Civil Aviation Safety Authority Supplementary Submission to the House of Representatives Standing Committee on Infrastructure and Communications.

Inquiry into Ratios of Cabin Crew Members on Aircraft

Introduction

1. CASA is satisfied that the proposal to change the number of cabin crew on single-aisle aeroplanes with more than 36 seats but not more than 216 seats from 1 to 36 cabin crew per passenger to 1 to 50 per passenger seat is safe.

2. As discussed in CASA's original submission and during the Inquiry's 19 May 2011 hearing, the 1 to 50 ratio is common practice throughout the world, including in the United States (US), Europe and New Zealand and is used by the majority of carriers operating to Australia. CASA is not aware of any reliable evidence or compelling studies suggesting that the 1 to 50 ratio is less safe than the current 1 to 36 ratio used on Australian aircraft.

3. This submission includes information in response to questions taken on notice and provides further evidence supporting CASA's views in relation to the ratio of cabin crew members to passengers on aircraft.

The history of international standards for the assignment of cabin crew on aircraft

4. The US requirements for emergency evacuation demonstrations by aircraft operators were first established in Part 121 of the US Federal Aviation Regulations (§ 121.291) by Amendment 121-2, effective March 3, 1965.

5. The US requirements for the carriage of flight attendants, which specify the 1:50 flight attendant to passenger seat ratio, were first established in Part 121 of the US Federal Aviation Regulations (§ 121.391) on 9 March 1965.

6. The requirements for US aircraft manufacturers to conduct an evacuation demonstration for aircraft having a seating capacity of more than 44 passengers were established in Federal Aviation Regulations Part 25 (§ 25.803) by Amendment 25-15, effective 24 October 1967.

7. The Federal Aviation Administration (FAA) considered that the manufacturer's demonstration would show the basic evacuation capability of a new aircraft. The intention of an aircraft operator's demonstration, on the other hand, was to evaluate the adequacy of crew procedures and training.

8. In 1987, a number of European states agreed to cooperate through the European Joint Aviation Authorities (JAA) in developing and implementing common safety regulatory standards and procedures. The JAA was given responsibility for common certification codes for large aeroplanes in order to meet the needs of European industry and international consortia such as

Airbus. Aircraft certification activities commenced using harmonised airworthiness and operational standards of the FAA.

9. The European Joint Aviation Requirement JAR-25.803, together with US Federal Aviation Regulations Part 25 (specifically § 25.803) included the requirement for aeroplanes (having a seating capacity of more than 44 passengers), to show that the maximum seating capacity of an aircraft including the number of crew members required by the operating rules for which certification is requested, could be evacuated from the aircraft to the ground under simulated emergency conditions within 90 seconds.

10. Compliance with this requirement was to be shown by actual demonstration using test criteria unless the Authorities found that a combination of analysis and testing provided data equivalent to that which would be obtained by actual demonstration.

11. In 2002, the European Aviation Safety Agency (EASA) was formed and took over many of the JAA functions in the interest of aviation standardisation across the European Union.

12. Numerous full scale demonstrations have been conducted by transport category aircraft manufacturers as part of the aircraft certification processes in the United States and Europe. These were usually conducted as joint FAA/JAA exercises.

13. The aircraft manufacturers' demonstrations provided data on evacuation rates and escape system performance.

14. The aircraft operators' demonstrations provided data on procedural quality, crew training effectiveness and the behaviour of passengers and crew members who evacuate the aircraft during the demonstration.

Evolution of Australian standards for assignment of aircraft cabin crew

15. Australia aligned with the US requirements for evacuation demonstrations from the early 1960s, most likely as a reflection of the fact that the majority of jet aircraft types entering the country were manufactured by the Boeing Company in the US.

16. Australian operators were (and still are) required to satisfy CASA that the evacuation procedures and training introduced by the operator would enable crew members to achieve an evacuation capability equivalent to that achieved when evacuation performance was demonstrated by the manufacturer.

17. CASA has continued to require operators to conduct partial evacuation demonstrations for new aircraft types for both 1:36 and 1:50 cabin crew ratios. These employ guidelines used by the FAA. CASA is satisfied that the FAA guidance assures a standardised approach to evacuation testing.

18. Air operators applying for permission from CASA (under regulation 208 of the Civil Aviation Regulations 1988 (CAR)) for a cabin crew ratio of up to 1:50 are required to provide the demonstration of evacuation capability under performance criteria based on the FAA guidance. If, after the safety risk management plan is assessed by CASA as satisfactory, and the demonstration is successful against the evacuation criteria, a permission may be issued. If the demonstration is assessed by CASA as unsuccessful, the operator is given a further opportunity to conduct the demonstration with new crew and passengers. Some of the demonstrations conducted since 2000 were not successful on the first attempt.

