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Agenda Item 5: **Other business**

NEW YORK WEST AIRSPACE HORIZONTAL SAFETY MONITORING REPORT - 2018

(Presented by United States)

EXECUTIVE SUMMARY

This paper provides the horizontal safety monitoring report for the continued-safe use of the reduced lateral and longitudinal separation minima in New York West Airspace. The safety assessment is conducted according to the methodology endorsed by the International Civil Aviation Organization (ICAO). This work makes use of reported large lateral deviations (LLDs) and large longitudinal errors (LLEs) and traffic sample data (TSD) for calendar year 2018.

There were 39 reported events for New York West airspace during calendar year 2018. Twenty of these events were determined to be risk-bearing LLDs. This report contains a high-level summary of the reported events and evaluates the application of reduced horizontal separation minima.

Strategic Objectives:
- Safety

References:
- Reports of Large Lateral Deviations (LLD) & Large Longitudinal Errors (LLE) in 2018
- 2018 Traffic Sample Data (TSD) from FAA Advanced Technologies and Oceanic Procedures (ATOP) oceanic automation system data reduction and archives (DR&A)
- ICAO Doc 9689 Manual on Airspace Planning Methodology for the Determination of Separation Minima
- ICAO Doc 9869 Performance-based Communication & Surveillance (PBCS) Manual
- ICAO Doc 10063 Manual on Monitoring Application of Performance-based Horizontal Separation Minima

1. Introduction

1.1 The North American Approvals Registry and Monitoring Organization (NAARMO), a service provided by the U.S. Federal Aviation Administration at the William J. Hughes Technical Center (WJHTC), fulfills the role of regional monitoring agency (RMA) for the Miami Oceanic, New York West, and San Juan airspace. In addition to the vertical safety monitoring, the NAARMO conducts airspace analyses studies to support the introduction and ongoing use of reduced horizontal separation minima in oceanic airspace.

1.2 In June 2008, a significant restructure of the airways within the New York West airspace was implemented in an effort to increase capacity and efficiency. The fixed route system residing in New York West airspace is referred to as the Western Atlantic Route System (WATRS). With the reorganization of the route system, the 50-NM lateral separation standard was introduced. The WJHTC conducted the safety assessment for the implementation of the 50-NM lateral separation standard in WATRS airspace.

1.3 In December 2013, the 50-NM longitudinal, 30-NM lateral, and 30-NM longitudinal separation minima were introduced in New York West airspace. The reduced horizontal separation minima are available for suitably equipped aircraft pairs. The application of the reduced horizontal separation standards is accomplished ad hoc between pairs of eligible aircraft; this means that the application of the separation minima is not planned prior to oceanic entry. The WJHTC conducted the pre-implementation safety assessment and the post-implementation monitoring activities for these reduced horizontal separation standards in the New York West FIR.

1.4 In March 2018, the Performance-Based Communication and Surveillance (PBCS) requirements and monitoring were implemented in New York West airspace. PBCS involves globally coordinated and accepted specifications for Required Surveillance Performance (RSP) and Required Communication Performance (RCP). Beginning 29 March 2018, the PBCS specifications for RCP 240 and RSP 180 and Required Navigation Performance (RNP) 4 specification are required for the application of reduced horizontal separation minima.

2. Traffic Data

2.1 The flight operations within the New York West Oceanic FIR are comprised of two distinct traffic flows. The two main traffic flows are East-West (North Atlantic (NAT) routes) and North-South (North America (NAM)-Caribbean (CAR) routes). The source of traffic data for the New York West FIR is the FAA Advanced Technologies and Oceanic Procedures (ATOP) oceanic automation system data reduction and archives (DR&A).

2.2 These data contain all the reported aircraft positions, as well as the pilot-ATC High Frequency (HF) radio communications and controller pilot data link communications (CPDLC) messages. **Figure 2-1** shows the archived reported positions within the New York West Oceanic FIR during December 2018. Position reports received via Automatic Dependent Surveillance – Contract (ADS-C) are contained in the DR&A archives.

