



*International Civil Aviation Organization*

**The 18<sup>th</sup> Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/18)**

Bangkok, Thailand, 1-4 April 2013

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**Agenda Item 3: Reports from Asia/Pacific RMAs and EMAs**

**MAAR SAFETY REPORT**

(Presented by Monitoring Agency for Asia Region)

**Summary**

This paper provides the results of the airspace safety oversight for the RVSM operation in the Bay of Bengal (BOB), Western Pacific/South China Sea (WPAC/SCS), and Mongolian airspace.

This paper relates to –

**Strategic Objectives:**

*A: Safety – Enhance global civil aviation safety*

**Global Plan Initiatives:**

GPI-2 Reduced vertical separation minima

**1. INTRODUCTION**

1.1. This paper provides the airspace safety oversight for the RVSM operation in Bay of Bengal (BOB) and Western Pacific/South China Sea (WPAC/SCS), and Mongolia, which are provided in **Attachment 1, 2 and 3** respectively.

1.2. The content of the safety oversight reports include:

- Introduction;
- Data Submission;
- Summary of Large Height Deviation (LHD) occurrences; and
- Risk Estimate and Safety Oversight.

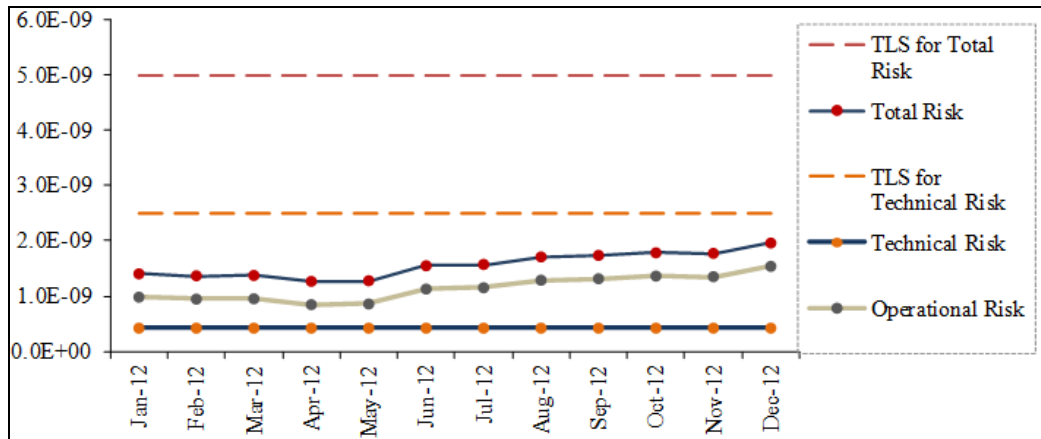
## 2. DISCUSSION

### Bay of Bengal Executive Summary

2.1. **Table 1** summarises the BOB airspace RVSM technical, operational, and total risks. **Figure 1** presents collision risk estimate trends during the period from January 2012 to December 2012.

Bay of Bengal RVSM Airspace – estimated annual flying hours = 1,238,166 (note: estimated hours based on December 2012 traffic sample data)			
Source of Risk	Lower Bound Risk Estimation	Target Level of Safety (TLS)	Remarks
<b>RASMAG/17 Total</b>	<b><math>1.59 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>
Technical Risk	$0.42 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.54 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>1.96 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>

**Table 1:** BOB Airspace RVSM Risk Estimates



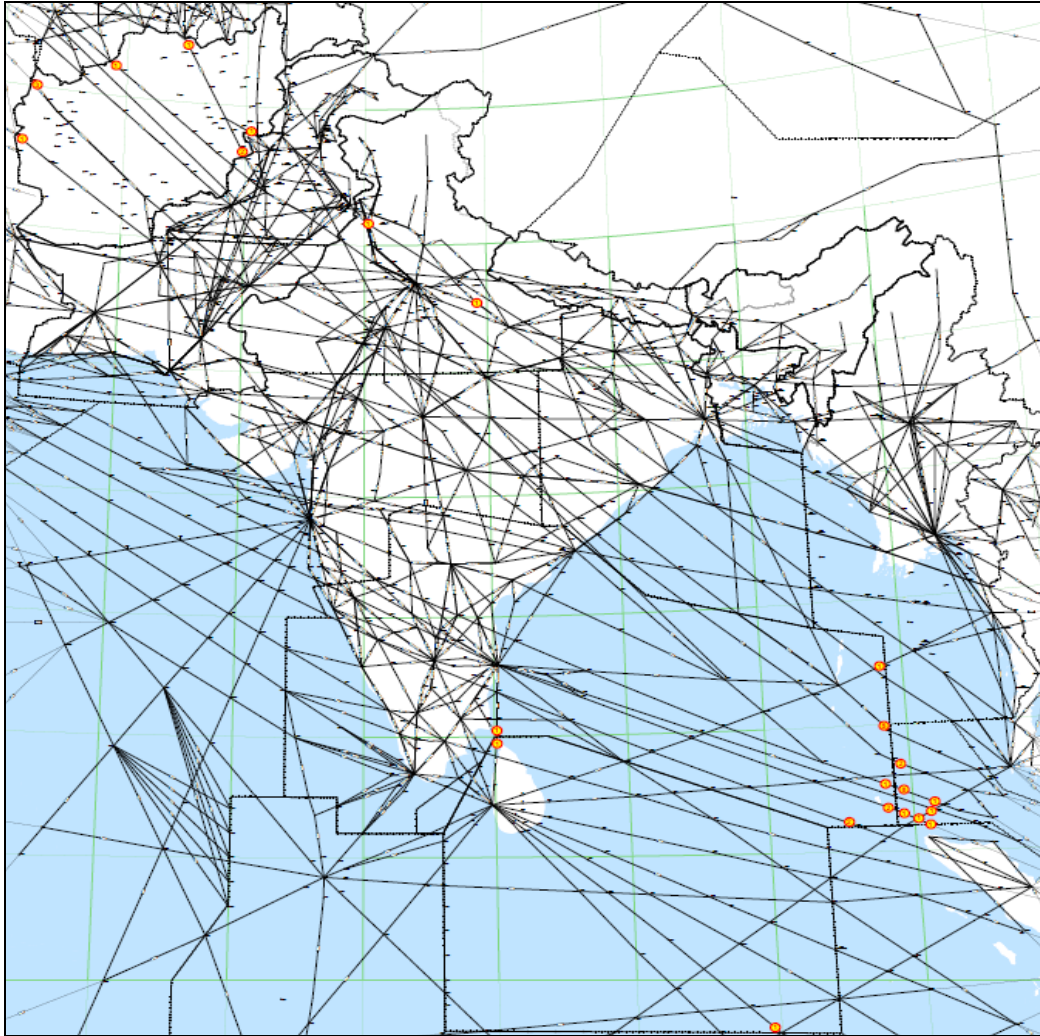
**Figure 1:** BOB Airspace RVSM Risk Estimate Trends

2.2. **Table 2** presents a summary of the LHD occurrences by causes within the BOB airspace from January 2012 to December 2012.

