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RVSM VERTICAL RISK ESTIMATES

2021 Canadian Domestic

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ATS Standards



REPORTING OF AVIATION OCCURRENCES (LEGAL OBLIGATION)

Canadian Domestic Airspace

**Canadian Aviation Regulations (CAR) SOR/96-433
Aeronautics Act, Subpart 7 — Aviation Occurrences
identifies our legal obligations.**

807.01 The holder of an ATS operations certificate shall report to the Minister any aviation occurrence information specified in the *CADORS Manual* in accordance with the criteria and reporting procedures specified in that manual.

AVIATION OCCURRENCE REPORTING PROCEDURES (NAV CANADA DOCUMENT)

The purpose of this document is to provide a single source of information on procedures for reporting aviation occurrences¹ and any other reportable occurrences.

The document amongst other information provides instructions on:

- ❖ how to report
- ❖ when to report
- ❖ what to report
- ❖ backup procedures

¹ OCCURRENCE — Any event which is irregular, unplanned, or non-routine in nature, including any accident, incident, or other occurrence which involves aircraft, NAV CANADA employees or facilities, or any ATS system deficiency.

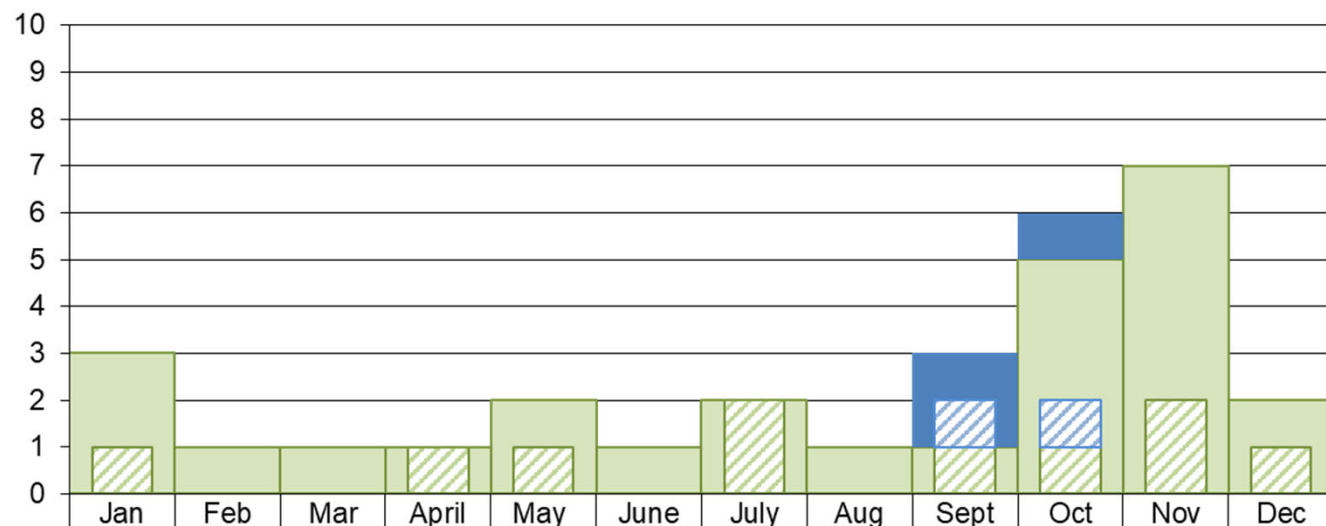
NAV CANADA SAFETY INFORMATION SYSTEM (NC-SIS)

- At NAV CANADA, any Aviation Occurrence Report (AOR) is entered into NC-SIS, our corporate database for follow up and referencing.
- As part of our Scrutiny Activities supporting NAARMO, all Occurrences designated with a Vertical Deviation are reviewed, classified and submitted to NAARMO annually.