19. Of the 11 operators who operate under CAR 208 permissions, permitting a cabin crew ratio between 1:37 and 1:50 (inclusive) passenger seats installed, all but one was required to conduct evacuation demonstrations. The aircraft type not requiring a demonstration was the Dash 8-400 where an increase of 2 seats (from 72 to 74) was proposed for a maximum cabin attendant to passenger seat ratio of 1:37.

20. For an Australian operator introducing a new aircraft type, CASA also requires a proving flight prior to the aircraft type being introduced. The proving flight is a practical demonstration by the operator that the documented procedures and systems previously assessed can work together in real time to produce a safe operation. This involves a number of simulated exercises including emergency exercises during flight involving the cabin crew.

21. For single-aisle large aircraft now operating in Australia, the last full evacuation demonstrations by a manufacturer is believed to be that of the Airbus 320 in August 1987 and the Boeing 737-400 in June 1988. A further full evacuation demonstration was conducted by Ansett Australia in 1988 when the first A320 arrived in Australia. This demonstration did not initially succeed due to cabin crew training deficiencies. A successful evacuation demonstration was carried out some weeks later following further development of the A320 cabin crew training program.

CASA's determination of equivalent safety

22. Operators are required to manage their safety risks in a manner consistent with the applicable legislation, and where there is discretion to do so, they are encouraged to develop risk management practices that are consistent with the standards envisaged by proposed Part 121 of the Civil Aviation Safety Regulations 1998 (CASR).

23. Operators utilising CASA CAR 208 permissions for cabin crew ratios above 1:36 have found that application of proposed CASR 121 standards provides improved safety risk outcomes by leveraging off the international experience behind the rules. The proposed CASR Part 121 requirement for exit row briefings for passengers at emergency exits has already been adopted by a number of Australian airlines and is already mandated in the US and Europe. This is a good example of the proactive incorporation of international standards by the Australian aviation industry.

24. Efficiency benefits must not compromise safety, and it is necessary to demonstrate that there are no unacceptable safety-significant differences between the current regime and any alternative proposed by an operator. Outcomes must involve a demonstrated equivalent or higher level of safety.

Recognition of the role of passengers in an emergency

25. Between 1982 and 1990 there was a number of accidents involving jet aircraft around the globe (although not in Australia), which led to a better understanding of the causal factors involved in such events.

26. A period of research followed in Europe and the US. This included further Cranfield University studies on behalf of the Civil Aviation Authority of the United Kingdom into methods of briefing passengers at "self help" exits.[1] The US National Transportation Safety Board (NTSB) safety study published in 2000, concerned emergency evacuation of commercial aircraft.[2]

27. The original CASA submission to the Committee referenced research carried out by Cranfield University, the FAA Civil Aero Medical Institute and Australian Transport Safety Bureau into the management of passengers in emergency situations.[3]

28. The NTSB recommended in its 2000 safety study that

> *"trained crewmembers are expected to operate most of the emergency equipment on an airplane, including most floor level exit doors. Over wing exits, on the other hand, are expected to be and will primarily be opened by passengers. Even in airplanes where flight attendants are assigned the responsibility for over wing exits, passengers are likely to make the first attempt to open over wing exit hatches because the flight attendants are not physically located near the over wing exits."*[4]

29. The benefit of exit row passengers receiving oral briefings from flight attendants was demonstrated in the runway collision in Los Angeles, California, on February 1, 1991. The NTSB report of that accident contained the following information:

> *"Passengers seated around row 10 stated that prior to departure, the flight attendant assigned to the R1 position interviewed a young passenger who was seated in 10D about whether he could fulfil the duties of an able-bodied person in the event of an emergency. The passenger advised the flight attendant that he was 17 years old.*

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[1] Cobbett, A.M., Liston, P. & Muir, H.C. (2001) An investigation into methods of briefing passengers at Type III exits. Civil Aviation Authority, London, CAA Paper 2001/6.

[2] National Transportation Safety Board. `Safety Study: Emergency Evacuation of commercial airplanes'. NTSB/SS-00/01, Washington DC. 2000

[3] Paragraphs 58-59.

[4] National Transportation Safety Board, op. cit., p 39.

However, to be sure the youth understood his responsibilities; the flight attendant conducted a special oral briefing for the persons seated in and around row 10. Passengers stated that the instructions provided by the R1 flight attendant aided in their evacuation".

30. The NTSB concluded that most passengers seated in exit rows do not read the safety information provided to assist them in understanding the tasks they may need to perform in the event of an emergency evacuation, and they do not receive personal briefings from cabin crew even though personal briefings can aid passengers in their understanding of the tasks that they may be called upon to perform. The NTSB believed that the FAA should require air carriers to provide all passengers seated in exit rows in which a qualified crewmember is not seated with a pre-flight personal briefing on what to do in the event the exit may be needed. This recommendation was adopted by CASA in the CAR 208 (1:50) permissions given since 2006. Other operators in Australia have incorporated emergency exit briefings at CASA's recommendation.