Code	LHD Category Description	No.
A	Flight crew fails to climb or descend the aircraft as cleared	1
D	ATC system loop error	5
E	ATC transfer of control coordination errors due to human factors	33
M	Other	7
Total		46

**Table 2:** Summary of LHD Causes within BOB Airspace

2.3. **Figure 2** provides the geographic location of risk bearing LHD reports within the BOB Airspace during the assessment period



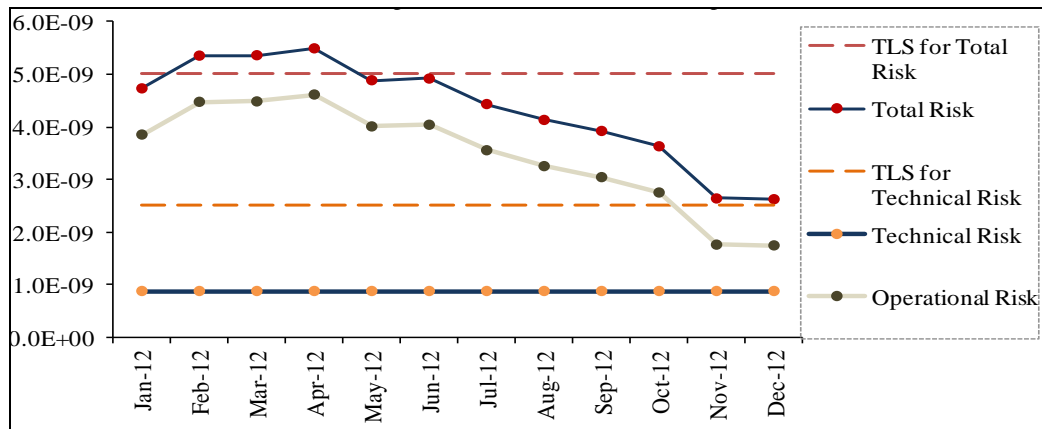
**Figure 2:** BOB Airspace – Risk Bearing LHD

South China Sea Executive Summary

2.4. **Table 3** summarise the WPAC/SCS airspace RVSM technical, operational, and total risks. **Figure 3** presents collision risk estimate trends during the period from January 2012 to December 2012.

WPAC/SCS RVSM Airspace – estimated annual flying hours = 1,183,483 (note: estimated hours based on December 2012 traffic sample data)			
Source of Risk	Lower Bound Risk Estimation	Target Level of Safety (TLS)	Remarks
<b>RASMAG/17 Total</b>	$5.30 \times 10^{-9}$	$5.0 \times 10^{-9}$	<b>Exceed Overall TLS</b>
Technical Risk	$0.88 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.74 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>2.62 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>

**Table 3:** The WPAC/SCS Airspace RVSM Risk Estimates



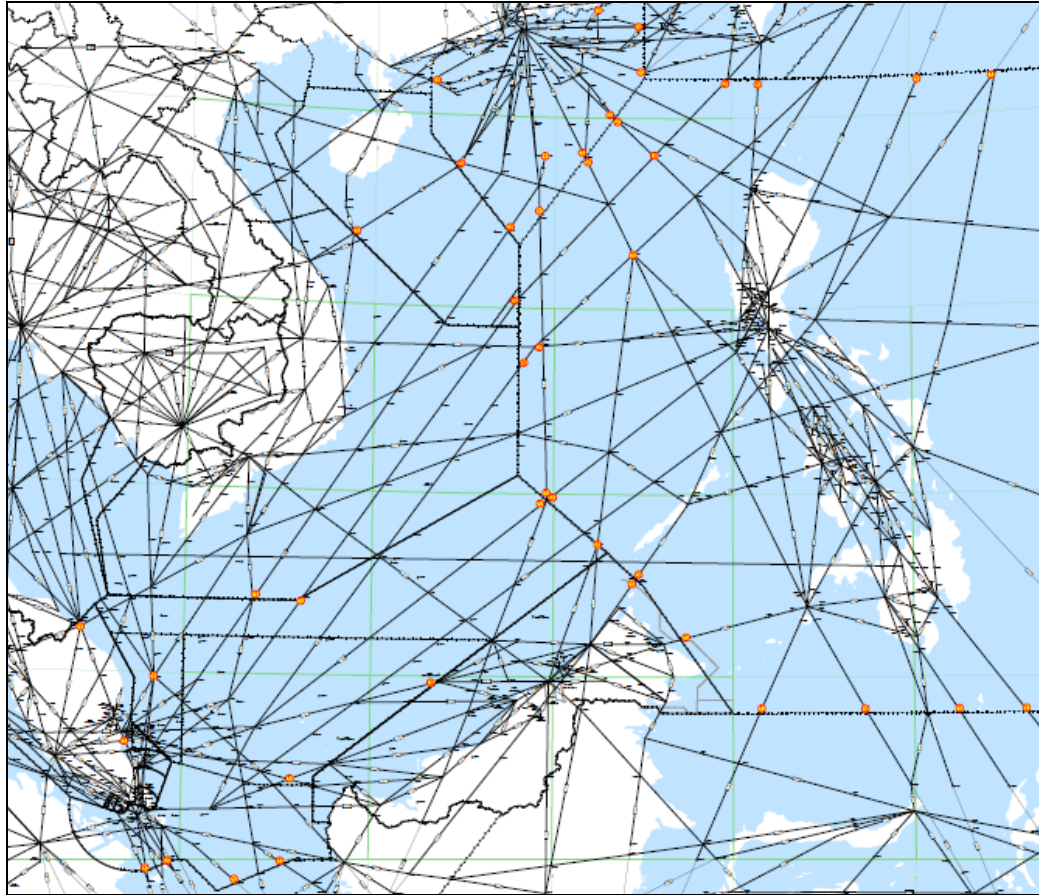
**Figure 3:** The WPAC/SCS Airspace RVSM Risk Estimate Trends

2.5. **Table 4** presents a summary of the LHD occurrences by causes within the WPAC/SCS airspace from January 2012 December 2012.

