



*International Civil Aviation Organization*

**The Thirteenth Meeting of the Regional Airspace Safety Monitoring  
Advisory Group (RASMAG/13)**

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**Agenda Item 5: Airspace safety monitoring activities/requirements in the Asia/Pacific Region**

**UPDATED ANALYSIS OF RVSM APPROVED AIRCRAFT EQUIPAGE OF ADS-B AND  
ITS POTENTIAL FOR USE AS A HEIGHT-KEEPING MONITORING SYSTEM IN THE  
AUSTRALIAN FIRs**

(Presented by Australia)

(Prepared by R. Butcher and L. Foden)

**SUMMARY**

This paper provides details of an analysis undertaken by the Australian Airspace Monitoring Agency (AAMA) to monitor the current potential in terms of aircraft equipage, for use of ADS-B as a ground-based system for RVSM height-keeping monitoring purposes.

**1. INTRODUCTION**

1.1 RASMAG has endorsed the continued joint research project between Airservices Australia and the Federal Aviation Administration (FAA) to validate the use of ADS-B as a means of undertaking height-keeping monitoring. While this activity is being progressed and with encouraging outcomes to date, the Australian Airspace Monitoring Agency (AAMA) is anticipating the use of ADS-B data to fulfil its monitoring obligations post the introduction of long term height monitoring in late 2010.

1.2 The currently implemented Australian ADS-B network provides total coverage of the continental landmass at altitudes above FL280. With the addition of data from the Indonesian ADS-B network, the ability for the AAMA to undertake monitoring of aircraft height keeping over a significant area of the Asia/Pacific region is greatly enhanced. As a result the AAMA has been updating its estimation of the number of aircraft that could potentially be monitored using ADS-B data. This paper provides some updated details of that analysis.

**2. DISCUSSION**

2.1 At RASMAG/12, an infrastructure plan was developed to assist APANPIRG to make decisions on the best height monitoring systems and their location to acquit the regions responsibilities in relation to the new long term height monitoring requirements being implemented from November 2010. In that plan, RASMAG has proposed that one area that includes Australia, Indonesia, Papua New Guinea and New Zealand could be effectively monitored using a mix of ADS-B and GMUs. As a result, the AAMA had taken steps to identify the number of aircraft types by operator that could potentially be monitored using ADS-B in the period from December 2010 to 12 December 2013, the latter being the currently scheduled time-frame for the introduction of an ADS-B equipage mandate in Australia. An initial analysis was presented to RASMAG/12 in working

paper 20. The data presented in that paper assessed not only Australian operators, but also foreign operators with flights in the Australian FIRs and who could potentially have a portion of their fleet type monitored using ADS-B while in that airspace. Identification of those foreign operators could potentially mean that they could achieve their monitoring responsibility during normal flight operations within Australian and potentially Indonesian airspace. This has particular merit considering the scheduled introduction of the ADS-B equipage mandate in Australian airspace in 2013.

