International Civil Aviation Organization

Twenty-Ninth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/29)

Bangkok, Thailand, 19 – 22 August 2024

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

CHINA RMA VERTICAL SAFETY REPORT

(Presented by China RMA)

SUMMARY

This paper presents the results of the airspace safety oversight for the RVSM operation in the airspace of 9 Chinese FIRs and Pyongyang FIR for 2023. The report updates vertical collision risk of the above-mentioned airspace and summarizes the LHD reports as received.

1. INTRODUCTION

1.1 China Regional Monitoring Agency (China RMA) is assigned with the annual task of reporting over RVSM (Reduced Vertical Separation Minimum) safety requirements compliance in the Shenyang FIR, Beijing FIR, Shanghai FIR, Guangzhou FIR, Kunming FIR, Wuhan FIR, Lanzhou FIR, Urumqi FIR, Sanya FIR and Pyongyang FIR.

2. DISCUSSION

2.1 This paper provides the results of the airspace safety oversight for the RVSM operation in the airspace of Chinese FIRs for the time of January 2023 to December 2023, as reflected in the Attachment A. The analysis conducted for the 9 Chinese FIRs is based on one-month traffic sample data (TSD) collected in December 2023 and the latest 12-month Large Height Deviation (LHD) reports until December 2023. Attachment B presents the risk assessment for Pyongyang FIR of DPR Korea.

Executive Summary-RVSM airspace of Chinese FIRs

2.2 **Table 1** summarizes Chinese FIRs RVSM technical, operational, and total risks. **Figure 1** presents collision risk estimate trends during the period from January 2023 to December 2023.

Table 1: Risk Estimates for the RVSM airspace of Chinese FIRs

The RVSM Airspace of Chinese FIRs – estimated annual flying hours = 2346975.6 hours *(note: estimated hours based on Dec 2023 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
RASMAG 28 Total Risk	*0.19×10^{-9}*	*5.0×10^{-9}*	*Below TLS*
Technical Risk	0.11×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	0.64×10^{-9}	-	-
Total Risk	**0.75×10^{-9}**	5.0×10^{-9}	**Below TLS**

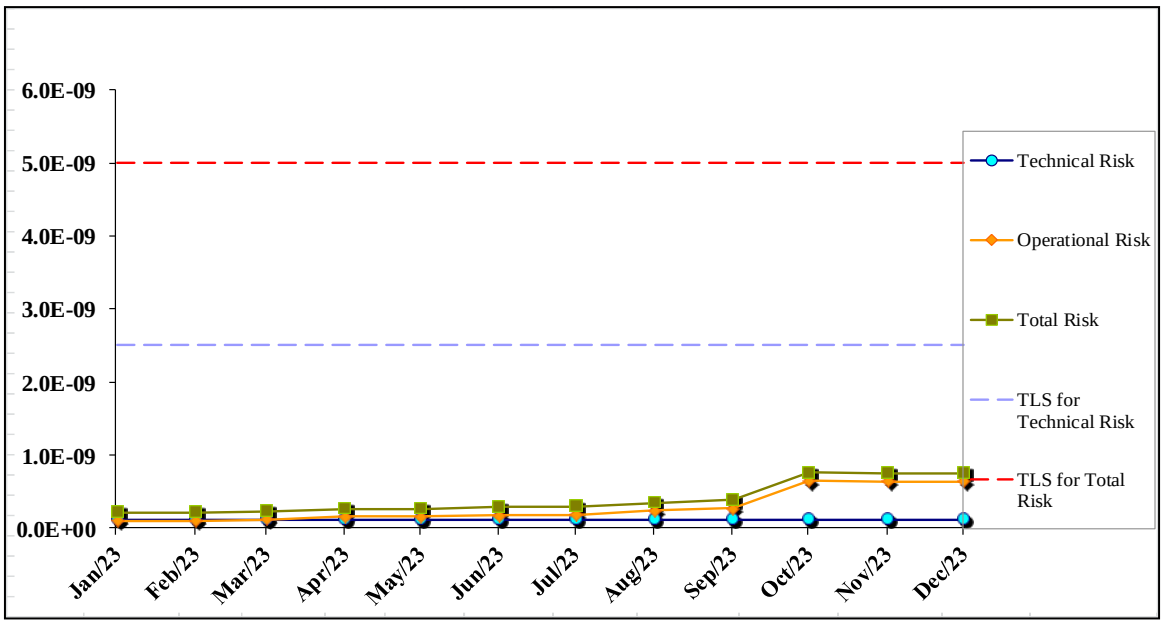

Figure 1: Chinese FIRs RVSM Risk Estimate Trends

2.3 **Table 2** presents a summary of the LHD causes within airspace of Chinese FIRs from January 2023 to December 2023.

Table 2: Summary of LHD Causes within Airspace of Chinese FIRs

Code	LHD Category Description	No.
A	Flight crew fails to climb or descend the aircraft as cleared	7
B	Flight crew climbing or descending without ATC clearance	1
C	Incorrect operation or interpretation of airborne equipment	1
D	ATC system loop error	3
E	Coordination errors in the ATC -to-ATC transfer of control responsibility as a result of human factors issues	8
F	ATC transfer of control coordination errors due to technical issues	8
G	Aircraft contingency leading to sudden inability to maintain level	0
H	Airborne equipment failure and unintentional or undetected level change	6
I	Turbulence or other weather-related cause leading to unintentional or undetected change of flight level	79
J	TCAS resolution advisory; flight crew correctly climb or descend following the resolution advisory	16
K	TCAS resolution advisory; flight crew incorrectly climb or descend following the resolution advisory	0
L	An aircraft being provided with RVSM separation is not RVSM approved	0
M	Others	94
Total		223

2.4 **Figure 2** provides the geographic location of risk-bearing LHD reports within Airspace of Chinese FIRs during the assessment period.

Figure 2: Airspace of Chinese FIRs – Risk-Bearing LHD

Executive Summary-RVSM airspace of Pyongyang FIR

2.5 **Table 3** provides the Pyongyang FIR RVSM technical, operational, and total risk estimates. According to the email response from ATMB of DPR Korea, there was no LHD event and zero flying hour in in Pyongyang FIR due to world public health crisis in 2023, so the operational risk, the technical risk and the total risk remain 0.

Table 3: Airspace of Pyongyang FIR RVSM Risk Estimates

RVSM Airspace of DPR Korea – estimated annual flying hours = 0 hours *(note: estimated hours based on Dec 2023 traffic sample data)*			
Risk	**Risk Estimation**	**TLS**	**Remarks**
RASMAG 28 Total Risk	*0*	*5.0×10^{-9}*	*Below TLS*
Technical Risk	0	2.5×10^{-9}	Below Technical TLS
Operational Risk	0	--	--
Total Risk	**0**	5.0×10^{-9}	**Below TLS**

3. ACTION 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.

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AIRSPACE SAFETY REVIEW FOR THE RVSM OPERATION IN THE NINE CHINESE FLIGHT INFORMATION REGIONS JANUARY 2023 – DECEMBER 2023

Presented by

中国地区监控组织
CHINA REGIONAL MONITORING AGENCY

August 2024

SUMMARY

This report presents the airspace safety oversight from China Regional Monitoring Agency (China RMA) for the reporting time from January to December 2023. The purpose of the report is to compare actual performance to safety goals related to the continued use of Reduced Vertical Separation Minimum (RVSM) in the Chinese FIRs. This report contains a summary of Large Height Deviation Reports received by the China RMA for the most recent reporting period of January 2023 -December 2023. This report also contains an update of the vertical collision risk. The vertical collision risk estimate for Chinese FIRs RVSM airspace in December 2023 is below the target level of safety (TLS) value of 5.0 x 10^{-9} fapfh.

1. Introduction

1.1 The report covers the reporting period from January to December 2023 in the China RMA's responsible FIRs. Each year, China RMA produces one report requested by the Regional Airspace Safety Monitoring Advisory Group (RASMAG).

1.2 It summarizes the airspace safety oversight for the China domestic FIRs, including the Large Height Deviation (LHD) reports analysis and an update of the vertical collision risk estimate for the China Domestic Airspace.