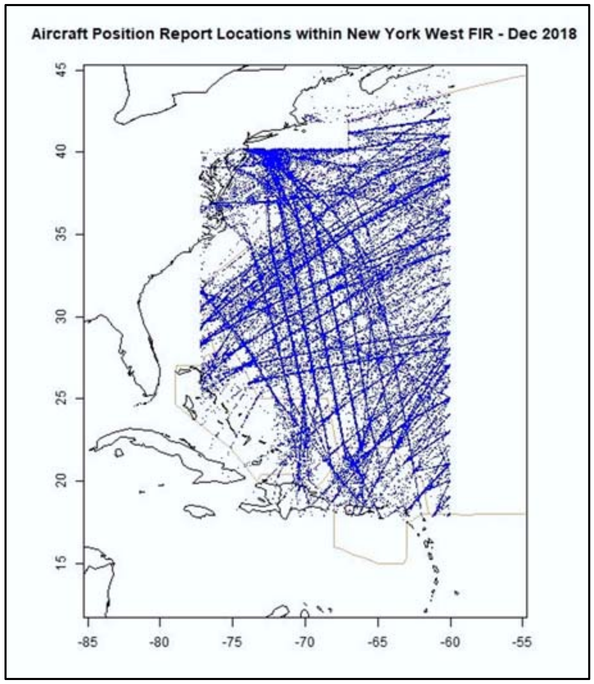

Figure 2-1. Aircraft/Pilot Reported Positions within New York West Airspace – December 2018

2.3 **Figure 2-2** shows the number of flights by day in the New York West FIR for December 2018. The vertical blue bars show the number of flight operations per day observed in the data sample. The average number of flight operations per day observed in the data is 593 flights per day. This represents a slight increase in the number of flight operations per day; in December 2017, this analysis showed 553 flight operations per day.

2.4 **Appendix A** contains the most current data link performance analysis summary conducted for the New York FIR. These data include the New York West and New York East FIRs for the period January – June 2019.

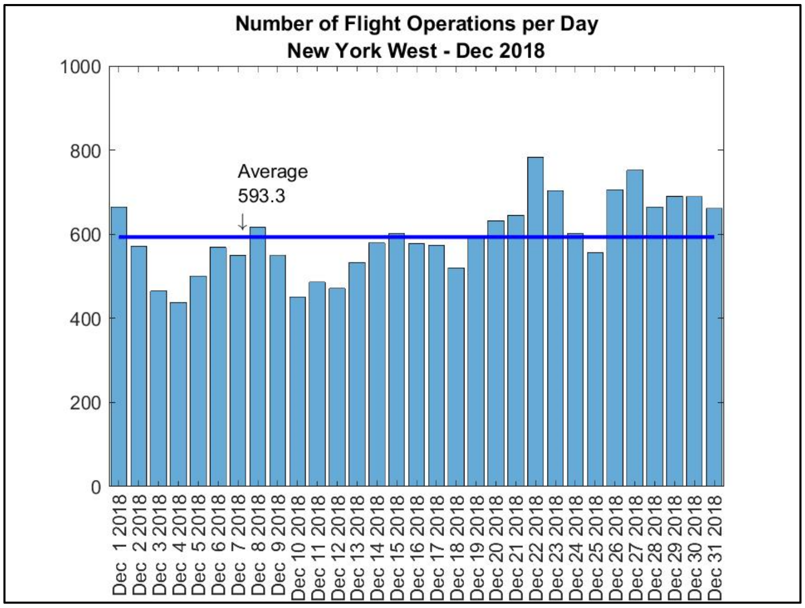

Figure 2-2. Number of Flight Operations Observed by Day – New York West FIR Dec 2018

3. Event Scrutiny Methodology

3.1 The lateral CRM methodology is analogous to, and aligns with, the vertical operational risk model, in that it explicitly accounts for the risk due to the number of tracks or routes crossed without clearance, and the risk due to time spent on the incorrect track or route. To employ this methodology, it is necessary to assess the number of tracks or routes crossed without clearance and the time spent on the incorrect track or route for each reported LLD.