Code	LHD Category Description	No.
B	Flight crew climbing or descending without ATC clearance	2
D	ATC system loop error	5
E	ATC transfer of control coordination errors due to human factors	76
F	ATC transfer of control coordination errors due to technical issues	4
G	Aircraft contingency leading to sudden inability to maintain level	1
I	Turbulence or other weather related cause	3
L	Non-approved RVSM aircraft being provided with RVSM separation	1
M	Other	2
Total		94

**Table 4:** Summary of LHD Causes within WPAC/SCS Airspace

2.6. **Figure 4** provides the geographic location of risk bearing LHD reports within the WPAC/SCS Airspace during the assessment period



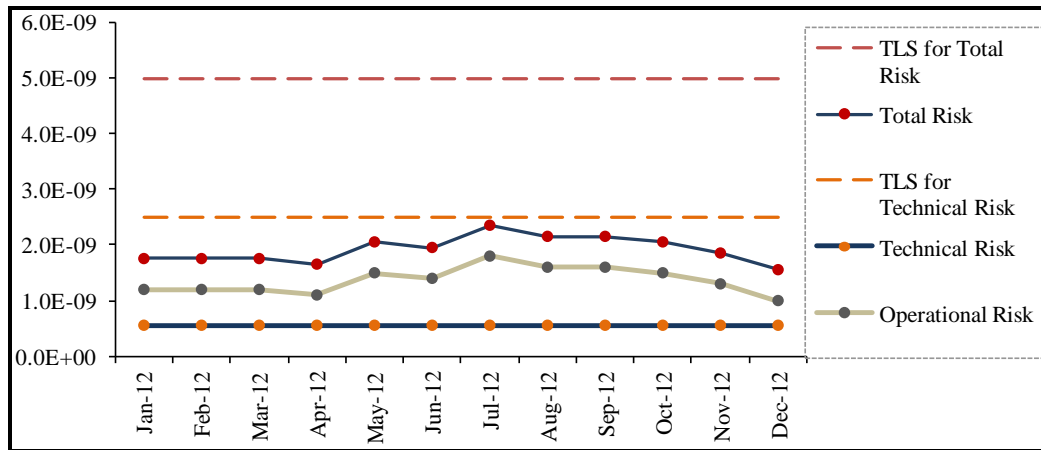
**Figure 4:** The WPAC/SCS Airspace – Risk Bearing LHD

Mongolian Airspace Executive Summary

2.7. **Table 5** summarizes Mongolian airspace RVSM technical, operational, and total risks. **Figure 5** presents collision risk estimate trends during the period from January 2012 to December 2012.

<b>Mongolian RVSM Airspace – estimated annual flying hours = 112,297 (note: estimated hours based on December 2012 traffic sample data)</b>			
<b>Source of Risk</b>	<b>Lower Bound Risk Estimation</b>	<b>Target Level of Safety (TLS)</b>	<b>Remarks</b>
<b>RASMAG/17 Risk</b>	<b><math>1.47 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b><i>Below Overall TLS</i></b>
Technical Risk	$0.56 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.00 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>1.56 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b><i>Below Overall TLS</i></b>

**Table 5:** Mongolian Airspace RVSM Risk Estimates



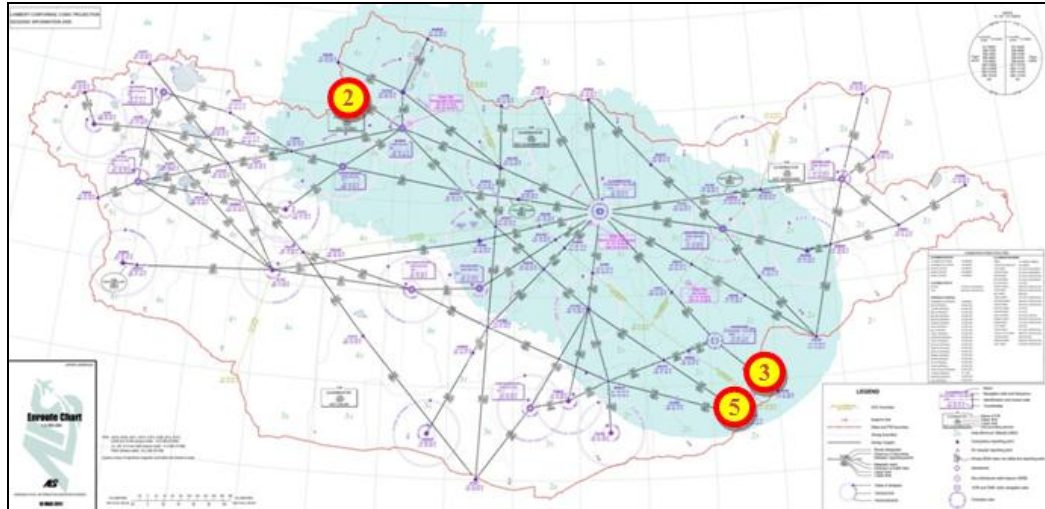
**Figure 5:** Mongolian Airspace RVSM Risk Estimate Trends

2.8. **Table 6** presents a summary of the LHD occurrences by causes within Mongolian airspace from January 2012 to December 2012.

<b>Code</b>	<b>LHD Category Description</b>	<b>No.</b>
E	ATC transfer of control coordination errors due to human factors	10
Total		10

**Table 6:** Summary of LHD Causes within Mongolian Airspace

2.9. **Figure 6** provides the geographic location of risk bearing LHD reports within the Mongolian Airspace during the assessment period



**Figure 6:** Mongolian Airspace – Risk Bearing LHD

### Traffic Sample Data Generation from FPL Messages

2.10. In 2012, MAAR initiated a program to assist States in generating Traffic Sample Data (TSD) from their Flight Plan (FPL) messages. An automatic conversion of FPL messages into TSD provides the following advantages over the conventional method:

- elimination of manual data entry in the process saves a lot of resources and reduces typing errors in the data;
- more significant points can be obtained from the route/fix fields, resulting in more detailed flight profiles; and
- gaining the information of “W” filing helps MAAR identify rogue aircraft more effectively.

2.11. The approach directly benefits States who currently do not have automated systems to generate TSD. For the December 2012 period, there were 3 States who submitted their FPL messages to MAAR. These messages were successfully converted into TSD for each State. MAAR encourages States who do not already have automated systems to generate TSD to participate in this program.