2.2 The analysis presented in this paper provides an update of that presented in WP/20 at RASMAG/12.

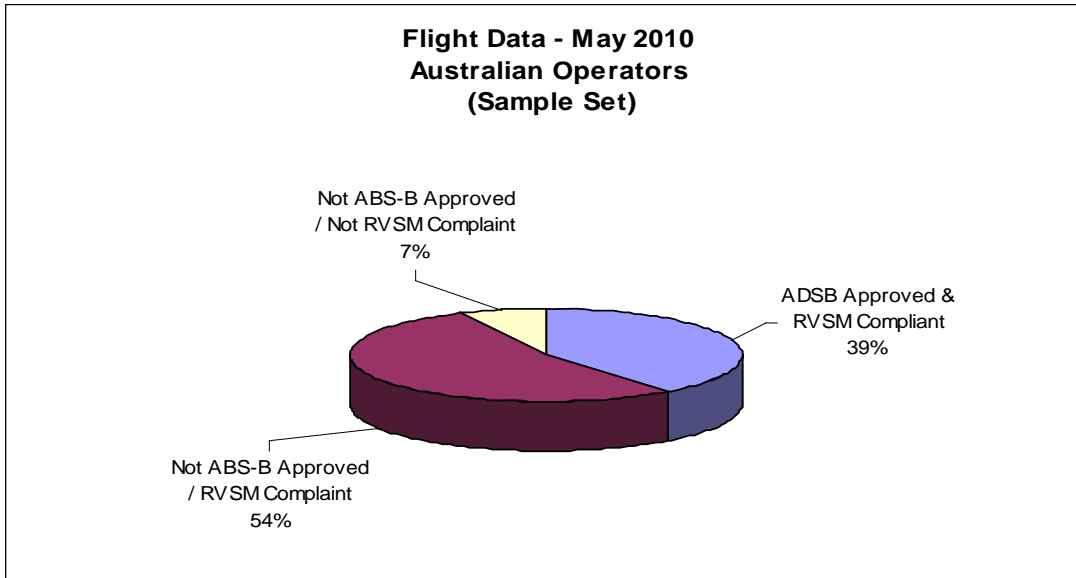
2.3 Analysis of the Australian FIRs. The analysis undertaken by the AAMA was aimed at:

- a. reviewing all regular passenger transport aircraft operators and types in Australian Airspace operating at RVSM levels (between Flight Level 290 and Flight Level 410 inclusive);
- b. reviewing all ADS-B approved aircraft in Australian Airspace in order for height monitoring; and
- c. comparing and analysing the numbers, types and operators of aircraft that require RVSM approval and that satisfy ADS-B approval for height monitoring.

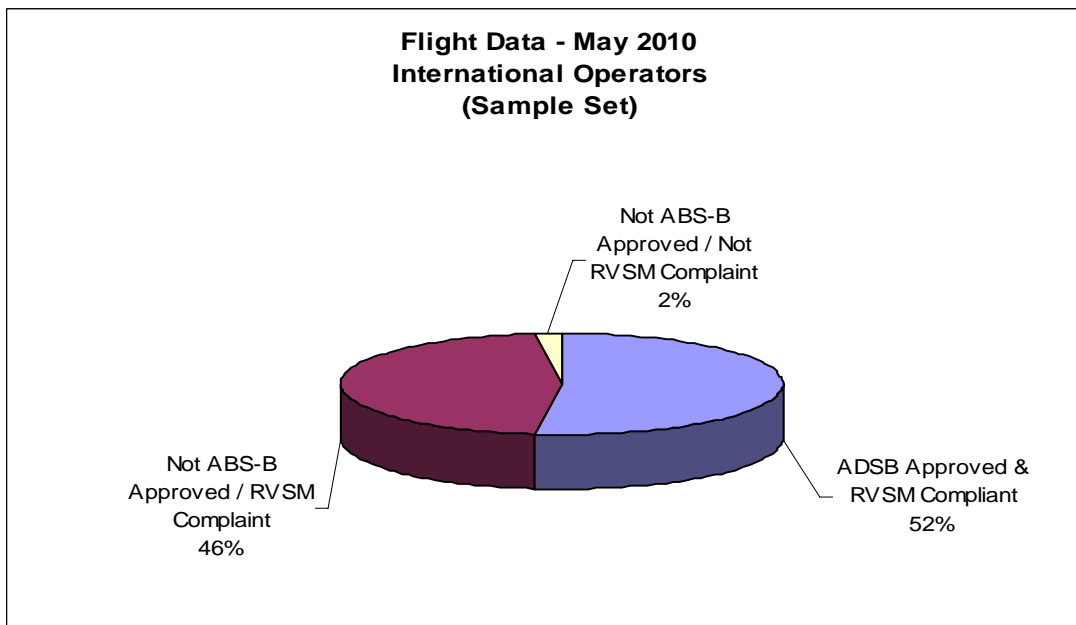
2.4 The analysis draws on a number of data sources as follows:

- a. ADS-B Approvals List – List of aircraft by operator currently approved to actively participate in the Australian ADS-B system;
- b. RVSM Approvals Database – current list of RVSM approved aircraft as maintained by the AAMA and other regional monitoring agencies;
- c. Australian FIR flight plans – a raw dataset that shows aircraft flight plans for operations above FL280 during May 2010.
- d. A dataset of international fleets flying into Australian Airspace; and
- e. CASA Aircraft Register – data base of all Australian registered aircraft.