31. In Australia, an operator constructively applied overseas experience in its operational practices in relation to the Airbus 321 (A321), where the manufacturer's evacuation demonstration, recommends 1 cabin crew member at the forward exits.[5] Following review of the manufacturer's demonstration data, and incorporation of European training standards supporting dual exit operation, the operator proposed further risk management measures by considering the front rows to be emergency exit rows.

32. Relevant to the matter of a single cabin attendant managing dual exits is research carried out by Cranfield University, which concerned the influence of cabin crew during emergency evacuations. The results clearly indicate the importance of having cabin crew adopting assertive behaviour which resulted in a significant increase in the speed of an evacuation. When the influence of 1 assertive cabin crew member was compared against 2 assertive cabin crew operating a pair of exits, the mean evacuation times were virtually identical at all stages of the evacuation, with the 45th person being evacuated at 36.6 seconds in both scenarios.[6] The results also recognised the value in having a cabin crew member who was particularly good at controlling and aiding participants in an evacuation.[7]

33. In the case of cabin crew incapacitation in an emergency, the capability of able-bodied passengers, to open a floor level exit on the A321 is considered to be a safety enhancement. In the event of a serious impact, an able-bodied passenger, who has received and acknowledged receipt of an exit safety briefing, is seen as capable of conducting 2 relatively simple actions, similar to

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[5] The A321 aircraft's evacuation capability was certified by Airbus in 1993

[6] Muir, H., and Cobbett, A., 1996, Influence of Cabin Crew During Emergency Evacuations at Floor Level Exits, Technical Report, CAA Paper 95006, Part A, (Table 6). Aviation Authority, London.

[7] The Australian A321 operator has provided special training and qualification for the cabin crew who are assigned to operate at the front of the A321 aircraft in line with recommendations of the European regulator.

those at the self help exits. This involves assessing outside conditions for fire, smoke, or water. If the area is clear, the passenger then should act to raise the operating handle as described in the preflight safety briefing. This will unlock the door, which then automatically opens under its own power, triggering deployment and inflation of the escape slide within 4 seconds, at which time the exit is available for use.

34. The International Civil Aviation Organization (ICAO) defines able-bodied passengers as "passengers selected by crew members to assist in managing emergency situations if and as required."[8] The provision of able-bodied passengers at floor level exits is seen as a further improvement to aircraft occupant safety and survival capability, in the event of cabin crew incapacitation in a catastrophic scenario.

35. CASA believes the recognition of the internationally accepted role of passengers in an emergency evacuation is an important consideration to which this Inquiry should have regard.

Passenger behaviour in an emergency

36. In 2000, Cranfield Aerospace University (UK), conducted significant studies into the operation of exits by able-bodied passengers. The studies focused on the pre-flight briefing offered to able-bodied passengers prior to operating an exit. The report found:

> "*Based on results from research into passenger briefing at over wing exits (specifically Type III self-help exits) conducted at Cranfield University, it was concluded that there was substantial benefit of providing passengers with more detailed information about the operation of the Type III exit. When comparing no-briefing and a minimum briefing against those containing more information, such as a combination of verbal & visual briefings, results indicated significantly less hesitation by passengers in the time to operate the exit. Cranfield University studies also concluded verbal & written (visual) briefings led to a greater number of participants correctly operating the Type III exit and the total time to operate the exit also improved significantly. The combination of visual and verbal briefings made participants aware that it was their responsibility to operate the exit and increased the number of passengers that studied the over-wing briefing cards.*"[9]

37. In 2001, the FAA's Civil Aeromedical Institute (CAMI) published a report concerning factors that control the emergency evacuation of naïve

[8] International Civil Aviation Organization (ICAO). *Training Manual: Cabin Attendants' Safety Training.* Doc 7192-AN/7587 Part E-1. Second Edition. Montreal Quebec. Canada. 1996.
[9] Flight Safety Foundation Editorial Staff. Publication: Cabin Crew Safety. Many Passengers in Exit Seats Benefit from Additional Briefings. Vol 36. No 3. May-June 2001.

passengers through the Type-III overwing exit on transport aircraft.[10] The report concluded:

> "*the research findings restate the need to address the conventional aircraft emergency evacuation problem for what it really is — a failure of passengers to understand and properly execute emergency procedures. The time has now come to move on to a search for better information and more effective passenger education and training techniques that will lead to safer and more productive emergency evacuations/survival"* .[11]

38. In 2006, University of Greenwich researchers published a further paper entitled "*An analysis of exit availability, exit usage and passenger exit selection behaviour exhibited during actual aviation accidents".* [12] The paper suggests that, even under emergency evacuation conditions, passengers are capable of making rational decisions based on information available to them and their knowledge of the aircraft at least as far as direction of travel and exit selection is concerned