## **3. ACTIONS BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.

**Attachment 1**

**AIRSPACE SAFETY REVIEW FOR THE RVSM OPERATION IN  
THE BAY OF BENGAL AIRSPACE**

Presented by



**Monitoring Agency for Asia Region  
December 2012**

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**1. Introduction**

This report provides the summary of airspace safety oversight for the RVSM operation in the BOB airspace. The RVSM safety oversight is conducted based on a one-month traffic sample data (TSD) collected in **December 2012** and monthly Large Height Deviation (LHD) reports between **January 2012 and December 2012** submitted by concerning States in the BOB region.

**2. Data Submission**

**2.1. Traffic Sample Data (TSD)**

**Table 1A** contains a summary of TSD received by MAAR.

<b>BOB States</b>	<b>FIR Name</b>	<b>Status</b>	<b>Remark</b>
Afghanistan	Kabul	Received	Complete
Bangladesh	Dhaka	Received	Complete
India	Chennai	Received	Complete
	Delhi	Received	Complete
	Kolkata	Received	Complete
	Mumbai	Received	Complete
Malaysia	Kuala Lumpur	Received	Complete
Maldives	Male	Received	Complete
Myanmar	Yangon	Received	Complete
Nepal	Katmandu	Received	Complete
Pakistan	Karachi	Received	Complete
	Lahore	Received	Complete
Sri Lanka	Colombo	Received	Complete
Thailand	Bangkok	Received	Complete

**Table 1A:** Summary of TSD Submitted by States in the BOB Region



## 2.2. Large Height Deviation (LHD)

Series of cumulative 12-month of LHD reports were used in this safety assessment. **Table 1B** provides the summary of the LHD reports submitted by the concerned States in the BOB Region.

State	Afghanistan	Bangladesh	India				Malaysia	Maldives	Myanmar	Nepal	Pakistan		Sri Lanka	Thailand
FIR	Kabul	Dhaka	Chennai	Delhi	Kolkata	Mumbai	Kuala Lumpur	Male	Yangon	Katmandu	Karachi	Lahore	Colombo	Bangkok
Jan 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Feb 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mar 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Apr 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
May 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Jun 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Jul 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aug 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sep 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Oct 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nov 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dec 12	X	X	X	X	X	X	X	X	X	X	X	X	X	X

**Table 1B:** Summary of LHD Reports Submitted by BOB States

### 3. Summary of LHD Occurrences in BOB Airspace

Based on the received LHD reports, the LHD occurrences and durations in the BOB region are summarized in **Table 1C** as follows:

Month-Year	No. of LHD Occurrences	LHD Duration (Minutes)	12-month Cumulative Occurrences	12-month Cumulative Duration (Minutes)
January 2012	4	18	33	81
February 2012	0	0	30	78
March 2012	4	4	31	79
April 2012	3	2	31	70
May 2012	5	22	32	71
June 2012	5	35	32	94
July 2012	2	2	34	96
August 2012	6	12	38	107
September 2012	2	4	36	110
October 2012	5	4	41	114
November 2012	5	3	43	115
<b>December 2012</b>	<b>5</b>	<b>11</b>	<b>46</b>	<b>117</b>

**Table 1C:** Summary of LHD Occurrences and Duration in BOB RVSM Airspace

**Table 1D** summarizes the number of LHD occurrences and associated LHD duration (in minutes) for 12-month cumulative LHD by cause of the deviation.

LHD Category Code	LHD Category Description	No. of LHD Occurrences	LHD Duration (Minutes)
A	Flight crew failing to climb/descend the aircraft as cleared	1	1
D	ATC system loop error; (e.g. ATC issues incorrect clearance or flight crew misunderstands clearance message)	5	5
E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non existent coordination, incorrect time estimate/actual, flight level, ATS route etc not in accordance with agreed parameters)	33	109
M	Others	7	2
<b>Total</b>		<b>46</b>	<b>117</b>

**Table 1D:** Summary of LHD Causes in the BOB RVSM Airspace

The LHD occurrences in the BOB airspace are summarized as follow:

- Compared to the previous Meeting (April 2012 assessment period), the number of 12-month cumulative LHD occurrences increased from 31 to 46 occurrences while the total duration increased from 70 to 117 minutes;
- The increase was mainly due to increasing number of non-nil reports from States as they start to actively provide reports to MAAR;
- Significant portion of large height deviation occurrences as well as duration is contributable to Category E;
- Most of the Category E LHDs occurred at the boundary of Chennai FIR and Kuala Lumpur FIR, which is one of the major traffic flow/routing areas;
- After reports were received, MAAR coordinated with States to ensure that all the concerned parties are aware of the situations and take actions as necessary;
- After the coordination, the number of occurrences started to decrease;
- Locations and number of LHD occurrences within the BOB region are provided in the **Appendix A** to this paper.

#### 4. Risk Estimate and Safety Oversight

This section updates the results of the safety oversight for the RVSM operation within the BOB airspace. The internationally accepted collision risk methodology is applied in assessing the safety of the RVSM operation in the BOB airspace.

##### 4.1. Estimate of the CRM Parameters

Table 1E summarizes the value and its source for the parameter estimations used in the internationally accepted Collision Risk Model (CRM) to conduct the safety oversight for the RVSM operation in the BOB airspace.

Symbol	Parameter Definition	Parameter	Source for Value
T	Annual flight hours	1,238,166	Based on the Dec 2012 Traffic Sample Data
$E_z(\text{same})$	Same-direction vertical occupancies	0.0308	
$E_z(\text{opposite})$	Opposite-direction vertical occupancies	0.0733	
$\lambda_x$	Average aircraft length	0.0273 NM	
$\lambda_y$	Average aircraft wingspan	0.0250 NM	
$\lambda_z$	Average aircraft height	0.0079 NM	
$\lambda_h$	Diameter of the disk representing the shape of an aircraft in the horizontal plane	0.0273 NM	
$P_z(0)$	Probability of vertical overlap (with planned vertical separation equal to zero)	0.5380	Conservative value used in Western Pacific/South China Sea and BOB RVSM safety assessments
$ \overline{\Delta V} $	Average relative along-track speed between aircraft on same direction routes	40.82 knots	Based on the submitted TSD
$ \overline{V} $	Average absolute aircraft ground speed	480 knots	Conservative value used in Western Pacific/South China Sea and BOB RVSM safety assessments