2. Data Submissions

2.1. China RMA requests an annual one-month traffic movement sample and monthly large height deviation reports from the ATS providers in Chinese RVSM airspace. The second and third column of **Table 1** lists the Flight Information Regions (FIRs) and relevant Area Control Centers in China.

2.2. Traffic Sample Data (TSD)

2.2.1. Traffic sample data for December 2023 for the airspace of Chinese FIRs were used in the assessment of risk for the RVSM airspace. **Table 1** contains a summary of the traffic sample data received by China RMA for each FIR. Traffic sample data were received from all of the FIRs.

FIR Name	FIR Code	Data Collected in ACCs	Collecting Method	Status	Remarks
Shenyang	ZYSH	Shenyang	Automatic system	Received	Data completed
		Dalian	Automatic system	Received	Data completed
		Harbin	Automatic system	Received	Data completed
Beijing	ZBPE	Beijing	Automatic system	Received	Data completed
Shanghai	ZSHA	Shanghai	Automatic system	Received	Data completed
		Qingdao	Automatic system	Received	Data completed
Guangzhou	ZGZU	Guangzhou	Automatic system	Received	Data completed
		Nanning	Automatic system	Received	Data completed
Kunming	ZPKM	Kunming	Automatic system	Received	Data completed
		Chengdu	Automatic system	Received	Data completed
		Lhasa	Automatic system	Received	Data completed
Wuhan	ZHWH	Included in Beijing and Guangzhou	--	--	Data completed
Lanzhou	ZLHW	Lanzhou	Automatic system	Received	Data completed
		Xi’an	Automatic system	Received	Data completed
Urumqi	ZWUQ	Urumqi	Automatic system	Received	Data completed
Sanya	ZJSA	Sanya	Automatic system	Received	Data completed

Table 1. Summary of Traffic Sample Data of December 2023 in the Airspace of Chinese FIRs

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

2.3.1. Series of cumulative 12-month of LHD reports were used in this safety assessment starting from January 2023 to December 2023. **Table 2** provides the summary of LHD reports submitted by each FIR.

FIR Name	Beijing	Shanghai	Guangzhou	Wuhan	Shenyang	Lanzhou	Urumqi	Kunming	Sanya
Jan-23	X	X	X	X	X	X	X	X	X
Feb-23	X	X	X	X	X	X	X	X	X
Mar-23	X	X	X	X	X	X	X	X	X
Apr-23	X	X	X	X	X	X	X	X	X
May-23	X	X	X	X	X	X	X	X	X
Jun-23	X	X	X	X	X	X	X	X	X
Jul-23	X	X	X	X	X	X	X	X	X
Aug-23	X	X	X	X	X	X	X	X	X
Sep-23	X	X	X	X	X	X	X	X	X
Oct-23	X	X	X	X	X	X	X	X	X
Nov-23	X	X	X	X	X	X	X	X	X
Dec-23	X	X	X	X	X	X	X	X	X

Table 2. Summary of LHD Reports collected from Chinese FIRs

X = Large Height Deviation Report was received for the specified month (including reports indicating "NIL" events)

3. Summary of LHD Occurrences

3.1. Based on the LHD reports in **Table 2**, the LHD occurrences in 2023 are summarized as below.

3.2. **Table 3** and **Figure 1** summarize the number of LHD occurrences, associated LHD duration (in minutes) and the number of flight levels crossed without clearance by month in Chinese FIRs in the reporting period:

Month-Year	No. of LHD Occurrences	LHD Duration (Minutes)	No. of flight levels transitioned without clearance
Jan-23	15	0	7
Feb-23	14	0	3
Mar-23	30	0	9
Apr-23	22	0	15
May-23	17	0	7
Jun-23	12	0	5
Jul-23	34	0	11
Aug-23	17	0	15
Sep-23	22	0	12
Oct-23	17	7	9
Nov-23	11	0	5
Dec-23	12	0	4
Total	223	7	102

Table 3. Summary of non-nil LHDs in Chinese FIRs in 2023

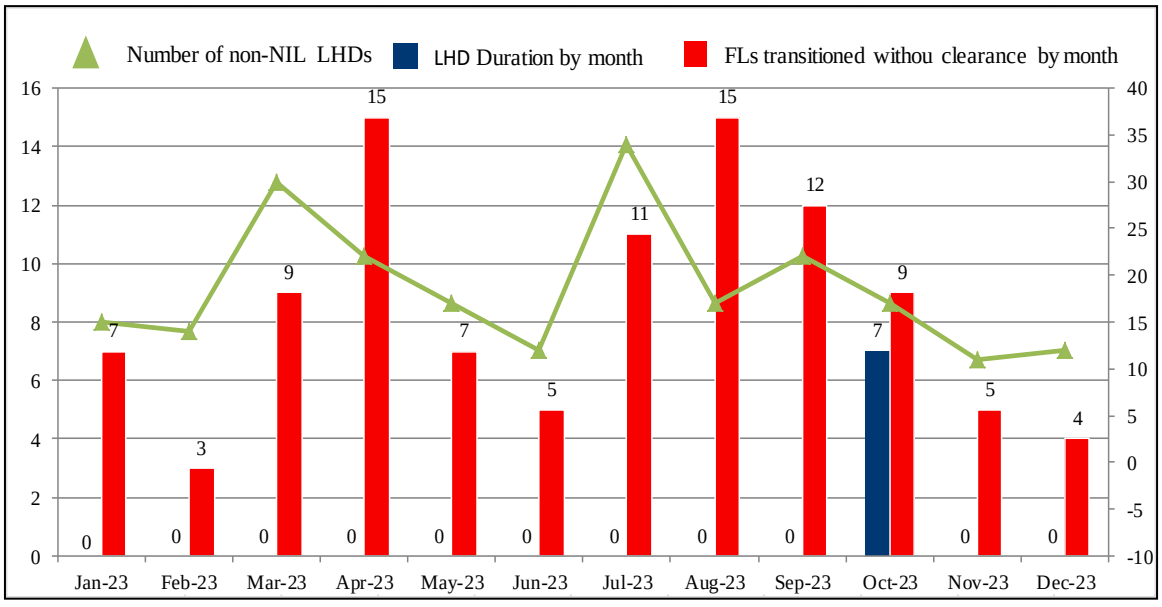

Figure 1. Illustrations of reported LHDs in Chinese FIRs between January 2023 and December 2023

3.3. The LHD reports are categorized by the description of the event. **Table 4**, **Figure 2**, **Figure 3** and **Figure 4** summarize the number of LHD occurrences inside Chinese airspace by the cause of the deviation.

LHD Code	LHD Category Description	No. of LHD Occurrences	LHD Duration (Min)	No. of flight levels transitioned without clearance
A	Flight crew failing to climb/descend the aircraft as cleared	7	0	8
B	Flight crew climbing/descending without Air Traffic Control (ATC) Clearance	1	0	1
C	Incorrect operation or interpretation of airborne equipment	1	0	1
D	ATC system loop error	3	0	3
E	ATC transfer of control coordination errors due to human factors	8	0	0
F	ATC transfer of control coordination errors due to technical issues	8	0	0
G	Aircraft contingency leading to sudden inability to maintain level	0	0	0
H	Airborne equipment failure and unintentional or undetected level change	6	0	6
I	Turbulence or other weather related cause	79	0	62
J	TCAS resolution advisory and flight crew correctly responds	16	0	16
K	TCAS resolution advisory and flight crew incorrectly responds	0	0	0
L	Non-approved aircraft is provided with RVSM separation	0	0	0
M	Other	94	7	5
Total		223	7	102