39. The ditching of US Airways flight 1549, an Airbus A320, in the Hudson River New Jersey on 15 January 2009 involved 3 cabin crew and 150 passengers under a maximum 1:50 cabin crew to passenger seat ratio[13]. The NTSB reported that, according to the flight attendants, the evacuation was relatively orderly and timely, despite a temporary bottleneck at the over wing exits. The NTSB Survival Factors Report does not specify any issues when over wing exit passengers were diverted forward to the floor level exits by the cabin crew. All passengers and crew were evacuated safely.[14]

The safety record of Australian aircraft passenger transport in context

40. ICAO publishes safety data on worldwide and major airline operating countries. The safety record of overseas operators is only relevant to the Australian context through a comparison of accident or fatality rates and then on a category by category basis.

41. Australia has had no fatal accidents since 1966 on transport category aircraft where cabin crew were carried. Passenger and cabin crew injuries on Australian aircraft in air transport operations are mainly the result of in-flight turbulence events. CASA is not aware of any accident or incident investigation

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[10] McLean, GA; Corbett, CL; Larcher, KG; McDown, JR; Palmerton, DA; Porter, KA; Shaffstall, RM; and Odom, RS. Access-to-Egress: Interactive effects of factors that control the emergency evacuation of naïve passengers through the transport airplane Type-III overwing exit. P34. DOT/FAA/AM-02/16.

[11] Ibid., p .34.

[12] Galea, E.R., Finney, K., Dixon, A.J.P., Siddiqui, A., and Cooney, D.P. An analysis of exit availability, exit usage and passenger exit selection behaviour exhibited during actual aviation accidents. *The Aeronautical Journal,* Vol 110, Number 1106, p 247. 2006.

[13] NTSB Survival Factors Group. US Airways Flight 1549, A320-214, Chairman's Report. p.41. 2009 .

[14] The first exits to be opened were self help exits opened by passengers 15 seconds after impact. This was followed by the 2 forward exits opened by the cabin crew at 23 seconds and 28 seconds. The last passenger was rescued from the aircraft 24 minutes after impact.

in a country that operates at a 1:50 ratio that has recommended an increase in cabin crew. Nor is CASA aware of any studies into cabin safety that have recommended an increase in cabin crew numbers.

42. CASA is not aware of any evidence supporting a link between the Australian requirement for 1 cabin attendant to 36 passengers and Australia's aviation safety record. Nor is CASA aware of any situation where the effective management of an event was enhanced as a consequence of a cabin crew ratio on that flight of being (up to) 1:36.

43. There has been one aircraft evacuation occurrence investigated by the Australian Transport Safety Bureau (ATSB) in the last 10 years involving single-aisle aircraft (a Boeing 717) carrying cabin crew.[15] This aircraft, with a passenger capacity of 125 seats, was carrying 26 passengers and 4 cabin crew. Following an evacuation as a result of a suspected engine fire on the ground, 11 passengers suffered minor injuries.

44. Safety actions recommended by the ATSB included consideration of improved procedures for evacuation commands, removal of high heeled shoes for passengers and improvements to cabin crew recurrent training. The cabin crew to passenger ratio on that flight was 1 to 6.5, well below the minimum requirements of 1:36. The conduct of the evacuation was not without its problems, due evidently to procedural and training issues, rather than the ratio of cabin crew to passengers.

45. There have been no emergency evacuations of Australian aircraft operating under a permission authorising a cabin crew to passenger ratio of 1:50.

Industry and public consultation during the regulatory development process

46. The Notice of Proposed Rule Making process utilised in connection with the consideration of an amendment to the Civil Aviation Orders, to allow a maximum ratio of 1 cabin attendant to 50 passenger seats, was widely advertised in newspapers and on the CASA website.

47. Since the end of the public comment response period, all submissions have been analysed, evaluated and considered. Should the Notice of Final Rule Making (NFRM) proceed, a report will be prepared and made publicly available in conjunction with the making of the Final Rule and in accordance with the normal procedure.

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[15] ATSB: Aviation Occurrence Report – 200502137: "Evacuation Hobart Airport. 17 May 2005. Boeing 717-200."p28. 2005.

Fatigue Issues

48. On 14 June 2011 the Council of ICAO adopted Standards and Recommended Practices and guidance material on fatigue management for cabin crew. CASA, as part of its standards development process, will be considering how this new ICAO material will be incorporated into Australian aviation safety regulations. It is anticipated that this will result in the finalising of policy work for cabin crew fatigue risk management systems during the second half of 2012.

49. In the meantime CASA is satisfied that operators have the operational capability to manage fatigue risk under their Safety Management Systems, in the same way they manage other identifiable operational risks.