**Table 1E:** Estimates of the Parameters in the CRM

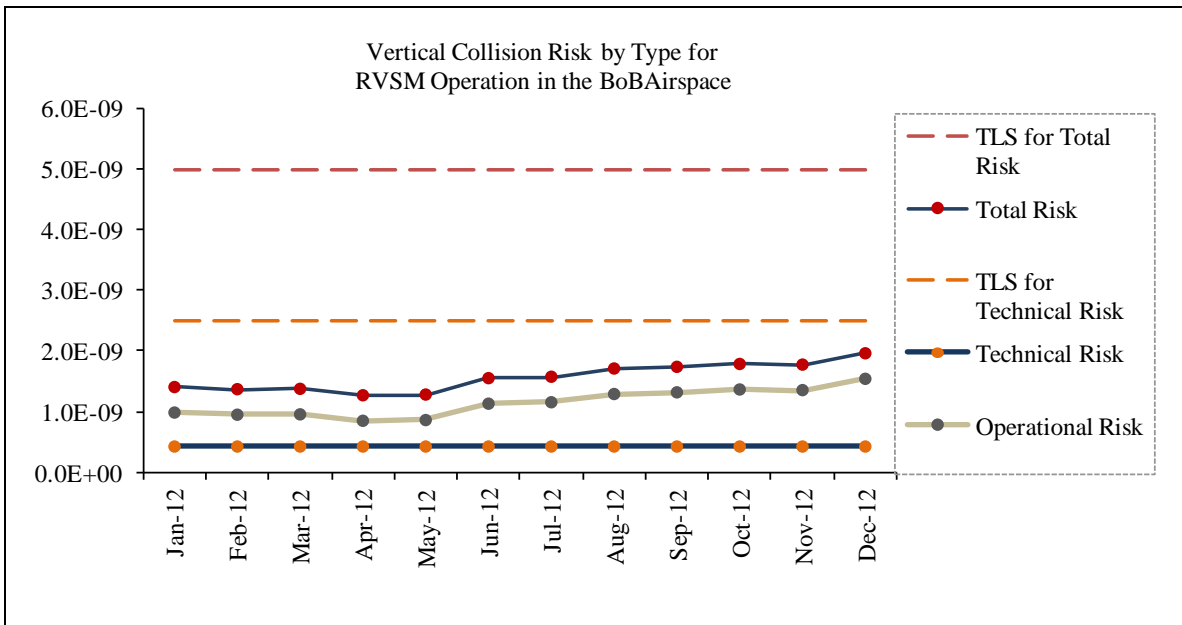
**4.2. Safety Oversight for the RVSM operation in BOB Airspace**

**Table 1F** summarizes the results of the airspace safety oversight, as of **December 2012**, in terms of the technical, operational, and total risks for the RVSM operation in the BOB airspace.

<b>Bay of Bengal RVSM Airspace – estimated annual flying hours = 1,238,166 hours (note: estimated hours based on December 2012 traffic sample data)</b>			
<b>Source of Risk</b>	<b>Lower Bound Risk Estimation</b>	<b>Target Level of Safety (TLS)</b>	<b>Remarks</b>
Technical Risk	$0.42 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.54 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>1.96 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>

**Table 1F:** Risk Estimates for the RVSM operation in BOB Airspace

In addition, **Figure 1G** presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month of LHD reports.



**Figure 1G:** Trends of Risk Estimates for the RVSM Operation in the BOB Airspace

Based on the risk estimates, both technical and total risks satisfy the agreed TLS value of no more than  $2.5 \times 10^{-9}$  and  $5.0 \times 10^{-9}$  fatal accidents per flight hour, respectively.

In addition, it is important to note that States are more active in providing safety related data, which allows MAAR to conduct a more accurate and effective safety report. Therefore, MAAR encourage States to continue to provide MAAR with safety related data so that any negative trends can be detected and managed in a timely manner.

**Attachment 2**

**AIRSPACE SAFETY REVIEW FOR THE RVSM OPERATION IN  
THE WESTERN PACIFIC/SOUTH CHINA SEA AIRSPACE**

Presented by



**Monitoring Agency for Asia Region**

**December 2012**

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**1. Introduction**

This report provides the summary of airspace safety oversight for the RVSM operation in the **Western Pacific/South China Sea (WPAC/SCS) airspace**. The RVSM safety oversight analysis is conducted based on a one-month traffic sample data (TSD) collected in **December 2012** and monthly Large Height Deviation (LHD) reports between **January 2012 and December 2012** submitted by concerning States in the WPAC/SCS region.

**2. Data Submission**

**2.1. Traffic Sample Data (TSD)**

**Table 2A** contains a summary of TSD received by MAAR for the RVSM safety oversight in the WPAC/SCS airspace.

<b>States</b>	<b>FIR Name</b>	<b>Status</b>	<b>Remark</b>
Cambodia	Phnom Penh	Received	Complete
China	Sanya	Received	Complete
	Hong Kong	Received	Complete
Lao PDR	Vientiane	Received	Complete
Malaysia	Kuala Lumpur	Received	Complete
	Kota Kinabalu	Received	Complete
Philippines	Manila	Received	Complete
Singapore	Singapore	Received	Complete
Thailand	Bangkok	Received	Complete
Vietnam	Hanoi	Received	Complete
	Ho Chi Minh	Received	Complete

**Table 2A:** Summary of TSD Submission by WPAC/SCS States

## 2.2. Large Height Deviation (LHD)

Series of cumulative 12-month of LHD Reports were used in this safety assessment. **Table 2B** provides the summary of LHD reports submitted by the concerned States in the WPAC/SCS Region.

State	Cambodia	China		Loa PDR	Malaysia		Philippines	Singapore	Thailand	Vietnam	
FIR	Phnom Penh	Sanya	Hong Kong	Vientiane	Kota Kinabalu	Kuala Lumpur	Manila	Singapore	Bangkok	Hanoi	Ho Chi Minh
Jan 12	X	X	X	X	X	X	X	X	X	X	X
Feb 12	X	X	X	X	X	X	X	X	X	X	X
Mar 12	X	X	X	X	X	X	X	X	X	X	X
Apr 12	X	X	X	X	X	X	X	X	X	X	X
May 12	X	X	X	X	X	X	X	X	X	X	X
Jun 12	X	X	X	X	X	X	X	X	X	X	X
Jul 12	X	X	X	X	X	X	X	X	X	X	X
Aug 12	X	X	X	X	X	X	X	X	X	X	X
Sep 12	X	X	X	X	X	X	X	X	X	X	X
Oct 12	X	X	X	X	X	X	X	X	X	X	X
Nov 12	X	X	X	X	X	X	X	X	X	X	X
Dec 12	X	X	X	X	X	X	X	X	X	X	X

**Table 2B:** Summary of LHD Reports Submission by WPAC/SCS States



### 3. Summary of LHD Occurrences in WPAC/SCS Airspace

Based on the received LHD reports, the LHD occurrences in the WPAC/SCS region are summarized as follows.