3.2 Due to the variety of possible lateral separation standards available to aircraft operations in New York West airspace, the magnitude of the deviation along with the aircraft capabilities are used to determine the number of tracks crossed and time spent on the incorrect track.

3.3 In 2018, the possible lateral separation standards varied depending on the filed performance-based navigation (PBN), performance-based communication (PBC), and performance-based surveillance (PBS) status of the aircraft. **Table 3-1** summarizes the possible reduced horizontal separation standards available for aircraft operations within the New York FIR in 2018.

Table 3-1. Horizontal Separation Standards Available in New York West FIR – 2018

Lateral/ Longitudinal	Separation Standard	Minimum PBN	Minimum PBC	Minimum PBS
Lateral	50 NM	RNP 10	-	-
Lateral	30 NM	RNP 4	RCP 240	RSP 180
Longitudinal	10 minutes	-	-	-
Longitudinal	50 NM	RNP 10	RCP 240	RSP 180
Longitudinal	30 NM	RNP 4	RCP 240	RSP 180

3.4 During the scrutiny of each reported event, the filed communication, navigation, and surveillance (CNS) capabilities of the aircraft involved are recorded. This information is used to assess the associated risk impact for each LLD and LLE. For LLD events, the deviation magnitude from the cleared route is examined to determine whether a track crossed should be counted. **Table 3-2** shows the lateral buffers used for LLD events to determine the number of tracks crossed. The number of tracks crossed, N_T, is determined from the deviation magnitude and the associated lateral buffer for the aircraft operation. The lateral buffer applies to the eligibility of the aircraft based on the filed flight plan not the separation standard applied at the time of the event.

3.5 The lateral buffers for the New York West FIR shown in **Table 3-2** are calculated in the following manner:

3.5.1 For aircraft operations eligible for 30NM lateral separation standard, the lateral buffer is 22NM = 30NM – 4NM [for RNP4] – 4NM [2 × SLOP to account for opposite direction traffic].

3.5.2 For aircraft operations eligible for 50NM lateral separation standard, the lateral buffer is 36NM = 50NM – 10NM [for RNP10] – 4NM [2 × SLOP to account for opposite direction traffic].

Table 3-2. Lateral Buffer for LLD Events (New York West FIR)

Separation Standard for which the aircraft operation is eligible	Lateral Buffer (NM)
30NM	22
50NM	36

3.6 The methodology to determine the number of tracks/routes crossed and time spent on the incorrect track/route is similar to the methodology used to determine the number of flight levels crossed and time spent on incorrect flight level for the estimate of vertical risk. For example, if the event report indicated the aircraft deviated 55NM from the cleared route and the filed flight plan showed the flight was eligible for the 30NM lateral separation standard, the number of tracks crossed, N_T, would be at least one. Unless the available aircraft position data provide more precise information, a general assumption of 5NM lateral movement for each minute is applied to the event. In this case, the lateral buffer for the second adjacent route begins once the lateral deviation reaches 52NM (= 30NM [lateral separation standard] + 22NM [lateral buffer]). Depending on the actual course of the aircraft involved, this case might result in two tracks crossed and no time spent on incorrect track, or one track crossed and time spent by the aircraft on the incorrect route beginning at the time the lateral deviation reached 52NM until the end of the event.

3.7 Another example is an event report that indicates an aircraft, who is eligible for the 30NM lateral separation minima, deviated 45NM. This case would result in time spent on the incorrect route and zero tracks crossed. This time would begin when the aircraft is estimated to have reached the 22NM lateral deviation buffer, and ends when the deviation amount reaches its maximum or the end of the event.

4. Reported Large Lateral Deviations (LLD) and Large Longitudinal Errors (LLE)

4.1 The NAARMO utilizes the FAA's Comprehensive Electronic Data Analysis and Reporting (CEDAR) database, which is a collection of safety-related events reported from various internal FAA sources. There were 39 reported events for New York West airspace during calendar year 2018. After scrutiny group review, 20 of these events were determined to be risk-bearing LLDs. There were no reported LLEs during calendar year 2018. There were 16 reports of prevented LLDs, in these cases a deviation was prevented by ATC action. There were two reported events classified as mitigated and non-risk bearing because the expected contingency/weather procedures were correctly followed. There was one reported event in which a lateral deviation was minimized due to ATC intervention.