LARGE HEIGHT DEVIATION (LHD) ANALYSIS

Canadian Domestic RVSM Airspace

2021 LHD Events by Month



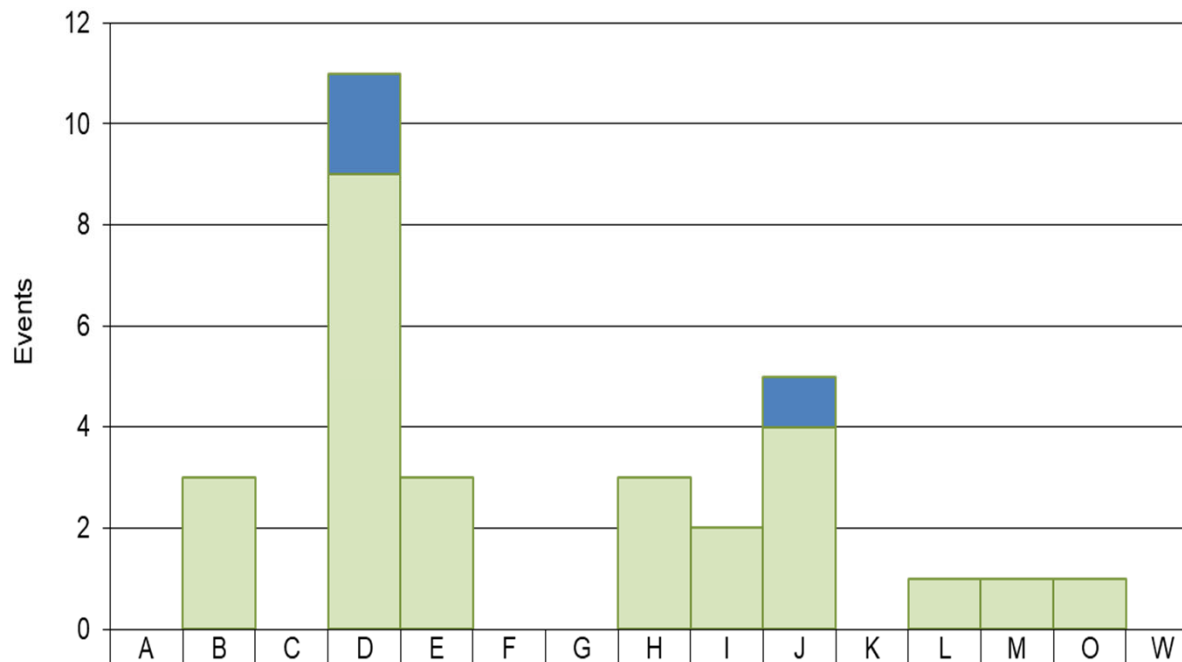
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
■ 3 - LHD's Recorded (Northern)	0	0	0	0	0	0	0	0	2	1	0	0
■ 27 - LHD's Recorded (Southern)	3	1	1	1	2	1	2	1	1	5	7	2
■ 2 - Applicable to Risk Estimation	0	0	0	0	0	0	0	0	1	1	0	0
■ 10 - Applicable to Risk Estimation	1	0	0	1	1	0	2	0	1	1	2	1

LARGE HEIGHT DEVIATION (LHD) ANALYSIS

Canadian Domestic RVSM Airspace

2021 LHD Events by Category

- A Contingency action due to engine fault.
- B Contingency action due to pressurization failure.
- C Contingency action due to other cause.
- D Failure to climb/descend as cleared.
- E Climb/descent without ATC clearance.
- F Entry to RVSM airspace at an incorrect level.
- G ATC FL re-clearance resulting in a loss of lateral or longitudinal separation.
- H Deviation due to TCAS.
- I Aircraft unable to maintain level.
- J ATC failure to correctly record, coordinate, or follow through on FL changes and/or other clearances.
- K Aircrew not maintaining level as cleared.
- L ATC failure to capture incorrect read back of control instructions, fails to maintain situational awareness, or fails to resolve transposed call signs.
- M Actions taken due to mechanical or equipment failure.
- O Other
- W Weather



	A	B	C	D	E	F	G	H	I	J	K	L	M	O	W
■ 3 - Northern Domestic	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0
■ 27 - Southern Domestic	0	3	0	9	3	0	0	3	2	4	0	1	1	1	0

- Since each event may be classified to multiple categories, Category Totals < > Number of events

LARGE HEIGHT DEVIATION (LHD) ANALYSIS

2021 LHD Events*, Time, Levels and Rate of Climb / Descent

Canadian Domestic RVSM Airspace	No. LHD's*	Time Incorrect Level (Min)	Levels Crossed	Descent Rate			Climb Rate		
				Drift	Normal	Rapid	Minimum	Normal	Expedite
Northern	2	0	3	0	2	0	0	1	0
Southern	10	0	15	0	5	0	0	10	0