Table 4. Summary of LHD Categories during the reporting period

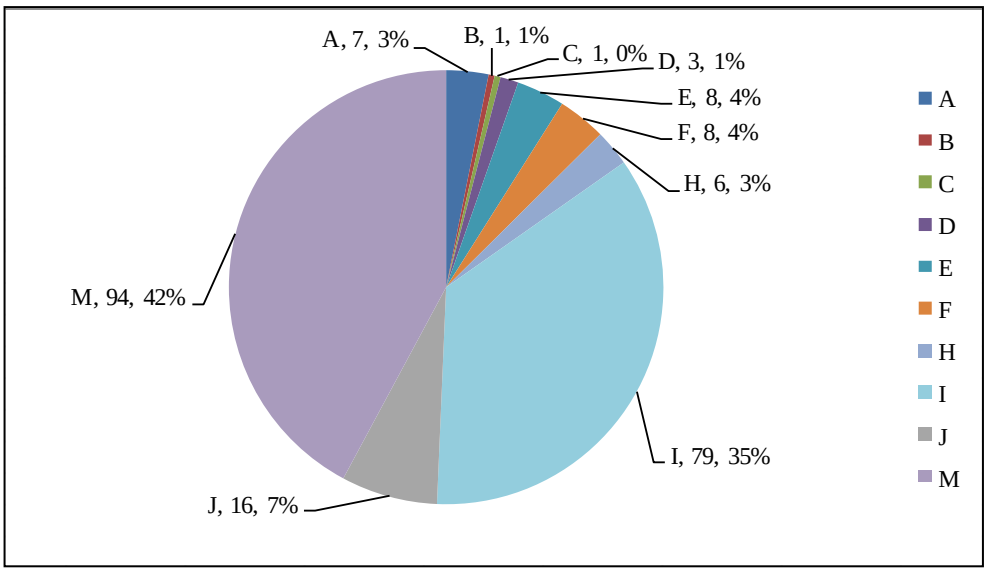

Figure 2. The LHD Events Sorted by Category

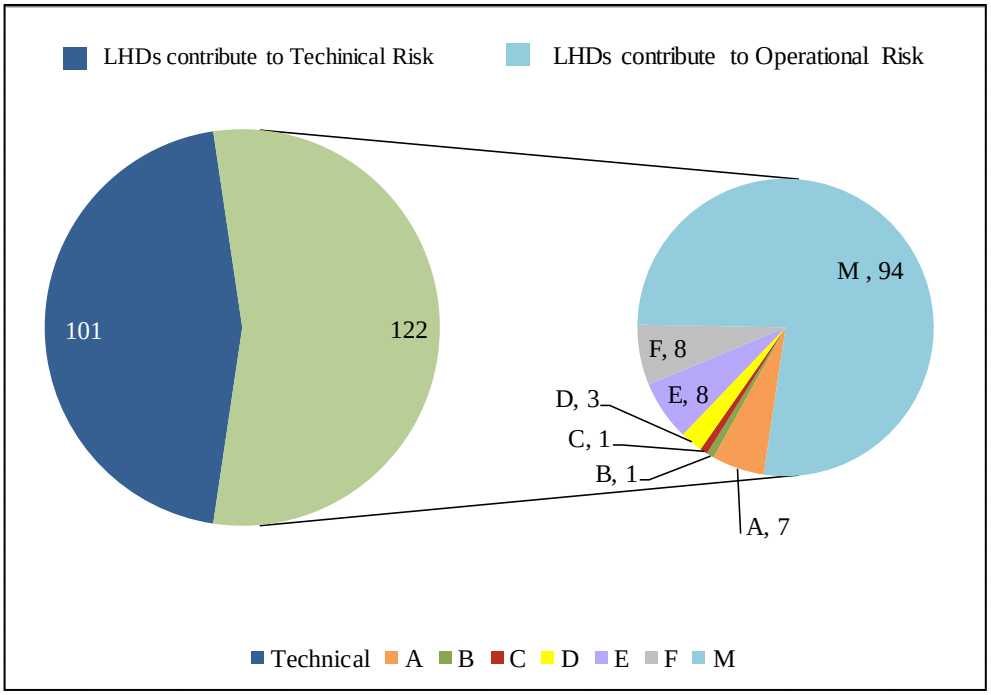

Figure 3. Breakdown of Operation Risk Contributors (Category and Number of Events)

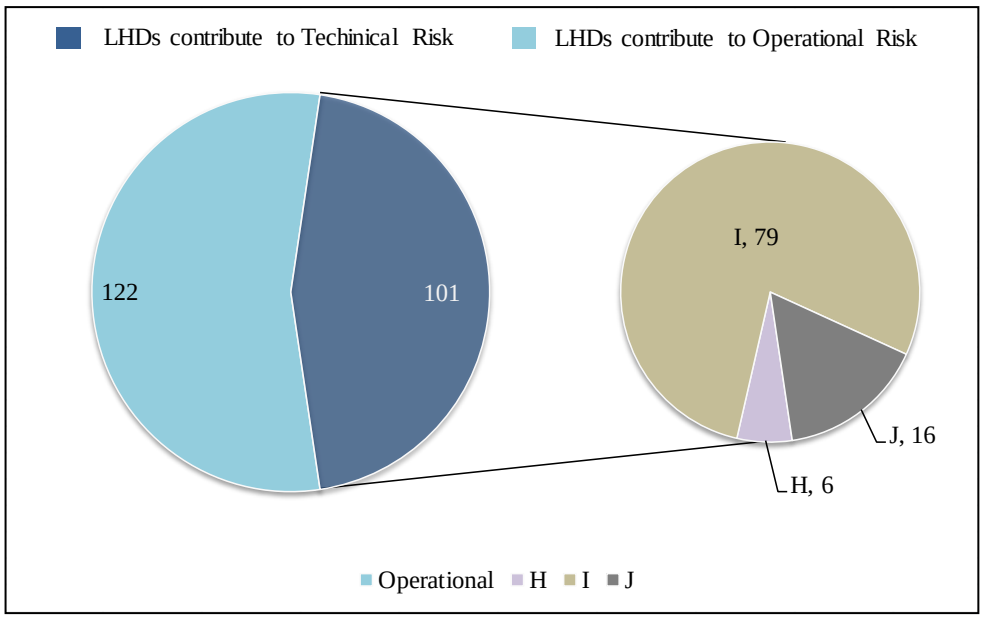

Figure 4. Breakdown of Technical Risk Contributors (Categories and Number of Events)

3.4. **Figure 5** demonstrates the monthly operational risk assessment and the individual event contribution, while **Figure 6** presents the operational risk estimate by categories visualizing the individual event contribution.

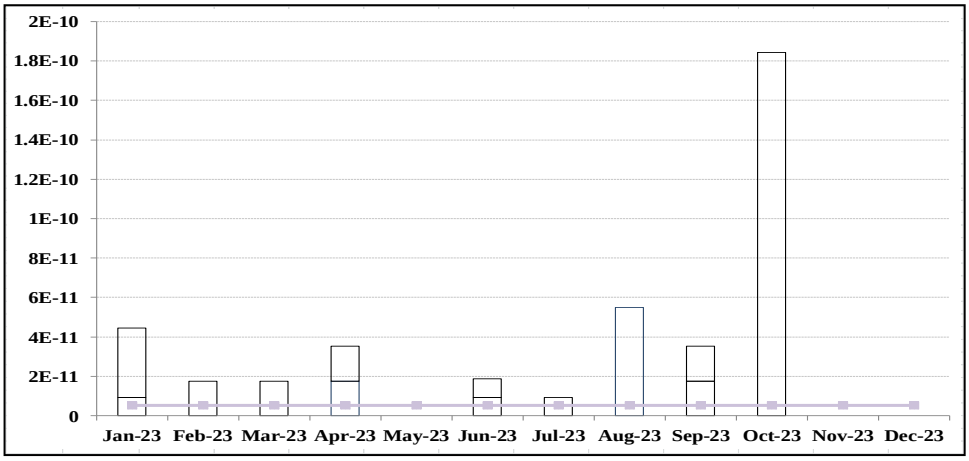

Figure 5. Monthly Assessed Risk Demonstrating the Individual Event Contribution

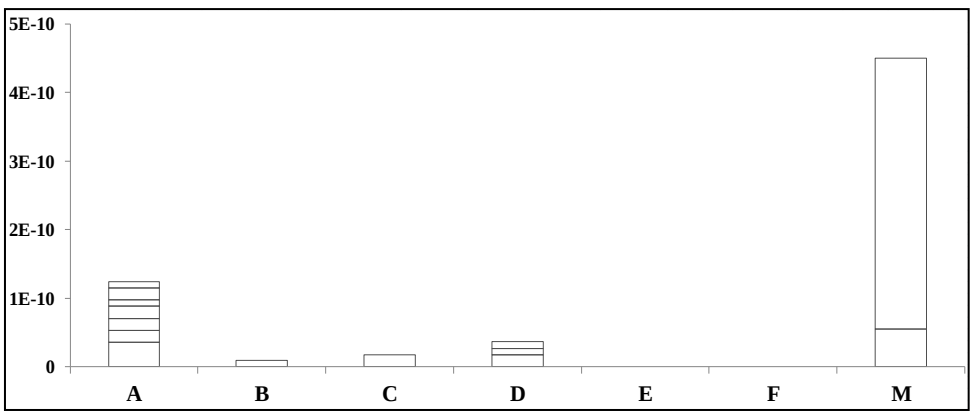

Figure 6. Operational Risk Estimate by Categories Demonstrating the Individual Event Contribution