4.2 **Table 4-1** contains a summary of all the risk-bearing LLDs by month. The third column of Table 4-1 shows the number of tracks crossed without clearance. The fourth column of Table 4-1 contains the sum of the at-risk time for reported LLD events.

Table 4-1. Risk-bearing LLDs and LLEs

Date	LLD/LLE Count	LLD Tracks Crossed	LLD Duration Spent on Incorrect Route (min)
Jan 2018	2	0	0
Feb 2018	0	0	0
Mar 2018	0	0	0
Apr 2018	4	1	0
May 2018	5	0	0
Jun 2018	1	0	0
Jul 2018	5	1	9
Aug 2018	1	0	3.8
Sep 2018	1	0	0
Oct 2018	1	0	0
Nov 2018	0	0	0
Dec 2018	0	0	0
TOTAL	**20**	**2**	**12.8**

4.3 The scrutiny review determined a general cause for each of the 20 risk-bearing LLDs. **Table 4-2** summarizes the reported LLDs by general cause category.

Table 4-2. Risk-bearing LLDs by Cause Category

Category Code	Category Description	Number of LLDs	Duration (min)	Number Tracks Crossed
A	Flight crew deviate without ATC Clearance	8	0	0
B	Flight crew incorrect operation or interpretation of airborne equipment (e.g., flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.)	8	12.8	0
D	ATC system loop error (e.g., ATC issues incorrect clearance, Flight crew misunderstands clearance message etc.)	1	0	0
E	Coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility	3	0	2
	TOTAL	**20**	**12.8**	**2**

4.4 There were eight risk-bearing events involving flight crews deviating without ATC clearance, category A. Half of the category A events involve pilots deviating around severe weather.

4.5 There are eight reported events classified as category B, flight crew incorrect operation or interpretation of airborne equipment. One of these events had nine minutes duration of lateral deviation, and was caused by a flight plan discrepancy issue. In this case, an earlier filed flight plan was maintained by the ATC system although the flight operator provided an updated/amended flight plan. This problem sometimes occurs when flight transit through multiple FIRs. There is a dedicated ICAO Task Force investigating these issues. The NAARMO will provide summary data from this analysis to the U.S. participants in the Task Force to help in that study. There were four reported risk-bearing LLDs involving a flight plan discrepancy, two of these events were assigned category B and two were assigned category E.

4.6 Another category B event had 3.8 minutes of lateral deviation duration. This case prompted a change to the FAA's ATC automation system. The ATC system alert message was changed to indicate the route is out of conformance. The pilot was following a different routing than expected by ATC. **Figure 4-1** shows the locations of the risk-bearing LLDs in 2018. The reported events involving aircraft eligible for the 30NM lateral separation standard are highlighted.