* Applicable to risk estimation

2021 ESTIMATES OF PASSING FREQUENCIES

	2021 (South)	2020 (South)	2021 (North)	2020 (North)
Number of Flights (24 day sample)	54,518	47,992	18,596	15,367
Flight Hours (24 day sample)	90,309	75,540	49,598	40,056
Estimated Annual Flight Minutes	82,407,201	69,119,789	45,259,023	36,652,112
Number of Passing Events (24 day sample)	238	219	63	52
Same	1,372	924	209	119
Opposite	3,286	2,307	288	171
Crossing				
Passing Frequency (per Flight Hour)				
Same	0.0053	0.0058	0.0025	0.0026
Opposite	0.0304	0.0245	0.0084	0.0059
Crossing	0.0728	0.0611	0.0116	0.0085
EODPF	0.0398	0.0348	0.0126	0.0102

2021 AIRCRAFT DIMENSIONS

Canadian Southern Domestic	Length		WingSpan		Height	
	Current Adopted	2021	Current Adopted	2021	Current Adopted	2021
Flights (24 day sample)		54,513		54,513		54,513
Analysed (96.9%)		52,842		52,842		52,842
Average Size (Feet)	149	161	134	147	43	45
Average Size (NM)	0.0245	0.0265	0.0221	0.0242	0.0071	0.0074
Change	Increase of 12 ft		Increase of 13 ft		Increase of 2 ft	

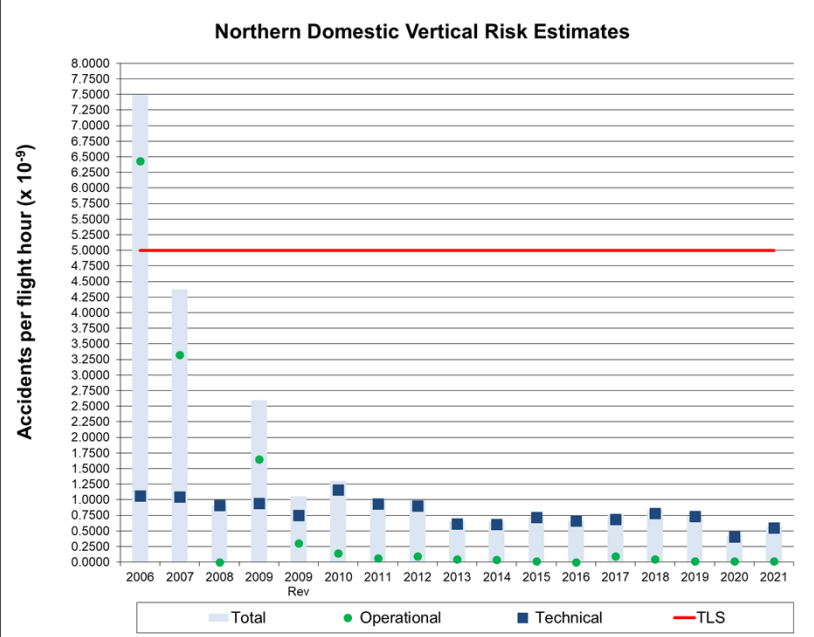
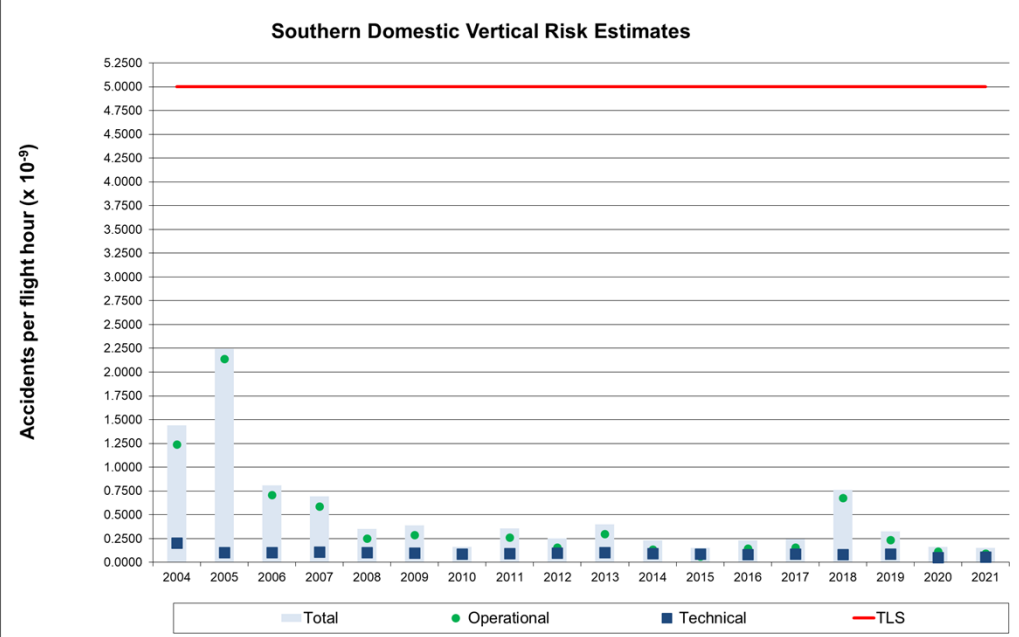
Canadian Northern Domestic	Length		WingSpan		Height	
	Current Adopted	2021	Current Adopted	2021	Current Adopted	2021
Flights (24 day sample)		18,593		18,593		18,593
Analysed (99.5%)		18,500		18,500		18,500
Average Size (Feet)	194	196	179	180	54	54
Average Size (NM)	0.0319	0.0322	0.0295	0.0296	0.0089	0.0089
Change	Increase of 2 ft		Increase of 1 ft		No change	