Operational Period Ending (Month-Year)	No. of LHD Occurrences	LHD Duration (Minutes)	12-month Cumulative Occurrences	12-month Cumulative Duration (Minutes)
January 2012	11	15	97	111
February 2012	8	6	103	113
March 2012	10	7	104	106
April 2012	8	5	111	110
May 2012	11	10	113	103
June 2012	13	9	117	101
July 2012	12	23	120	112
August 2012	1	1	113	104
September 2012	1	1	106	97
October 2012	7	4	105	97
November 2012	6	4	99	91
<b>December 2012</b>	<b>6</b>	<b>8</b>	<b>94</b>	<b>93</b>

**Table 2C:** Summary of LHD Occurrences and Duration in the WPAC/SCS RVSM Airspace

**Table 2D** summarizes the number of LHD occurrences and associated LHD duration (in minutes) for 12-month cumulative LHD by cause of the deviation.

LHD Category Code	LHD Category Description	No. of LHD Occurrences	LHD Duration (Minutes)
B	Flight crew climbing/descending without ATC clearance	2	2
D	ATC system loop error; (e.g. ATC issues incorrect clearance or flight crew misunderstands clearance message)	5	3
E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or nonexistent coordination, incorrect time estimate/actual, flight level, ATS route etc not in accordance with agreed parameters)	76	79
F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	4	3
G	Aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure)	1	1
I	Deviation due to turbulence or other weather related cause	3	3
L	An aircraft being provided with RVSM separation is not RVSM approved (e.g. flight plan indicating RSVM approval but aircraft not approved, ATC misinterpretation of flight plan)	1	1
M	Other	2	1
<b>Total</b>		<b>94</b>	<b>93</b>

**Table 2D:** Summary of LHD Causes in the WPAC/SCS RVSM Airspace



The LHD occurrences in the WPAC/SCS RVSM airspace are summarized as follow:

- There is a total of 94 occurrences during this 12-month assessment period with duration of 93 minutes;
- Significant portion of LHD occurrences (78 of 96 occurrences) as well as duration (84 of 98 minutes) is contributable to coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (Category E);
- Since August 2012, the number of monthly LHD occurrences was down to a single digit number of occurrences;
- The 12-month cumulative LHD duration reduced to less than 100 minutes since September 2012 onward;
- In addition to a reduction in the number of LHD occurrences, there was also no LHD report involving aircraft operating in the incorrect direction since March 2012.
- Overall, the LHD situation in the WPAC/SCS EVSM airspace has shown a positive trend.
- Locations and number of LHD occurrences within the WPAC/SCS area are provided in the Appendix B to this paper.

#### 4. Risk Estimate and Safety Oversight

This section updates the results of safety oversight for the RVSM operation within the WPAC/SCS airspace. Accordingly, the internationally accepted collision risk methodology is applied in assessing the safety of the RVSM operation in the WPAC/SCS airspace.

##### 4.1. Estimate of the CRM Parameters

**Table 2E** provides the value and its source for the parameter estimation of the internationally accepted Collision Risk Model (CRM) to conduct the safety oversight for the RVSM Operation in the WPAC/SCS airspace.

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
T	Annual flight hours	1,183,483 flight-hours per year	Based on the Dec 2012 Traffic Sample Data
$E_z(\text{same})$	Same-direction vertical occupancies	0.4307 (uni-directional) 0.0286 (bi-directional)	
$E_z(\text{opposite})$	Opposite-direction vertical occupancies	0.0217 (uni-directional) 0.2108 (bi-directional)	
$\lambda_x$	Average aircraft length	0.0284 NM (uni-direction) 0.0265 NM (bi-direction)	
$\lambda_y$	Average aircraft wingspan	0.0260 NM (uni-direction) 0.0242 NM (bi-direction)	
$\lambda_z$	Average aircraft height	0.0080 NM (uni-direction) 0.0076 NM (bi-direction)	
$\lambda_h$	Diameter of the disk representing the shape of an aircraft in the horizontal plane	0.0281 NM (uni-direction) 0.0278 NM (bi-direction)	

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
Pz(0)	Probability of vertical overlap (with planned vertical separation equal to zero)	0.5380	Conservative value used in NAT, Pacific, Western Pacific/South China Sea RVSM safety assessments
$ \overline{\Delta V} $	Average relative along-track speed between aircraft on same direction routes	22.22 knots	Based on the Dec 2011 Traffic Sample Data
$ \overline{V} $	Average absolute aircraft ground speed	480 knots	Conservative value used in NAT, Pacific, Western Pacific/South China Sea RVSM safety assessments

**Table 2E:** Estimates of the Parameters in the CRM

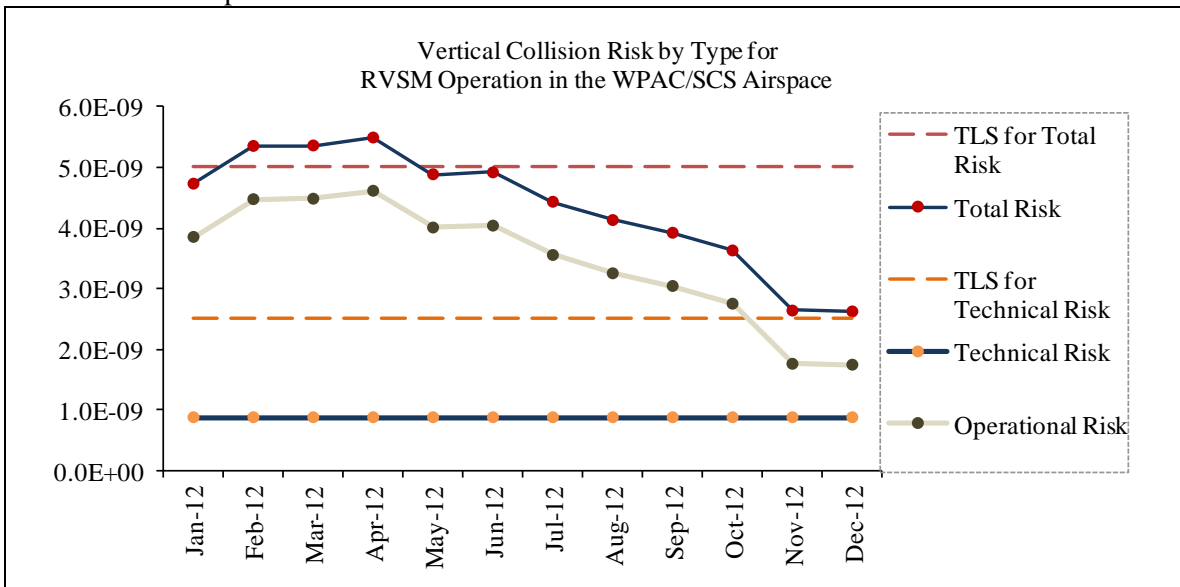
#### 4.2. Safety Oversight for the RVSM operation in WPAC/SCS Airspace