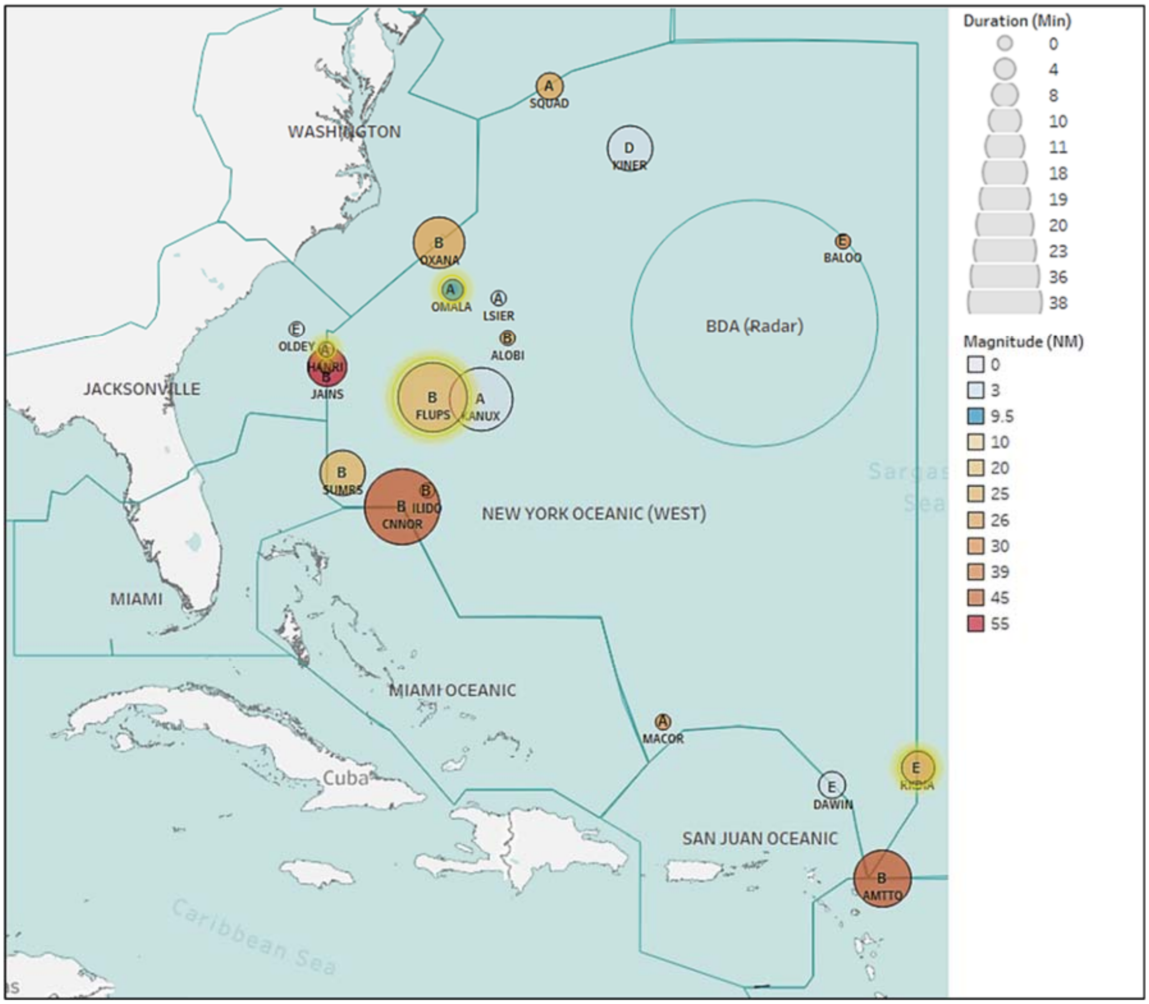

Figure 4-1. Risk-bearing LLDs Location

4.7 The standard lateral separation in New York West airspace is 50NM; aircraft indicating RNP 10 in the filed flight plan are eligible for this separation, there is no PBCS requirement for the 50NM lateral separation standard.

4.8 The standard longitudinal separation is 10 minutes. The airspace is not exclusive with regard to airspace user satisfaction of horizontal-plane navigation standards as a requirement for airspace use and does allow for non-RNP 10 operations.

4.9 Eligible flight operations for the 30NM lateral separation standard must file RCP240, RSP180 and RNP4 in their flight plan. The proportion of RCP240, RSP180 and RNP4 operations in New York West airspace observed in December 2018 is 37 percent; this includes aircraft operations on both the east-west NAT routes and north-south NAM-CAR routes. The majority of the eligible aircraft operations operate on the east-west NAT routes.

4.10 **Appendix B** provides a high-level summary of the risk-bearing LLD events for 2018. The reported LLD events involving flight operations eligible for the 30NM lateral separation standard are highlighted.