3.5. LHD Analysis and Safety Treatment of Identified LHDs

3.6. 230 LHD events were received during the reporting period. 223 events occurred inside Chinese ATS area, and 7 events occurred outside Chinese ATS area. With the increase of air traffic flow, more LHD events occurred compared with 2022.

3.7. 189 LHD events were received from Chinese ATC units, 25 LHD event from Chinese operators, and 16 LHD events shared by PARMO. China RMA has made great efforts to improve the reporting mechanism of Chinese operators, including conducting training and research ,some Chinese operators could report "NIL" or LHD events every month, and have established internal reporting mechanism.

3.8. 15 category E and 8 category F events were received in 2023. 22 events occurred in AKARA Corridor between Shanghai ACC and Incheon ACC, 1 event occurred between Urumqi ACC and Islamabad ACC. All events were transfer events, and receiving ACC could confirm the transfer information before the aircraft passing the transfer point, so there was no operational risk during these events.

3.9. There were 122 operational risk events occurred in 2023, and only 14 events affected operational risk, which were 7 category A, 1 category B, 1 category C, 3 category D and 2 category M. The largest quantities of operational risk events were category M events, which were 94 in the whole year. Most of the category from the aircraft losing RVSM capability during the flight because of the on-board equipment failure (most were TCAS failure events). China RMA conducted field investigations covering 7 Chinese Reginal ATMBs in the first half of 2024, communicating with controllers in terms of RVSM control operation, including the control operation procedures for TCAS failure aircraft, for detail information please see another paper submitted by China RMA in RASMAG/29.

3.10. Hot spot identification in trial

3.11. According to the method proposed in MAWG/9 WP07 in RASMAG/27 meeting, China RMA identified 3 clusters as showed in Figure 7, Figure 8 and Figure 9. The cluster 1 is the transfer point SADLI between Shanghai ACC and Incheon ACC in AKARA Corridor. The cluster 2 is at Beijing FIR, and the cluster 3 is at Guangzhou FIR.

Figure 7. Cluster identification in Chinese airspace for 2023

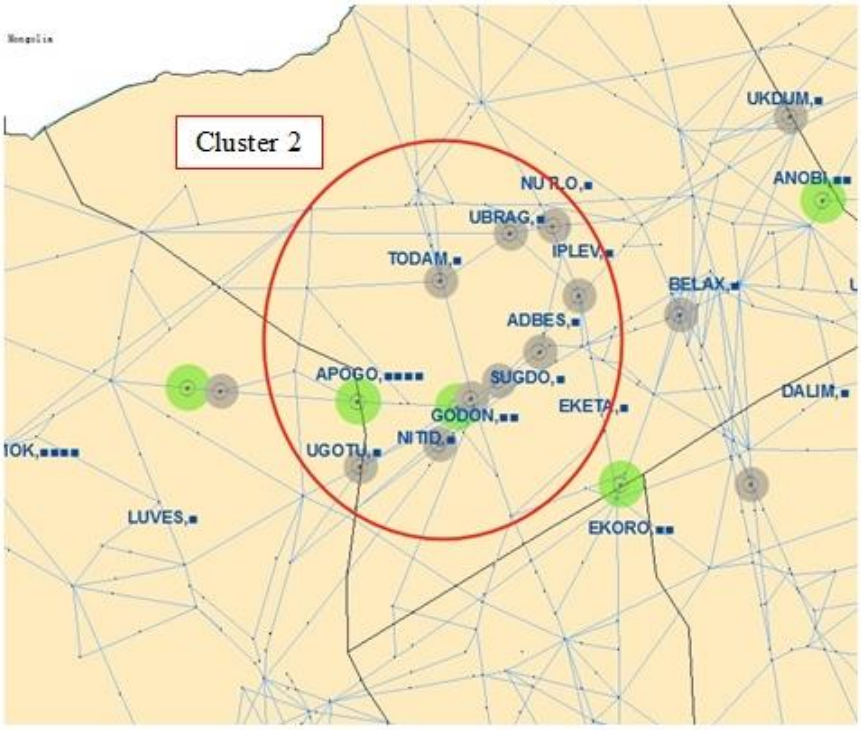

Figure 8. Cluster 2 area zoomed in

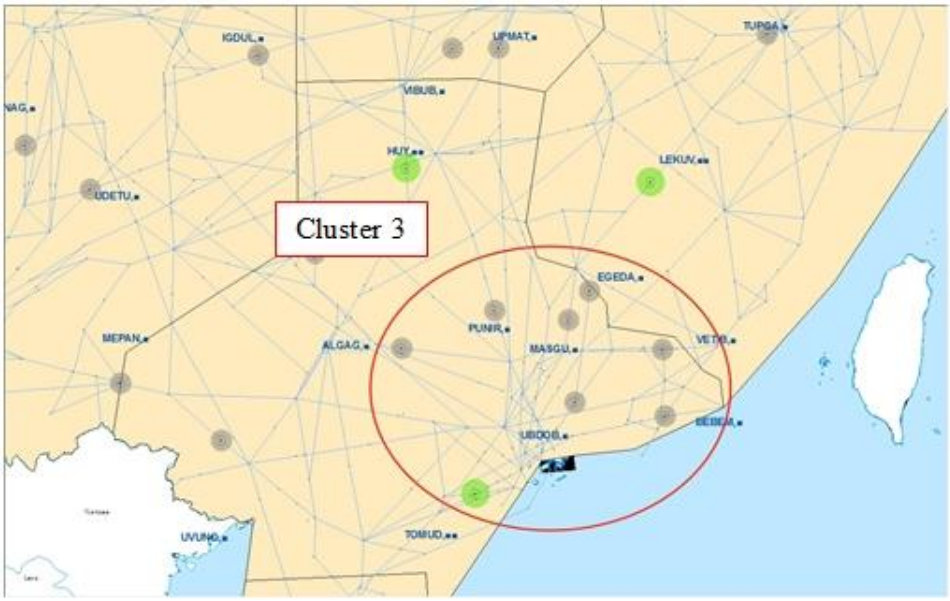

Figure 9. Cluster 3 area zoomed in

3.12. **Table 5** shows the Hot Spot criteria and **Table 6** shows the result against the criteria

	2023
Number of Clusters	3
Number of Operational LHD Events	122
Operational Risk ($x10^{-9}$)	0.64
Criteria: Number	30.5
Criteria: Risk ($x10^{-9}$)	0.16

Table 5. The Hot Spot criteria in 2023

	Cluster 1	Cluster 2	Cluster 3
Number of Operational LHDs	16	15	9
Check Criteria: Number	Negative	Negative	Negative
Risk	0	0	0.01
Check Criteria: Risk	Negative	Negative	Negative
Check Criteria: TLS	Negative	Negative	Negative

Table 6. The results of checking against the criteria

3.13. According to the result of cluster identification, there was no Hot Spot in Chinese airspace. The total risk of 2023 is 0.75 x 10-9, which is below TLS, and there was also no high risk event occurred in this year.