**Table 2E** summarizes the results of the airspace safety oversight, as of **December 2012**, in terms of the technical, operational, and total risks for the RVSM operation in the WPAC/SCS airspace.

WPAC/SCS RVSM Airspace – estimated annual flying hours = 1,183,483 hours (note: estimated hours based on December 2012 traffic sample data)			
Source of Risk	Lower Bound Risk Estimation	Target Level of Safety (TLS)	Remarks
Technical Risk	$0.88 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.74 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>2.62 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>

**Table 8:** Risk Estimates for the RVSM Operation in WPAC/SCS Airspace

**Figure 2E** presents the trends of collision risk estimates using the appropriate cumulative 12-month of LHD reports.



**Figure 2E:** Trends of Risk Estimates for the RVSM Operation in the WPAC/SCS Airspace

Based on the risk estimates, both technical and total risks satisfy the agreed TLS value of no more than  $2.5 \times 10^{-9}$  and  $5.0 \times 10^{-9}$  fatal accidents per flight hour, respectively.

The improvement in the risk estimate for this period is mainly attributable to two main factors i) the absence of LHD occurrences involving aircraft operating in the incorrect direction, which occurred in May, July, October and November 2011 for this assessment period and ii) the decreasing number of non-nil LHD reports towards the end of this assessment period, especially in relatively higher traffic density airspace.

The overall improvement should be credited to States who actively responded to requests from MAAR and take appropriate actions to improve the situation.

Despite the recent positive trend in the risk estimate for the WPAC/SCS region, it is important to note that LHD occurrences involving aircraft operating in the incorrect direction have significant adverse effect on the risk estimate. Therefore, the issue should be emphasized and managed attentively especially when aircraft is required to change a flight level at FIR boundaries to prevent such occurrences and to keep the future risk estimate below the target level of safety.

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**AIRSPACE SAFETY REVIEW FOR THE RVSM OPERATION IN  
THE MONGOLIAN AIRSPACE**

Presented by



**Monitoring Agency for Asia Region  
December 2012**

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**1. Introduction**

This report provides the summary of airspace safety oversight for the RVSM operation in the **Mongolian airspace**. The RVSM safety oversight is conducted based on a one-month traffic sample data (TSD) collected in **December 2012** and monthly Large Height Deviation (LHD) reports between **January 2012 and December 2012**.

**2. Data Submission**

**2.1. Traffic Sample Data (TSD)**

The December 2012 TSD was received.

**2.2. Large Height Deviation (LHD)**

**Table 3A** provides the summary of the LHD reports submitted by Mongolia.

<b>Period</b>	<b>Status</b>
January 2012	Received
February 2012	Received
March 2012	Received
April 2012	Received
May 2012	Received
June 2012	Received
July 2012	Received
August 2012	Received
September 2012	Received
October 2012	Received
November 2012	Received
December 2012	Received

**Table 3A:** Summary of LHD Reports Submitted by Mongolia

### 3. Summary of LHD Occurrences

Based on the received LHD reports, the LHD occurrences and durations are summarized as follows:

Month-Year	No. of LHD Occurrences	LHD Duration (Minutes)	12-month Cumulative Occurrences	12-month Cumulative Duration (Minutes)
January 2012	1	1	13	12
February 2012	0	0	13	12
March 2012	0	0	12	12
April 2012	0	0	11	11
May 2012	4	4	15	15
June 2012	0	0	14	14
July 2012	5	5	18	18
August 2012	0	0	16	16
September 2012	0	0	16	16
October 2012	0	0	15	15
November 2012	0	0	13	13
<b>December 2012</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>10</b>

**Table 3B:** Summary of LHD Occurrences and Duration

**Table 3C** summarizes the number of LHD occurrences and associated LHD duration (in minutes) for 12-month cumulative LHD by cause of the deviation.

LHD Category Code	LHD Category Description	No. of LHD Occurrences	LHD Duration (Minutes)
E	Coordination errors in the ATC to ATC transfer or control responsibility as a result of human factors issues (e.g. late or non-existent coordination, incorrect time estimate/actual, flight level, ATS route etc not in accordance with agreed parameters)	10	10
<b>Total</b>		<b>10</b>	<b>10</b>

**Table 3C:** Summary of LHD Causes

The LHD occurrences in the Mongolian airspace are summarized as follow:

- There was no significant change for LHD occurrences in the Mongolian airspace as there were 10 occurrences accounting for 10 minutes of LHD duration compared to 11 occurrences reported at the previous meeting;
- All of the LHD occurrences were Category E and had duration of less than one minute as they occurred within radar coverage area;
- There was no non-nil LHD report since August 2012;
- **Figure 3D** presents the locations and numbers of the LHD occurrences between January 2012 and December 2012.