2.5 As a first step, the analysis identified the operators using the Australian RVSM airspace. This data was obtained from analysing the flight plan data set for the month of May 2010. Figure 1 and 2 below represents the percentage breakdown of Aircraft using the airspace against ADS-B approval and RVSM Compliance.



**Figure 1**



**Figure 2**

2.6 The data from the flight plan data set for May 2010 shows that 52% of International aircraft flying within the RVSM airspace are both ADS-B approved and RVSM Compliant compared with 39% of Australian operated aircraft.

2.7 Table 1 below summarises Australian operators that flight planned within the RVSM airspace during May 2010 and whether they have aircraft that are ADS-B equipped that would enable height-keeping monitoring using that system. The shaded Operators have aircraft that are both ADS-B Approved and RVSM Compliant. The table also identifies the number of aircraft each Operator has currently approved by aircraft type. From December 2013, all aircraft operating above F1290 in the Australians FIRs must be ADS-B equipped.

**Table 1****May 2010 Flight Data - Australian Operators**

Operator	Aircraft Type	ADS-B Approved	RVSM Compliant	Total ADS-B Approved Aircraft
AIR NATIONAL AUSTRALIA PTY. LTD.	CL60 LJ35		Yes Yes	
ALLIANCE AIRLINES PTY LTD	F100		Yes	
AUSTRALASIAN JET PTY. LTD.	C551			
AVWEST PTY LTD	CL60 GLF4 H25B		Yes Yes Yes	
BOSTON L.H.F. PTY LTD	H25C		Yes	
BUSINESS AVIATION SOLUTIONS PTY LTD	BE40 C650 C750		Yes Yes Yes	
CAPITEQ LIMITED	E170		Yes	
CAREFLIGHT (QLD) LIMITED	LJ45		Yes	
CELIJET AVIATION SOLUTIONS PTY LTD	C25B		Yes	
CHINA SOUTHERN WEST AUSTRALIAN FLYING COLLEGE PTY LTD	C550			
COLDFOOT CONSULTING PTY LTD	B200		Yes	
CROWN MELBOURNE LIMITED	GLF5		Yes	
DICK SMITH ADVENTURE PTY LTD	C25B		Yes	
EDWARDS COACHES PTY. LIMITED	C525			
EWG AIRCRAFT PTY LTD	B350			
EXECUJET AUSTRALIA PTY LIMITED	GLEX GLF4 LJ60		Yes Yes Yes	
EXECUTIVE AIRLINES PTY. LTD.	C550		Yes	
FOX AVIATION PTY LTD	C501			
FUGRO SPATIAL SOLUTIONS PTY LTD	C441			
GANDEL INVESTMENTS PTY. LTD.	GLEX		Yes	
GOJET PTY. LTD.	H25B PRM1		Yes Yes	
GROLLO AVIATION PTY LTD	B350			
INGHAMS ENTERPRISES PTY LIMITED	C650		Yes	
JET CITY PTY. LTD.	C750 LJ35		Yes Yes	
JETSTAR AIRWAYS PTY LIMITED	A320 A321 A332	Yes Yes Yes	Yes Yes Yes	39 3 7
LINFOX GLOBAL CHARTER PTY LTD	GLEX		Yes	
LITTLE AVIATION PTY. LIMITED	F900		Yes	
LLOYD AVIATION JET CHARTER PTY. LTD.	F900		Yes	