5. Lateral Collision Risk Estimation

5.1 This section of the paper provides the parameter estimates used in the ICAO lateral risk model. The collision risk methodology consists of a mathematical model to estimate risk for comparison to the safety criterion, the target level of safety (TLS). The section also provides information on the sources of data used to estimate risk model parameters. Based on the December 2018 traffic data, the NAARMO estimates approximately 305,207 annual flying hours for New York West airspace.

5.2 Aircraft Types Observed in the New York West FIR

5.2.1 **Figure 5-1** provides the top 25 aircraft types observed in the December 2018 traffic data by flying hours. The aircraft types in Figure 5-1 account for more than 93 percent of total flying hours observed the airspace. The flying hours associated with the Airbus A320 family; including A319, A320, and A321, accounts for the most observed aircraft in the traffic sample at 21 percent. The Boeing 737 NGX; including the B737, B738, and B739 accounts for 15 percent of all flying hours observed in the traffic data.

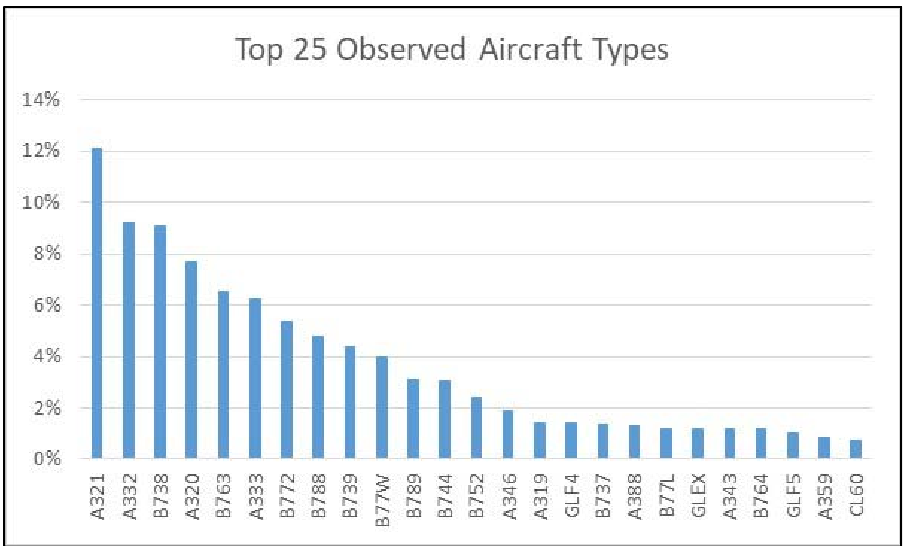

Figure 5-1. Observed Aircraft Types in Terms of Flying Hours in New York West Airspace

5.3 Aircraft Size

5.3.1 The collision risk model parameters related to the aircraft size are: length, wingspan, and height. These parameters are estimated directly from the ATOP DR&A December 2018 data and related aircraft specifications. The weighted dimensions are calculated using the actual dimensions of the aircraft type multiplied by the proportion of total flying time observed for the type in the traffic sample. The resulting CRM parameters for the aircraft length, wingspan, and height are presented in **Table 5-1.**

Table 5-1. CRM Parameter Estimates for Aircraft Size

Airspace	Length λ_x (NM)	Wingspan λ_y (NM)	Height λ_z (NM)
New York West	0.0281 *171 ft*	0.0260 *158 ft*	0.0080 *49 ft*

5.4 Same-Direction and Opposite-Direction Lateral Occupancy

5.4.1 The traffic data are used to estimate the number of lateral aircraft pairs. A lateral aircraft pair is observed when two aircraft, operating on the same flight level and on laterally separated routes, have reported positions within 15 minutes. **Table 5-2** shows the same and opposite-direction lateral occupancy estimates for the New York West airspace. Because most of the aircraft operations occur on fixed routes with a flight level allocation scheme (FLAS) in place, there were very few observed opposite-direction lateral aircraft pairs in the traffic data. The lateral separation used to determine the lateral occupancy values is 50NM.

