canberra: Department of Transport and Regional Development.

BASI (1997b). Research paper *Human Factors in Airline Maintenance: A Study of Incident Reports*. Canberra: Department of Transport and Regional Development.

BASI (1998). Report *An Evaluation of the BASI-INDICATE Safety Program*. Canberra: Department of Transport and Regional Development.

BTCE (1995). *Australian Transport Statistics*. Bureau of Transport and Communication Economics. Canberra: AGPS.

CAA (1994). *Aviation Safety Surveillance Program Manual*, amendment status 12 May 1994. Civil Aviation Authority. Canberra: Author.

Cohen, A. (1977). Factors in successful occupational safety programs. *Journal of Safety Research*, 9, 168–178.

Cooper, D. (1995). *Measurement of safety climate: A component analysis.* Paper presented at the IOSH meeting, London, Feb. 1.

Dawson, D. & Reid, K. (1997). Fatigue, Alcohol and Performance Impairment. *Nature*, 388, 235.

Department of Transport (1987). *Merchant shipping act: Wreck report MV Herald of Free Enterprise*. UK Department of Transport. London: HMSO.

Edkins, G. & Coakes, S. (1998). Measuring Safety Culture in the Australian Regional Airline Industry: The Development of the Airline Safety Culture Index (ASCI). *Safety Science, 26.*

Hidden, A. (1989). *Investigation into the Clapham Junction Railway Accident*. UK Department of Transport. London: HMSO.

ICAO (1993). *Human factors digest No. 10: Human Factors, Management and Organisation*. International Civil Aviation Organisation. Montreal, Canada: Author.

ICAO (1994). *International Standards and Recommended Practices – Airspace Management*. Annex 15 to the Convention on International Civil Aviation, Chicago 1944. Montreal, Canada: Author.

Lautman, L. G. & Gallimore, P. L. (1987). Control of the crew caused accident. *Airliner*, April–June 1987, 1–6.

Morris, P. (1995). *Plane Safe*. Inquiry into Aviation Safety: the Commuter and General Aviation Sectors. Report from the House of Representatives Standing Committee on Transport, Communications and Infrastructure (The Hon. Peter Morris MHR, Chairman). Canberra: AGPS.

Moshansky, V. P. (1992). *Commission of Inquiry into the Air Ontario crash at Dryden, Ontario*. Ottawa: Ministry of Supply and Services Canada.

Pidgeon, N. F. & O'Leary, M. (1994). Organisational safety culture: Implications for aviation practice. In N. Johnston, N. McDonald & R. Fuller (Eds.), *Aviation Psychology in Practice*. London: Ashgate Press.

Potter, R. F. & Nendick M. D. (1997). *The Clarity and Accessibility of NOTAM Information for the Aviation Industry*, technical report prepared for the Bureau of Air Safety Investigation, January 1997.

Smith, A. J. (1993). The role of human factors in ensuring the safety of engineering systems: A UK perspective. In C. M. Pollock & L. M. Straker (Eds.), Ergonomics in a changing world. *Proceedings of the 29th Annual Conference of the Ergonomics Society of Australia*. Perth: Australia.

Taggart, W. R. (1990) Introducing CRM into Maintenance Training. *Proceedings of Third Federal Aviation Administration Meeting on Human Factors Issues in Aircraft Maintenance and Inspection*. Atlantic City, New Jersey.

Turner, B. A., Pidgeon, N. F., Blockley, D. I. & Toft, B. (1989). *Safety culture: Its importance in future risk management*. Position paper for Second World Bank Workshop on Safety Control and Risk Management. 6–9 November. Karlstad, Sweden.

Weinstein, N. D. (1980). Unrealistic Optimism About Future Life Events. *Journal of Personality and Social Psychology, 39,* 806–820.

Wiener, E. L., Kanki, B. G., & Helmreich, R. L. (1993). *Cockpit Resource Management*. San Diego, CA: Academic Press.

Williams, J. C. (1991). Safety cultures: Their impact on quality, reliability, competitiveness and profitability. In R. H. Matthews (Ed.), *Reliability '91*. London: Elsevier.