LYNDEN AVIATION PTY LIMITED	C650		Yes	
MACARTHUR JET CHARTER PTY LIMITED	C550		Yes	
MARCPLAN CHARTER PTY. LTD.	E135 H25B		Yes Yes	
MAXEM AVIATION PTY LTD	C550 C560 CL60		Yes Yes	
NANTAY PTY LTD	H25B HS25		Yes Yes	
NATIONAL JET EXPRESS PTY LTD	B463			
NATIONAL JET SYSTEMS PTY. LTD.	B712		Yes	
NAURU AIR CORPORATION	B733		Yes	
NETWORK AVIATION PTY LTD	F100		Yes	
PACIFIC FLIGHT SERVICES PTY LTD	LJ35 LJ45		Yes Yes	
PEL-AIR AVIATION PTY LIMITED	LJ35 WW24			
PRATT AVIATION PTY LTD	GLEX		Yes	
PROFESSIONAL JET AVIATION PTY LTD	BE40 C550 H25B		Yes Yes Yes	
		Yes	Yes	1
QANTAS AIRWAYS LIMITED	A332 A333 A388 B734 B738 B73Y B744 B763	Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes	5 6 7  11  30
QUASAR RESOURCES PTY. LTD.	C550			
RAMSAY AIRCHARTER PTY LIMITED	H25B		Yes	
REVESCO AVIATION PTY LTD	C550 CL60		Yes	
SHORTSTOP JET CHARTER PTY. LTD.	C550 LJ35			
SKYWEST AIRLINES (AUSTRALIA) PTY LTD	F100		Yes	
SOUTHERN AIR SERVICES PTY LTD	C525		Yes	
SOUTHERN CROSS AIRCRAFT ENGINEERING SERVICES PTY LTD	C525			
STATE OF QUEENSLAND	H25B		Yes	
STRATEGIC AIR CHARTER PTY LTD	C525		Yes	
STRATEGIC AIRLINES PTY. LTD.	A320 A332		Yes Yes	
		Yes	Yes	1
SYDNEY JET CHARTER PTY LIMITED	F2TH		Yes	
TATARY PTY. LTD.	GL5T H25B		Yes Yes	
TIGER AIRWAYS AUSTRALIA PTY LIMITED	A320	Yes	Yes	8
VIRGIN BLUE AIRLINES PTY LIMITED	B737 B738 E170 E190	Yes Yes	Yes Yes Yes Yes	18 6
VIRGIN BLUE INTERNATIONAL AIRLINES PTY LTD	B77W		Yes	
WALKER AIR SERVICES PTY LIMITED	GLEX		Yes	

2.8 The analysis identified that many of the minor domestic operators do not have aircraft currently fitted with ADS-B.

2.9 Table 2 below summarises International operators that flight planned within the RVSM airspace during May 2010 and whether they have aircraft that are ADS-B equipped that would enable height-keeping monitoring using that system. The shaded Operators have aircraft that are both ADS-B Approved and RVSM Compliant. The table also identifies the number of aircraft each Operator has currently approved by aircraft type. For simplicity, not all international operators in the data set are identified in this list.

**Table 2**

**May 2010 Flight Data - International Operators**

<b>Operator</b>	<b>Aircraft Type</b>	<b>ADS-B Approved</b>	<b>RVSM Compliant</b>	<b>Total ADS-B Approved Acft</b>
AEROLINEAS ARGENTINAS	A342		Yes	
AIR AUSTRAL	B772		Yes	
AIR CALEDONIE INTERNATIONAL	A320		Yes	
	A332		Yes	
AIR CANADA	B77L	Yes	Yes	18
AIR CHINA	A319		Yes	
	A332	Yes	Yes	7
	B738		Yes	
AIR MADAGASCAR	B763		Yes	
AIR MAURITIUS LIMITED	A319		Yes	
	A332		Yes	
	A343		Yes	
AIR NEW ZEALAND LTD	A320	Yes	Yes	12
	B744	Yes	Yes	5
	B772	Yes	Yes	8
AIR NIUGINI	B752	Yes	Yes	1
	B763		Yes	
AIR PACIFIC LIMITED	B737		Yes	
	B738		Yes	
	B744		Yes	
	B763		Yes	
AIR SEYCHELLES	B762		Yes	
	B763		Yes	
AIR TAHITI	F2TH		Yes	
AIR TAHITI NUI	A343		Yes	
AIR VANUATU	B738	Yes	Yes	1
AIR ZIMBABWE	B732		Yes	
	B762		Yes	
AIRASIA X SDN BHD	A333	Yes	Yes	5
ASIANA AIRLINES	B772		Yes	
BRITISH AIRWAYS	B744	Yes	Yes	57
	B772	Yes	Yes	4