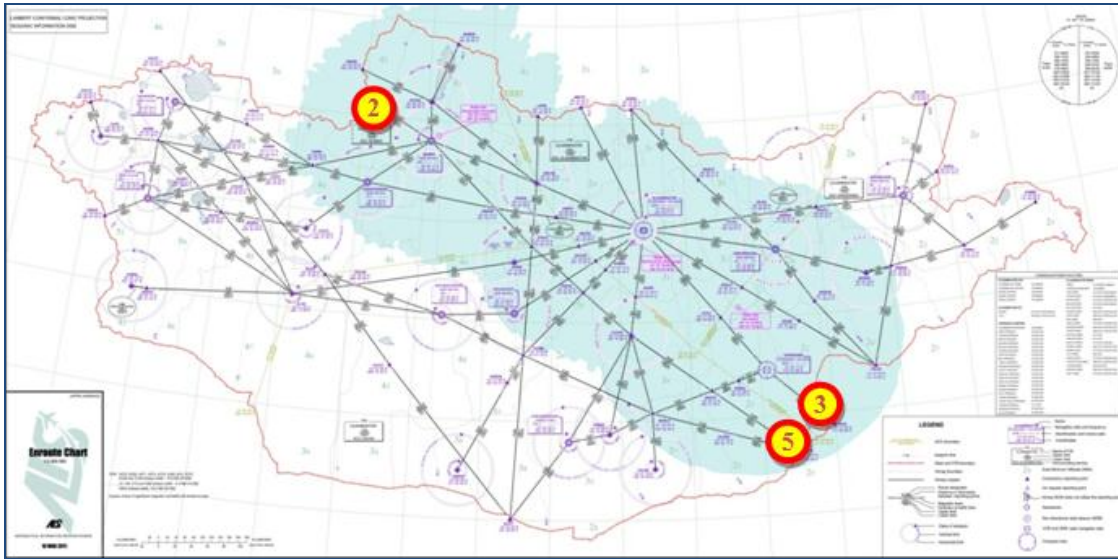


Figure 3D: LHD Locations

#### 4. Risk Estimate and Safety Oversight

This section updates the results of the safety oversight for the RVSM operation within the Mongolian airspace. The internationally accepted collision risk methodology is applied in assessing the safety of the RVSM operation in the Mongolian airspace.

##### 4.1. Estimate of the CRM Parameters

Table 3E summarizes the value and its source for the parameter estimations used in the internationally accepted Collision Risk Model (CRM) to conduct the safety oversight for the RVSM operation in the Mongolian airspace.

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
T	Annual flight hours	112,297	Based on December 2012 TSD
$E_z(\text{same})$	Same-direction vertical occupancies	0.0002	
$E_z(\text{opposite})$	Opposite-direction vertical occupancies	0.0456	
$\lambda_x$	Average aircraft length	0.0337 NM	
$\lambda_y$	Average aircraft wingspan	0.0310 NM	
$\lambda_z$	Average aircraft height	0.0092 NM	
$\lambda_h$	Diameter of the disk representing the shape of an aircraft in the horizontal plane	0.0337 NM	
$P_y(0)$	Probability of lateral overlap	0.0739	Based on average aircraft wingspan
$P_z(0)$	Probability of vertical overlap (with planned vertical separation equal to zero)	0.5380	Conservative value used in Western Pacific/South China Sea and BOB RVSM safety assessments

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
$ \overline{\Delta V} $	Average relative along-track speed between aircraft on same direction routes	40.82 knots	Value used in BOB RVSM safety assessments
$ \overline{V} $	Average absolute aircraft ground speed	480 knots	Value used in WPAC/SCS and BOB RVSM safety assessments
$S_x$	Longitudinal Separation	50 NM	

**Table 3E:** Estimates of the Parameters in the CRM

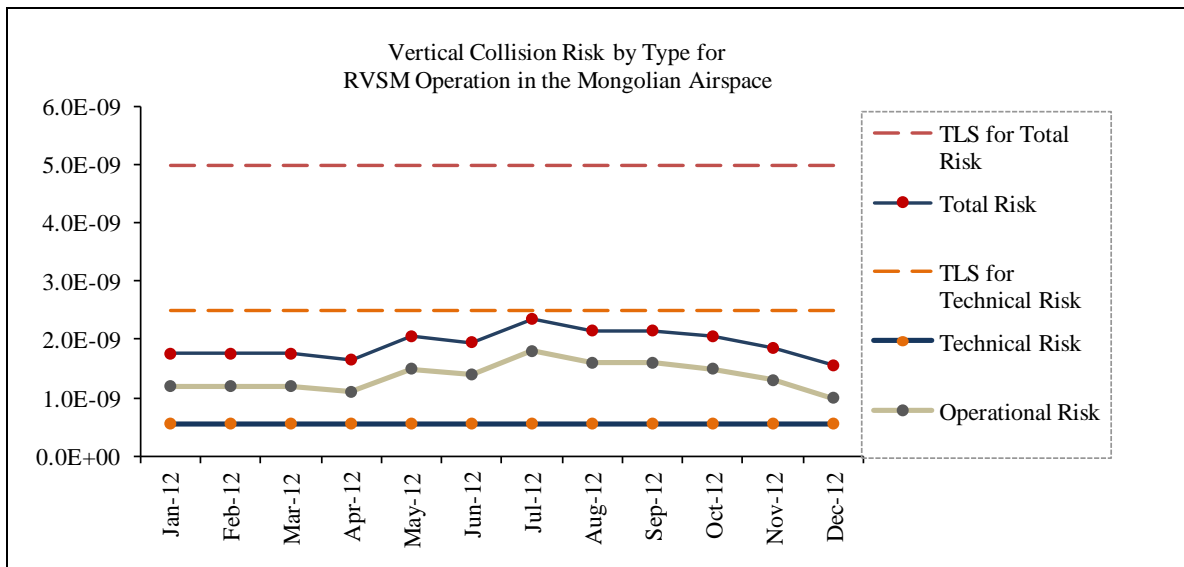
#### 4.2. Safety Oversight for the RVSM operation in Mongolian Airspace

**Table 3F** summarizes the results of the airspace safety oversight, as of **December 2012**, in terms of the technical, operational, and total risks for the RVSM operation in the Mongolian airspace.

Mongolian RVSM Airspace – estimated annual flying hours = 112,297 hours (note: estimated hours based on December 2012 traffic sample data)			
Source of Risk	Lower Bound Risk Estimation	Target Level of Safety (TLS)	Remarks
Technical Risk	$0.56 \times 10^{-9}$	$2.5 \times 10^{-9}$	Below Technical TLS
Operational Risk	$1.00 \times 10^{-9}$	-	-
<b>Total Risk</b>	<b><math>1.56 \times 10^{-9}</math></b>	<b><math>5.0 \times 10^{-9}</math></b>	<b>Below Overall TLS</b>

**Table 3F:** Risk Estimates for the RVSM operation in the Mongolian Airspace

**Figure 3G** presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month of LHD reports.



**Figure 3G:** Trends of Risk Estimates for the RVSM Operation in the Mongolian Airspace

Based on the risk estimates, both technical and total risks satisfy the agreed TLS value of no more than  $2.5 \times 10^{-9}$  and  $5.0 \times 10^{-9}$  fatal accidents per flight hour, respectively.