Table 5-2. Same and Opposite direction lateral occupancy values

Airspace	**Same Direction Lateral Occupancy Value**	**Opposite Direction Lateral Occupancy Value**
New York West	0.0837	0.0006

5.5 Probability of Vertical Overlap

5.5.1 The probability of vertical overlap accounts for contributions to vertical error arising from the effects of turbulence, loss of altitude hold and crew response to airborne collision avoidance system alerts as well as from errors in aircraft altimetry and altitude-keeping system performance.

5.5.2 Currently, the U.S. Aircraft Geometric Height Measurement Element (AGHME) and the GPS Monitoring Unit (GMU) systems provide the NAARMO with estimates of aircraft altimetry system error (ASE), an important contributor to the estimated probability of vertical overlap. The NAARMO estimate for the probability of vertical overlap for aircraft pairs operating on the same flight level, $P_z(0)$, used in the estimation of lateral risk is 0.42.

5.6 Time Spent on Unexpected/Incorrect Route

5.6.1 The proportion of flying time spent on unexpected/incorrect routes is determined as the ratio of the amount of time spent on unexpected/incorrect routes to the total amount of flying time in the airspace during the period when the incorrect route events occurred. The risk-bearing LLDs for calendar year 2018 contain 12.8 minutes of flying time spent on unexpected/incorrect routes. This is a significant decrease in the number of minutes spent on unexpected/incorrect routes compared to that reported for calendar year 2017. In calendar year 2017, there were 164 minutes of flying time spent on unexpected routes compared to 12.8 minutes in calendar year 2018.

5.6.2 **Tables 4-1 and 4-2** provide the duration on unexpected/incorrect routes. The proportion of flying time spent on unexpected/incorrect routes is estimated using the values in Table 4-1 and dividing by the estimated flying hours. The estimated annual flying hours for New York West airspace obtained from the ATOP DR&A data are 305,207 hours. The resulting ratios of time spent on unexpected/incorrect routes is 7×10^{-7} for New York West airspace.

5.7 Probability of Lateral Overlap

5.7.1 The probability of lateral overlap accounts for contributions to lateral error arising from navigation system performance. The probability that two aircraft operating on the same route and flight level are in lateral overlap, $P_y(0)$, is 0.1. This value is currently used in lateral risk estimates in the Asia and Pacific Region. This value is expected to increase with the use of Global Navigation Satellite System (GNSS) in aircraft navigation systems.

5.7.2 The probability that two aircraft operating on adjacent routes and the same flight level are in overlap, $P_y(S_y)$, is determined from the value of $P_y(0)$ and the risk-bearing LLDs. The lateral separation standard is represented by the term S_y. There are two estimates of $P_y(S_y)$, one for the time spent on unexpected/incorrect route and another for the number of unexpected/incorrect routes crossed. The $P_y(S_y)$ value for time spent on unexpected/incorrect routes is shown below.

$$P_y(S_y) = \frac{T_r}{F(NY)} \times P_y(0)$$

5.7.3 The total time spent on unexpected/incorrect routes during a calendar year is represented by the term T_r. The estimated annual flying hours for New York West airspace is given by $F(NY)$. The $P_y(S_y)$ value for the number of unexpected/incorrect routes crossed is shown below.

$$P_y(S_y) = \frac{N_r}{F(NY)} \times \frac{2\lambda_y}{\overline{|\dot{y}_r|}}$$

5.7.4 The number of routes unexpected/incorrect routes crossed is represented by the term N_r. The term $\overline{|\dot{y}_r|}$ represents the lateral closer rate of aircraft crossing through an unexpected/incorrect route.