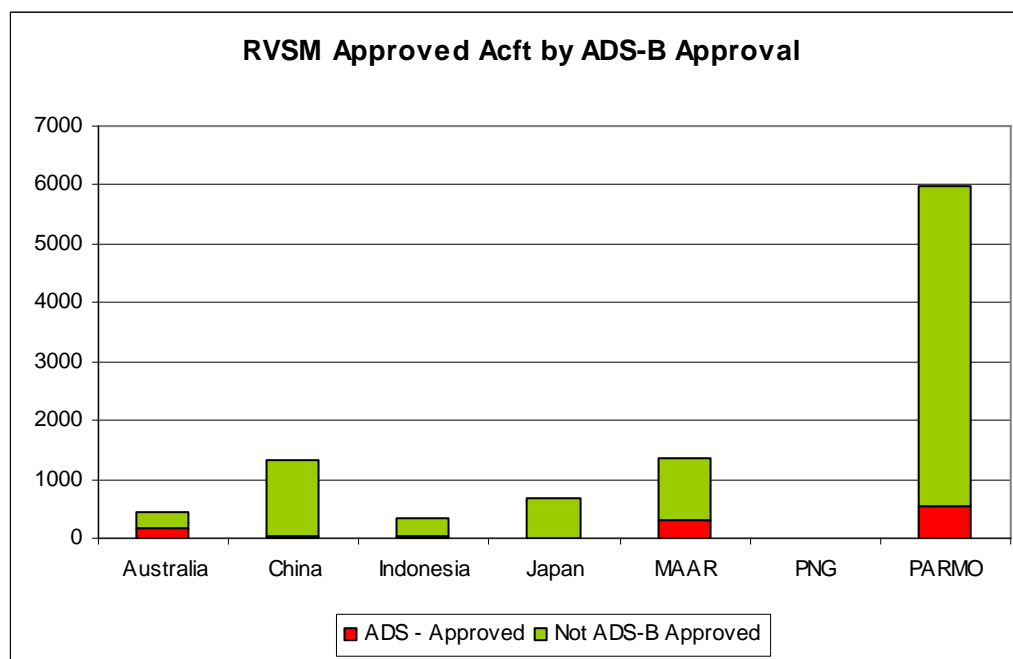
CATHAY PACIFIC AIRWAYS LTD.	A333	Yes	Yes	20
	A343		Yes	
	B744	Yes	Yes	7
CHINA AIRLINES	A333	Yes	Yes	13
	A343	Yes	Yes	5
	B738		Yes	
	B744		Yes	
CHINA EASTERN AIRLINES	A332	Yes	Yes	5
	A333	Yes	Yes	13
CHINA SOUTHERN AIRLINES	A332	Yes	Yes	6
	A333	Yes	Yes	4
	B772	Yes	Yes	10
	MD90		Yes	
CONTINENTAL MICRONESIA	B737		Yes	
	B738		Yes	
DELTA AIR LINES	A332		Yes	
	A333		Yes	
	B77L		Yes	
EGYPT AIR	A320		Yes	
	A332		Yes	
	A342		Yes	
	B738		Yes	
	B772		Yes	
	B77W		Yes	
EMIRATES	A332	Yes	Yes	29
	A343		Yes	
	A345	Yes	Yes	10
	A388	Yes	Yes	15
	B744		Yes	
	B772	Yes	Yes	55
	B773	Yes	Yes	
	B77L	Yes	Yes	9
	B77W	Yes	Yes	24
ETIHAD AIRWAYS	A306		Yes	
	A319		Yes	
	A320		Yes	
	A332	Yes	Yes	29
	A345	Yes	Yes	10
	A346	Yes	Yes	
	MD11		Yes	
EVA AIRWAYS CORPORATION	A332	Yes	Yes	11
	MD11		Yes	
FEDERAL EXPRESS CORPORATION (LITTLE ROCK)	A310		Yes	
	B77L		Yes	
	DC10		Yes	
	MD11	Yes	Yes	60
GARUDA INDONESIA	A332	Yes	Yes	4
	A333		Yes	
	B734		Yes	
	B738	Yes	Yes	27
	B744	Yes	Yes	3