2021 CANADIAN DOMESTIC VERTICAL RISK ESTIMATES

	SOUTH			NORTH		
	Technical Risk	Operational Risk	Total Risk	Technical Risk	Operational Risk	Total Risk
Target	2.5×10^{-9}	2.5×10^{-9}	5.0×10^{-9}	2.5×10^{-9}	2.5×10^{-9}	5.0×10^{-9}
2021	0.06×10^{-9}	0.09×10^{-9}	0.15×10^{-9}	0.55×10^{-9}	0.01×10^{-9}	0.56×10^{-9}
2020	0.05×10^{-9}	0.11×10^{-9}	0.16×10^{-9}	0.41×10^{-9}	0.01×10^{-9}	0.42×10^{-9}
Change	0.01×10^{-9}	-0.02×10^{-9}	-0.01×10^{-9}	0.14×10^{-9}	No Change	0.14×10^{-9}

Current adopted (2015) aircraft dimensions used for calculations.

HISTORICAL VERTICAL RISK ESTIMATES



2021 CANADIAN VERTICAL RISK ESTIMATE

- Northern Domestic flight hours = 35.45% of total Canadian flight hours
(754,317 flight hours over a year (2021) period)
- Southern Domestic flight hours = 64.55% of total Canadian flight hours
(1,373,453 flight hours over a year (2021) period)
- Technical Risk = $(0.3545 * 0.55 \times 10^{-9}) + (0.6455 * 0.06 \times 10^{-9}) = 0.234 \times 10^{-9}$
- Operational Risk = $(0.3545 * 0.01 \times 10^{-9}) + (0.6455 * 0.09 \times 10^{-9}) = 0.062 \times 10^{-9}$
- **Total Vertical Risk = 0.296×10^{-9}** (*Total Vertical Risk in 2020: 0.249×10^{-9}*)

Risk estimates expressed as accidents per flight hour (apfh).

2021 CANADIAN RVSM VERTICAL RISK ESTIMATES

Conclusions

- The **2021 Canadian Total Vertical Risk Estimate of 0.296×10^{-9} accidents per flight hour (apfh)** remains well below the Target Level of Safety (TLS).
- 30 Altitude Deviations were recorded for the period of which 12 Large Height Deviations (LHD's) were applicable to the 2021 risk estimation.
- Failure to climb/descent as cleared (D) accounted for 37% of the Altitude Deviations recorded and ATC failure to correctly record, coordinate, or follow through on FL changes and/or other clearances (J) accounted for 17%.
- 0 Minutes of Time at an Incorrect Flight Level and 18 Levels crossed were applicable to the 2021 risk estimation.
- Flights identified for 2021 risk estimation showed a year over year traffic recovery from the impacts of COVID 19 in both Northern (21%) and Southern (13%) domestic airspace.
- 2021 review of aircraft dimensions; in both Northern and Southern domestic airspace, showed an increase in aircraft size over the 2015 adopted values used for 2021 risk estimation.



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THANK YOU

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