4. Estimate of Vertical Collision Risk for Chinese RVSM Airspace

4.1. The vertical collision risk estimate is to determine whether the Target Level of Safety (TLS) continued to be met in China Domestic airspace, thus supporting the ongoing safe application of RVSM.

4.2. This section updates the results of safety oversight for the RVSM implementation in the monitored airspace. Accordingly, the internationally accepted collision risk methodology is applied in the safety of the RVSM implementation assessment in the airspace.

4.3. The TSD of December 2023, the continuous LHD reports in the airspace of Chinese domestic airspace between January 2023 and December 2023 were adopted to produce the risk estimates presented in this report.

4.4. **Collision Risk Model (CRM) parameters Estimate**

4.4.1. **Table 7** summarizes the value and source material for values estimation of the empirical parameters of the CRM. The CRM is adopted for the risk assessment and the safety oversight for the RVSM implementation in the China domestic airspace.

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
S_x	Longitudinal separation standard for a region, or Length of longitudinal window used to calculate occupancy	80Nm	Standard value used in overall airspace
S_h	Planned Horizontal Separation	80Nm	Standard value used in overall airspace
$P_z(0)$	Probability of vertical overlap (with planned vertical separation equal to zero)	0.4026	Estimated based on the radar data form from Upper Control Area of Beijing, Guangzhou, Shanghai, August 2008
$P_z(S_z)$	Prob. that 2 aircraft nominally separated by the vertical separation minimum S_z are in vertical overlap.	5.604 x 10^{-9}	
$P_y(0)$	Probability of Lateral Overlap	0.025	Estimated by FAA Technical Center based on the proportion of GPS operations observed in the TSD data collected in China
$P_h(\theta)$	Probability of Horizontal Overlap	6.88 x 10^{-7}	Value used in the Western Pacific/South China Sea safety assessment
$\left\lvert\overline{h(\dot{\theta})}\right\rvert$	Average relative horizontal speed during overlap for aircraft pairs on routes with crossing angle θ (let θ=45°)	367.4 knots	Value used in Western Pacific/South China Sea safety assessment (corresponds to an average aircraft speed of 480 knots)
$\lvert\overline{\dot{y}}\rvert$	Average absolute relative cross track speed for an aircraft pair nominally on the same track	2.8 knots	Estimated by FAA Technical Center based on the proportion of GPS operations observed in the TSD data collected in China
$\lvert\overline{\dot{z}}\rvert$	Average absolute relative vertical speed of an aircraft pair that has lost all vertical separation	1.5 knots	Value used in NAT RVSM safety assessment
λ_x	Average aircraft length	0.02345Nm	Estimated based on the collected TSD
λ_y	Average aircraft wingspan	0.02073Nm	
λ_z	Average aircraft height	0.0070 Nm	
λ_h	Diameter of the disk representing the shape of an aircraft in the horizontal plane	0.02345Nm	

Table 7. Estimate of the empirical Parameters in the CRM

4.4.2. **Table 8** summarizes the value and source material for values estimate of the empirical parameters of the TSD. The TSD is adopted for the risk assessment and the safety oversight for the RVSM implementation in the airspace.

Parameter Symbol	Parameter	Parameter Definition
T	2346975.6	Annual flight hours
E_z(same)	0.1009	Same-direction vertical occupancies
E_z(opposite)	0.0695	Opposite-direction vertical occupancies
Crossing pairs	4552980	Annual estimate of crossing pairs in crossing route
$\overline{\lvert\Delta V\rvert}$	35.5447	Average relative along-track speed between aircraft on same direction routes
$\overline{\lvert V\rvert}$	449.2596	Average absolute aircraft ground speed

Table 8. Estimate of the Parameters Based on the Collected TSD

4.5. **Estimate of Vertical Collision Risk for Chinese RVSM Airspace**

4.5.1. This section summarizes the results of the safety assessment for the airspace of Chinese FIRs. **Figure 10** presents the Technical Risk computed by the TSD collected in December 2023.

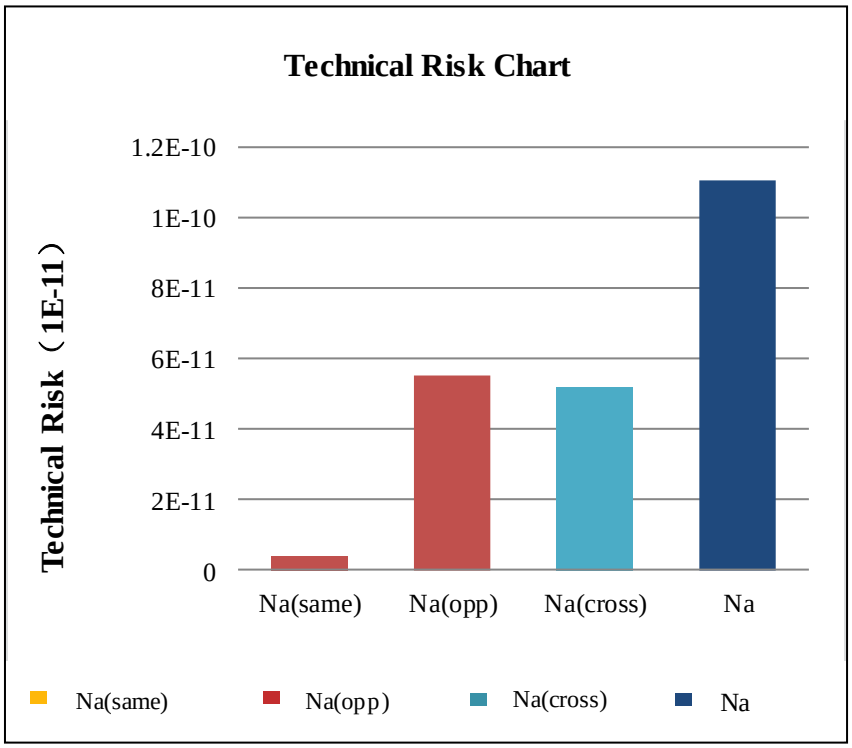

Figure 10. Technical Risk Bar Chart Computed by the TSD Collected in December 2023

4.5.2. **Table 9** presents the estimates of vertical collision risk for the airspace of Chinese FIRs, in terms of the technical, operational, and total risks. The technical risk is estimated to be 0.11 x 10^{-9} fapfh. The operational risk estimate is 0.64 x 10^{-9} fapfh. The estimate of the overall vertical collision risk is 0.75 x 10^{-9} fapfh, which is below the overall TLS value of 5.0x 10^{-9} fapfh.

The RVSM Airspace of Chinese FIRs – estimated annual flying hours = 2346975.6 hours *(note: estimated hours based on Dec 2023 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.11 x 10^{-9}	2.5 x 10^{-9}	Below Technical TLS
Operational Risk	0.64 x 10^{-9}	--	--
Total Risk	**0.75 x 10^{-9}**	**5.0 x 10^{-9}**	**Below Overall TLS**

Table 9. Risk Estimates for the RVSM Implementation in the airspace of Chinese FIRs

4.5.3. **Figure 11** presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month of LHD reports.