GULF AIR	A320 A332 A343		Yes Yes Yes	
HANG KHONG VIET NAM	A321 B772	Yes	Yes Yes	4
HAWAIIAN AIRLINES	B763		Yes	
JALWAYS CO. LTD	B763 B772		Yes Yes	
JAPAN AIR LINES INTERNATIONAL CO.	B744		Yes	
JETSTAR ASIA AIRWAYS PTE LTD	A320	Yes	Yes	5
KOREAN AIR LINES CO.	A332 A333 B738 B744 B772 B773 B77W	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes	45 14 5 4
MALAYSIAN AIRLINES SYSTEM BERHAD	A333 B734 B742 B743 B744 B772 GLEX	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes	15 17
NAURU AIR CORPORATION	B733		Yes	
PACIFIC BLUE (NZ) LTD	B738	Yes	Yes	5
PHILIPPINE AIR LINES INC. (PAL)	A320 A333 A343 B744 B773		Yes Yes Yes Yes Yes	
QATAR AIRWAYS COMPANY	A319 A320 A332 A333 B77L B77W	Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes	8 16
ROYAL BRUNEI AIRLINES	B763		Yes	
SAUDI ARABIAN AIRLINES	B744 B772		Yes Yes	
SILKAIR (SINGAPORE) PTE LTD	A319 A320		Yes Yes	
SINGAPORE AIRLINES LIMITED	A333 A388 B772 B773 B77W	Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes	11 17 77
SOUTH AFRICAN AIRWAYS (SAA)	A342 A343 A346		Yes Yes Yes	
THAI AIRWAYS INTERNATIONAL LTD.	A333 A345 A346	Yes Yes Yes	Yes Yes Yes	4 6

	B772	Yes	Yes	14
	B773	Yes	Yes	6
TIGER AIRWAYS	A319	Yes	Yes	2
	A320	Yes	Yes	9
UNITED AIRLINES INC.	B744	Yes	Yes	20
	B772		Yes	
UNITED PARCEL SERVICE COMPANY	B752		Yes	
	B763	Yes	Yes	59
	MD11	Yes	Yes	38
V AUSTRALIA	B77W		Yes	
VIRGIN ATLANTIC	A346	Yes	Yes	19

2.10 The analysis identified that 52% of the International Operators flying in the RVSM airspace are ADS-B approved and RVSM Compliant

2.11 Figure 3 below shows the number of RVSM approved aircraft by Australian ADS-B approval for participating Regional Monitoring Agencies (RMA's).



**Figure 3**

### 3. CONCLUSION

3.1 The analysis undertaken by the AAMA shows that currently a significant number of RVSM approved aircraft operating within the Australia FIRs are equipped with ADS-B. This fact and the expectation of increased fitment in the next few years due to new aircraft purchases and the Australian FIR mandate for fitment scheduled for December 2013, demonstrates an ability for the AAMA to use ADS-B to provide monitoring for a number of Asia/Pacific based operators and aircraft type. The data also shows a not insignificant IGA fleet within Australia, often with operators using a single aircraft type and which will need to be accommodated in terms of monitoring in the short term, using GMUs.

3.2 The AAMA has already held informal discussions with Indonesian authorities to establish the availability of ADS-B data for monitoring purposes. This would enable the monitoring of the extensive Indonesian RVSM approved fleet and also to provide monitoring opportunities for other regionally based operators with flights within Indonesian airspace. Further formal discussions with Indonesia are planned for later in 2010.

4. **ACTIONS BY THE MEETING**

4.1 The meeting is invited to:

- a. Review and discuss the information provided by the AAMA; and
- b. Consider the broader opportunity for the use of ADS-B as a height-keeping monitoring system in the Asia/Pacific region;

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