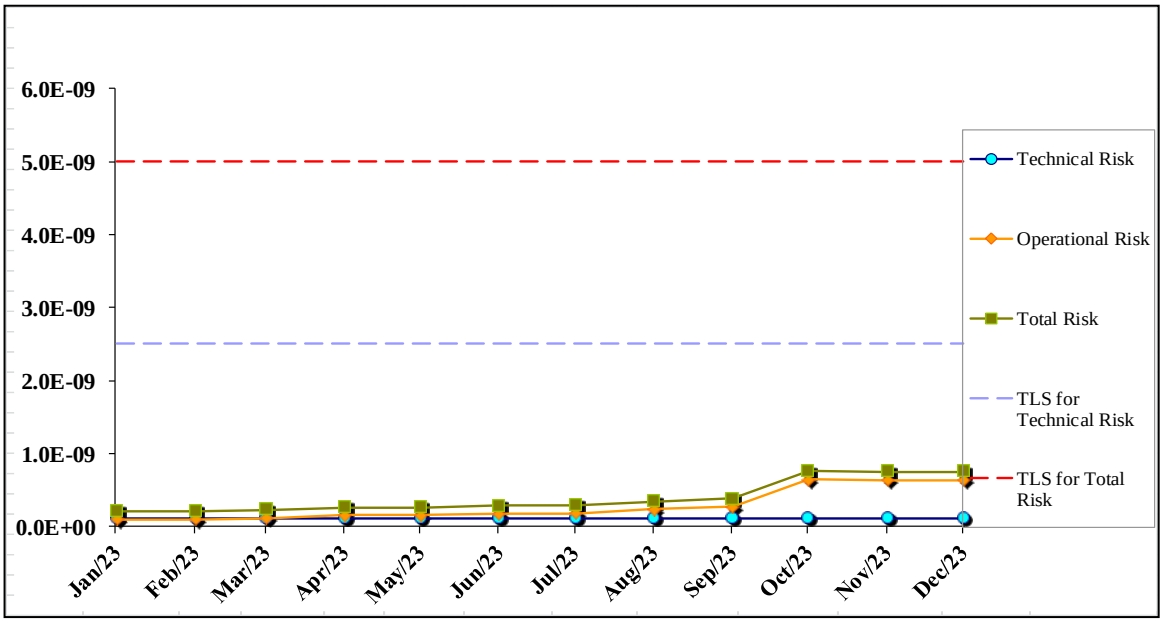

Figure 11. Trends of Risk Estimates for the Airspace of Chinese FIRs

4.5.4. Based on these collision risk estimates, the estimates of both technical risk and total risk from the available TSD and LHD reports satisfy the agreed TLS value of no more than 2.5 x 10^{-9} and 5.0 x 10^{-9} fapfh.

Appendix A Detail of LHDs inside Chinese FIRs from January 2023 to December 2023

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
1	03/01/2023	Guangzhou ACC	SHL	0		Lose RVSM capability due to	M
2	04/01/2023	Beijing ACC	VYK	0	1	TCAS RA and pilot correctly	J
3	04/01/2023	Urumqi ACC	OSUPO	0	1	Turbulence	I
4	05/01/2023	Dalian ACC	UNSEK	0	1	Pilot descend/climb the aircraft	B
5	11/01/2023	Beijing ACC	NITID	0		Lose RVSM capability due to	M
6	11/01/2023	Chengdu ACC	SANUK	0		Lose RVSM capability due to	M
7	13/01/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
8	13/01/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
9	16/01/2023	Shanghai ACC	VETIB	0		Lose RVSM capability due to	M
10	24/01/2023	Qingdao ACC	HCH	0		Lose RVSM capability due to	M
11	25/01/2023	Chengdu ACC	PAVMO	0	1	Turbulence	I
12	26/01/2023	Guangzhou ACC	NO	0	1	Turbulence	I
13	28/01/2023	Beijing ACC	EKETA	0		Lose RVSM capability due to	M
14	29/01/2023	Guangzhou ACC	BIGVI	0		Lose RVSM capability due to	M
15	29/01/2023	Chengdu ACC	IPNAG	0	2	Pilot not descend/climb the aircraft	A
16	02/02/2023	Guangzhou ACC	QP	0		Lose RVSM capability due to	M
17	04/02/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
18	06/02/2023	Chengdu ACC	MUGNU	0	1	Pilot misunderstands clearance	D
19	08/02/2023	Shanghai ACC	ANISA	0	1	Airborne equipment failure	H
20	08/02/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
22	08/02/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
22	09/02/2023	Shanghai ACC	SHR	0		Lose RVSM capability due to	M
23	11/02/2023	Capital airlines	Unknown	0	0	Turbulence	I
24	17/02/2023	Chengdu ACC	IPLOL	0	1	Bad weather	I
25	18/02/2023	Guangzhou ACC	LEKUV	0		Lose RVSM capability due to	M

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
26	20/02/2023	Shanghai ACC	Unknown	0		Lose RVSM capability due to	M
27	21/02/2023	Kunming ACC	NIXAS	0		Lose RVSM capability due to	M
28	27/02/2023	Guangzhou ACC	VARDU	0		Lose RVSM capability due to	M
29	27/02/2023	Xi'an ACC	NSH	0		Lose RVSM capability due to	M
30	02/03/2023	Chengdu ACC	IGDUL	0		Lose RVSM capability due to	M
31	02/03/2023	Shanghai ACC	NIXEM	0		Lose RVSM capability due to	M
32	08/03/2023	Guangzhou ACC	ALGAG	0		Lose RVSM capability due to	M
33	10/03/2023	Beijing ACC	OC	0		Lose RVSM capability due to	M
34	11/03/2023	Chengdu ACC	ELKAL	0	0	Bad weather	I
35	11/03/2023	Lanzhou ACC	OMBON	0	0	Turbulence	I
36	11/03/2023	Qingdao ACC	XDX	0		Lose RVSM capability due to	M
37	12/03/2023	Guangzhou ACC	UPMAT	0		Lose RVSM capability due to	M
38	12/03/2023	Shanghai ACC	Unknown	0		Lose RVSM capability due to	M
39	13/03/2023	Guangzhou ACC	CD	0		Lose RVSM capability due to	M
40	14/03/2023	Kunming ACC	ELASU	0		Lose RVSM capability due to	M
41	18/03/2023	Beijing ACC	UKDUM	0		Lose RVSM capability due to	M
42	19/03/2023	Guangzhou ACC	PEXID	0	0	Bad weather	I
43	20/03/2023	Lanzhou ACC	Unknown	0	1	Bad weather	I
44	22/03/2023	Shanghai ACC	KHN	0	1	Turbulence	I
45	23/03/2023	Guangzhou ACC	VAKVU	0	1	Bad weather	I
46	23/03/2023	Guangzhou ACC	ODOPI	0	1	Turbulence	I
47	23/03/2023	Beijing ACC	SUGDO	0		Lose RVSM capability due to	M
48	25/03/2023	Guangzhou ACC	BIPOP	0		Bad weather	I
49	25/03/2023	Shanghai ACC	LAMEN	0	1	Pilot not descend/climb the aircraft	A
50	26/03/2023	Lasa ACC	DUMIX	0	1	Bad weather	I
51	26/03/2023	Shanghai ACC	Unknown	0	1	Bad weather	I

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
52	28/03/2023	Chengdu ACC	HUY	0	1	Bad weather	I
53	28/03/2023	Beijing ACC	ADBES	0		Lose RVSM capability due to	M
54	29/03/2023	Capital airlines	Unknown	0	1	Bad weather	I
55	29/03/2023	Beijing ACC	BELAX	0		Lose RVSM capability due to	M
56	29/03/2023	Nanning ACC	Unknown	0	0	Turbulence	I
57	30/03/2023	Guangzhou ACC	PUNIR	0		Lose RVSM capability due to	M
58	30/03/2023	Chengdu ACC	HUY	0		Lose RVSM capability due to	M
59	31/03/2023	Urumqi ACC	SALMO	0	0	Turbulence	I
60	01/04/2023	Urumqi ACC	SALMO	0	1	Turbulence	I
61	01/04/2023	Kunming ACC	BIDRU	0	1	Pilot not descend/climb the aircraft	A
62	03/04/2023	Guangzhou ACC	ZK	0		Lose RVSM capability due to	M
63	04/04/2023	Qingdao ACC	TAO	0	1	Bad weather	I
64	04/04/2023	LOONGAIR	ATLED	0	0	Turbulence	I
65	08/04/2023	Guangzhou ACC	LLC	0		Lose RVSM capability due to	M
66	09/04/2023	Lanzhou ACC	NOGEX	0	1	Bad weather	I
67	09/04/2023	Lanzhou ACC	Unknown	0	0	Bad weather	I
68	11/04/2023	Lanzhou ACC	Unknown	0	1	Bad weather	I
69	11/04/2023	Beijing ACC	TODAM	0	1	Turbulence	I
70	12/04/2023	Beijing ACC	TAMIX	0	1	TCAS RA and pilot correctly	J
71	12/04/2023	Nanning ACC	LON	0	1	Pilot not descend/climb the aircraft	A
72	14/04/2023	Chengdu ACC	SB	0	1	Turbulence	I
73	14/04/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
74	15/04/2023	Chengdu ACC	MUBOP	0	1	Turbulence	I
75	15/04/2023	Beijing ACC	BELUM	0	0	Turbulence	I
76	17/04/2023	Chengdu ACC	Unknown	0	1	Bad weather	I
77	17/04/2023	Chengdu ACC	BOKIR	0	1	Turbulence	I

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
78	18/04/2023	Qingdao ACC	TAO	0		Lose RVSM capability due to	M
79	19/04/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
80	19/04/2023	PARMO/Incheon	SADLI	0		No FL revision	E
81	26/04/2023	Chengdu ACC	DOLGU	0	1	Turbulence	I
82	05/05/2023	Urumqi ACC	PURPA	0	0	Bad weather	I
83	07/05/2023	Beijing ACC	IPLEV	0		Lose RVSM capability due to	M
84	08/05/2023	Sanya ACC	DSA	0	1	Turbulence	I
85	08/05/2023	Sanya ACC	LH	0	1	Airborne equipment failure	H
86	13/05/2023	Chengdu ACC	DUBID	0	1	Turbulence	I
87	13/05/2023	Capital airlines	DUBID	0	1	Bad weather	I
88	14/05/2023	Shanghai ACC	HFE	0	1	Turbulence	I
89	15/05/2023	Shenyang ACC	ISKEM	0		Lose RVSM capability due to	M
90	16/05/2023	Sanya ACC	DSA	0	1	TCAS RA and pilot correctly	J
91	18/05/2023	Qingdao ACC	KARPI	0		Lose RVSM capability due to	M
92	19/05/2023	Guangzhou ACC	PLT	0	0	Lose RVSM capability due to	M
93	22/05/2023	Lanzhou ACC	OBMIG	0		Lose RVSM capability	M
94	24/05/2023	Guangzhou ACC	UBDOB	0		Lose RVSM capability due to	M
95	25/05/2023	PARMO/Incheon	SADLI	0		No transfer	E
96	26/05/2023	Urumqi ACC	KABDO	0		Lose RVSM capability due to	M
97	30/05/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
98	30/05/2023	Shenyang ACC	ANOBI	0		Lose RVSM capability due to	M
99	01/06/2023	Guangzhou ACC	LEKUV	0		Fail to communicate	M
100	04/06/2023	Lanzhou ACC	Unknown	0	1	Bad weather	I
101	04/06/2023	PARMO/Incheon	SADLI	0		No FL revision	E
102	05/06/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
103	11/06/2023	Capital airlines	Unknown	0	1	Bad weather	I

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
104	14/06/2023	Guangzhou ACC	ZGHY	0		Lose RVSM capability due to	M
105	14/06/2023	Shenyang ACC	NUBKI	0		Lose RVSM capability due to	M
106	14/06/2023	Air Travel	VMB	0	1	Bad weather	I
107	15/06/2023	Beijing ACC	EKORO	0	1	Pilot misunderstands clearance	D
108	15/06/2023	Beijing ACC	EKORO	0	1	Pilot misunderstands clearance	D
109	18/06/2023	PARMO/Incheon	SADLI	0		No FL revision	E
110	25/06/2023	Lanzhou ACC	GUY	0	0	Bad weather	I
111	02/07/2023	Guangzhou ACC	OPUNI	0	1	Bad weather	I
112	05/07/2023	Shenyang ACC	Unknown	0		Lose RVSM capability due to	M
113	08/07/2023	Guangzhou ACC	ENH	0	0	Bad weather	I
114	08/07/2023	Shenzhen Airlines	Unknown	0	1	Bad weather	I
115	09/07/2023	Guangzhou ACC	ENH	0	1	Bad weather	I
116	09/07/2023	Shenzhen Airlines	Unknown	0	1	Bad weather	I
117	10/07/2023	Shanghai ACC	BEBEM	0	1	Pilot not descend/climb the aircraft	A
118	12/07/2023	Chengdu ACC	CDX	0	1	Bad weather	I
119	12/07/2023	Beijing ACC	HUR	0	0	Bad weather	I
120	17/07/2023	PARMO/Incheon	SADLI	0		No transfer	E
121	20/07/2023	Chengdu ACC	AKVEP	0	1	Bad weather	I
122	20/07/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
123	20/07/2023	PARMO/Incheon	SADLI	0		Late transfer	E
124	21/07/2023	Shanghai ACC	DO	0	1	Bad weather	I
125	21/07/2023	Guangzhou ACC	VAKVU	0	1	Bad weather	I
126	25/07/2023	Chengdu ACC	DUBID	0	1	Bad weather	I
127	25/07/2023	Capital airlines	Unknown	0	1	Bad weather	I
128	25/07/2023	Kunming ACC	UDETU	0		Lose RVSM capability	M
129	25/07/2023	Beijing ACC	NUTLO	0		Lose RVSM capability	M

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
130	25/07/2023	Beijing ACC	Unknown	0		Lose RVSM capability	M
131	27/07/2023	Lanzhou ACC	MIMOK	0		Lose RVSM capability	M
132	28/07/2023	Xi'an ACC	APOGO	0	0	Lose RVSM capability	M
133	28/07/2023	Chengdu ACC	DUBID	0		Lose RVSM capability	M
134	28/07/2023	Xi'an ACC	APOGO	0		Lose RVSM capability	M
135	28/07/2023	Xi'an ACC	APOGO	0		Lose RVSM capability	M
136	28/07/2023	Beijing ACC	TYN	0		Lose RVSM capability	M
137	28/07/2023	Beijing ACC	UBRAG	0		Lose RVSM capability	M
138	28/07/2023	Beijing ACC	TODAM	0	0	Lose RVSM capability	M
139	28/07/2023	Beijing ACC	GODON	0		Lose RVSM capability	M
140	28/07/2023	Lanzhou ACC	MIMOK	0		Lose RVSM capability	M
141	28/07/2023	Lanzhou ACC	MIMOK	0		Lose RVSM capability	M
142	28/07/2023	Beijing ACC	GODON	0		Lose RVSM capability	M
143	28/07/2023	Xi'an ACC	APOGO	0		Lose RVSM capability	M
144	29/07/2023	Shanghai ACC	ENVEN	0	0	Bad weather	I
145	02/08/2023	Beijing ACC	Unknown	0	5	Other	M
146	02/08/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
147	07/08/2023	Guangzhou ACC	LLC	0	1	Bad weather	I
148	07/08/2023	Sichuan airlines	Unknown	0	1	Bad weather	I
149	08/08/2023	Guangzhou ACC	LIN	0	0	Bad weather	I
150	16/08/2023	PARMO/Incheon	SADLI	0		Coordination error due to AIDC fail	F
151	17/08/2023	China Southern Airlines	XLN	0	1	Bad weather	I
152	18/08/2023	Shanghai ACC	KHN	0		Lose RVSM capability due to	M
153	20/08/2023	Kunming ACC	BIDRU	0	1	Bad weather	I
154	22/08/2023	Shenzhen Airlines	Unknown	0	1	Bad weather	I
155	23/08/2023	Kunming ACC	ELASU	0	1	Bad weather	I

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
156	26/08/2023	Guangzhou ACC	Unknown	0	1	Bad weather	I
157	26/08/2023	Shenzhen Airlines	Unknown	0	1	Bad weather	I
158	26/08/2023	Sichuan airlines	NUVGA	0	1	Bad weather	I
159	29/08/2023	Shenyang ACC	ANOBI	0		Lose RVSM capability due to	M
160	31/08/2023	Lanzhou ACC	MIMOK	0		Lose RVSM capability due to	M
161	31/08/2023	Xi'an ACC	LUVES	0		Lose RVSM capability due to	M
162	02/09/2023	Beijing airlines	Unknown	0		Lose RVSM capability due to	M
163	05/09/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
164	07/09/2023	Beijing ACC	BIKUT	0	1	TCAS RA and pilot correctly	J
165	16/09/2023	Nanning ACC	LBN	0		Lose RVSM capability	M
166	19/09/2023	Beijing ACC	TAMIX	0	1	Bad weather	I
167	21/09/2023	Shenzhen Airlines	Unknown	0		Lose RVSM capability due to	M
168	21/09/2023	Nanning ACC	LBN	0		Lose RVSM capability due to	M
169	21/09/2023	Kunming ACC	MEPAN	0		Lose RVSM capability	M
170	22/09/2023	Kunming Airlines	Unknown	0		Lose RVSM capability due to	M
171	22/09/2023	Kunming Airlines	Unknown	0		Lose RVSM capability due to	M
172	22/09/2023	Guangzhou ACC	VIBUB	0	1	Pilot not descend/climb the aircraft	A
173	22/09/2023	Chengdu ACC	HUY	0		Lose RVSM capability due to	M
174	22/09/2023	Air Travel	VIBUB	0	1	Pilot incorrect operation	C
175	24/09/2023	Shanghai ACC	DOPNO	0		Lose RVSM capability	M
176	24/09/2023	Sanya ACC	SYX	0	1	Turbulence	I
177	26/09/2023	Kunming ACC	ELASU	0	2	TCAS RA and pilot correctly	J
178	26/09/2023	Sanya ACC	NYB	0	1	Bad weather	I
179	27/09/2023	Fuzhou airlines	Unknown	0		Lose RVSM capability due to	M
180	27/09/2023	Beijing ACC	DALIM	0		Lose RVSM capability due to	M
181	27/09/2023	Dalian ACC	DONVO	0	1	TCAS RA and pilot correctly	J

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
182	27/09/2023	Beijing airlines	Unknown	0		Lose RVSM capability	M
183	28/09/2023	Shanghai ACC	XUVG	0	2	Turbulence	I
184	04/10/2023	Shanghai ACC	DPX	0	1	Airborne equipment failure	H
185	11/10/2023	Lanzhou ACC	BUKPU	0	1	Turbulence	I
186	13/10/2023	Beijing ACC	LRU	0	1	TCAS RA and pilot correctly	J
187	16/10/2023	Lasa ACC	LUPMI	0	1	Turbulence	I
188	17/10/2023	Sanya ACC	SYX	0	0	Bad weather	I
189	18/10/2023	Lanzhou ACC	OMGUP	0		Lose RVSM capability due to	M
190	18/10/2023	Urumqi ACC	OBDEG	0		Lose RVSM capability due to	M
191	19/10/2023	Chengdu ACC	DUBID	0		Lose RVSM capability due to	M
192	19/10/2023	Sanya ACC	NYB	0	1	Turbulence	I
193	19/10/2023	Shanghai ACC	TUPGA	0	1	Pilot not descend/climb the aircraft	A
194	20/10/2023	Shanghai ACC	Unknown	0		Lose RVSM capability due to	M
195	20/10/2023	Guangzhou ACC	VEXAN	0		Lose RVSM capability due to	M
196	22/10/2023	Lanzhou ACC	IRSUM	0	1	Airborne equipment failure	H
197	23/10/2023	Capital airlines	LIN	0		Lose RVSM capability due to	M
198	29/10/2023	Xi'an ACC	UGOTU	0		Lose RVSM capability	M
199	31/10/2023	Beijing ACC	LRU	0	2	TCAS RA and pilot correctly	J
200	31/10/2023	Shanghai ACC	LASAN	7		Fail to communicate	M
201	04/11/2023	Urumqi ACC	RIMDU	0	1	Bad weather	I
202	05/11/2023	Chengdu ACC	TESIL	0	1	Bad weather	I
203	05/11/2023	Nanning ACC	UVUNO	0		Lose RVSM capability due to	M
204	05/11/2023	Shanghai ACC	ELNEX	0	0	TCAS RA and pilot correctly	J
205	10/11/2023	Chongqing Airlines	Unknown	0	1	Bad weather	I
206	14/11/2023	Guangzhou ACC	LLC	0	0	TCAS RA and pilot correctly	J
207	23/11/2023	Chengdu ACC	KWE	0		Lose RVSM capability	M

No	EVENT DATE	SOURCE	LOCATION	DURATION (Min)	FLs TRANSITIONED WITHOUT CLEARANCE	CAUSE	CODE
208	27/11/2023	Xi'an ACC	ZNX	0		Lose RVSM capability due to	M
209	28/11/2023	Guangzhou ACC	XSH	0		Lose RVSM capability due to	M
210	29/11/2023	Lasa ACC	OMGEV	0	1	Turbulence	I
211	30/11/2023	Hebei Airlines	OVLAR	0	1	Turbulence	I
212	04/12/2023	Urumqi ACC	BATUS	0	0	Turbulence	I
213	05/12/2023	Ruili Airlines	VYK	0	1	Airborne equipment failure	H
214	07/12/2023	Guangzhou ACC	EGEDA	0		Lose RVSM capability due to	M
215	07/12/2023	Guangzhou ACC	TOMUD	0		Lose RVSM capability due to	M
216	10/12/2023	Guangzhou ACC	TOMUD	0		Lose RVSM capability due to	M
217	11/12/2023	Shanghai ACC	SADLI	0	1	TCAS RA and pilot correctly	J
218	15/12/2023	Chengdu ACC	UNSUV	0	1	Bad weather	I
219	20/12/2023	Shanghai ACC	SAPIN	0	1	Airborne equipment failure	H
220	27/12/2023	PARMO/Incheon	SADLI	0		No transfer	E
221	27/12/2023	PARMO/Incheon	SADLI	0		No transfer	E
222	28/12/2023	Guangzhou ACC	MASGU	0		Lose RVSM capability due to	M
223	29/12/2023	Okay Airways	Unknown	0		Lose RVSM capability due to	M

Appendix C Geographic Location of Risk-Bearing LHD within airspace of Chinese FIRs from January to December 2023

Figure 12 provides the geographic location of risk-bearing LHD reports within Chinese FIRs during the reporting period.

Figure 12. Geographic Location of Risk-Bearing LHD Reports in the Region

AIRSPACE SAFETY REVIEW FOR THE RVSM OPERATION IN THE AIRSPACE OF PYONGYANG FLIGHT INFORMATION REGION JANUARY 2023 -DECEMBER 2023

Presented by

中国地区监控组织
CHINA REGIONAL MONITORING AGENCY

August 2024

SUMMARY

This report presents the airspace safety oversight from China Regional Monitoring Agency (China RMA) for the airspace of Democratic People's Republic of Korea (DPR Korea) for the time January 2023 -December 2023. This report also contains an update of the vertical collision risk. The vertical collision risk estimate for the airspace of Pyongyang FIR is 0 in 2023.

1. Introduction

1.1 China Regional Monitoring Agency (China RMA) serves as the regional monitoring agency (RMA) for Pyongyang FIR.

1.2 The report covers the reporting period from January to December 2023 in Pyongyang FIR. Each year, China RMA produces one report requested by the Regional Airspace Safety Monitoring Advisory Group (RASMAG) on the FIR.

2. Data Submission

2.1. China RMA requests an annual one-month traffic movement sample and monthly Large Height Deviation (LHD) reports from the General Administration of Civil Aviation, DPR Korea.

2.2 According to the email response from ATMB of DPR Korea, there were no LHD events and flying hours in in Pyongyang FIR due to world public health crisis in 2023.

3. Estimate of Vertical Collision Risk for DPR Korea's RVSM Airspace

3.1 **Table 1** presents the estimates of vertical collision risk for the airspace of Pyongyang in terms of the technical, operational, and total risks. All of them are 0.

RVSM Airspace of DPR Korea – estimated annual flying hours = 0 hours			
Source of Risk	**Lower Bound Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0	2.5×10^{-9}	Below Technical TLS
Operational Risk	0	-	-
Total Risk	**0**	**5.0×10^{-9}**	**Below Overall TLS**

Table 1. Risk Estimates for the RVSM Implementation in the Airspace of DPR Korea