5.8 Collision Risk Model Parameters

5.8.1 The individual parameters of the models, their definitions, estimates, and sources are given in **Table 5-3.**

Table 5-3. Lateral Collision Risk Model Parameter Estimates

Term	Definition	Estimate	Source
$P_z(0)$	Probability that two aircraft operating on the same flight level are in vertical overlap	0.42	Value used in the vertical risk estimates for Pacific airspace
$P_y(50)$) for time spent on unexpected / incorrect route	Probability that two aircraft assigned to laterally adjacent tracks lose all planned lateral separation and are in lateral overlap due to time spent on unexpected/incorrect route.	7×10^{-8}	Estimated from traffic data, and risk-bearing LLDs (12.8 minutes spent on unexpected/incorrect route
$P_y(50)$) for unexpected / incorrect routes crossed	Probability that two aircraft assigned to laterally adjacent tracks lose all planned lateral separation and are in lateral overlap due unexpected / incorrect routes crossed.	4.3×10^{-9}	Estimated from traffic data, and risk-bearing LLDs (two unexpected/ incorrect routes crossed)
$P_y(30)$) for time spent on unexpected / incorrect route	Probability that two aircraft assigned to laterally adjacent tracks lose all planned lateral separation and are in lateral overlap due to time spent on unexpected/incorrect route.	0	Estimated from traffic data, and risk-bearing LLDs (zero minutes spent on unexpected/incorrect route)
$P_y(30)$) for unexpected / incorrect routes crossed	Probability that two aircraft assigned to laterally adjacent tracks lose all planned lateral separation and are in lateral overlap due unexpected / incorrect routes crossed.	5.8×10^{-9}	Estimated from traffic data, and risk-bearing LLDs (one unexpected/ incorrect routes crossed) and prorated flying hours
$P_y(0)$	Probability that two aircraft on the same track are in lateral overlap	0.1	Value used in the vertical risk estimates for Pacific airspace
λ_x	Average aircraft length.	0.0281 NM	Estimated from New York West traffic data
λ_y	Average aircraft wingspan.	0.0260 NM	Estimated from New York West traffic data
λ_z	Average aircraft height with undercarriage retracted.	0.0080 NM	Estimated from New York West traffic data
$E_y(same)$	Same-direction lateral occupancy for a pair of aircraft on same flight level on adjacent routes.	0.0837	Estimated from New York West traffic data
$E_y(opp)$	Opposite-direction lateral occupancy for a pair of aircraft on same flight level on adjacent routes.	0.0006	Estimated from New York West traffic data
$\overline{\lvert\Delta V\rvert}$	Average absolute relative along-track speed between aircraft on same-direction routes.	13 knots	Value used in the North Atlantic, Pacific, and US Domestic airspace lateral risk estimates
$\overline{\lvert V\rvert}$	Average absolute aircraft ground speed.	480 knots	Value used in the North Atlantic, Pacific, and US Domestic airspace lateral risk estimates
$\overline{\lvert\dot{y}\rvert}$	Average absolute relative cross-track	5 knots	Value used in the North

Term	Definition	Estimate	Source
	speed for an aircraft pair assigned to adjacent routes as the y lose all planned lateral separation, S_y.		Atlantic, Pacific, and US Domestic airspace lateral risk estimates
$\overline{\lvert\dot{y}_r\rvert}$	Average lateral closure rate of aircraft crossing through an unexpected/incorrect route	80 knots	Value used in the NAT lateral risk estimates
$\lvert\bar{\dot{z}}\rvert$	Average absolute relative vertical speed of an aircraft pair assigned to the same flight level which are in vertical overlap	1.5 knots	Value used in the North Atlantic, Pacific, and US Domestic airspace lateral risk estimates
F(NY)	Estimated flying hours within New York West FIR	305,206	Estimated from FAA ATOP DR&A for New York West airspace

6. Results and Conclusions

6.1 The reported risk-bearing LLDs within New York West airspace are applied to the estimated flying hours and lateral occupancy values for New York West airspace. There were two unexpected/incorrect routes crossed and 12.8 minutes spent on an unexpected/incorrect route. The estimated lateral risk for the application of the 50NM lateral separation minimum in New York West airspace is 0.4×10^{-9} fatal accidents per flight hour (fapfh). This estimate meets the overall safety goal of 5.0×10^{-9} fapfh.

6.2 The reported risk-bearing LLDs within New York West airspace are applied to the prorated flying hours and lateral occupancy values for New York West airspace. The proportion of eligible flight operations for the 30NM lateral separation standard in December 2018 was 37 percent. There was one unexpected/incorrect routes crossed and zero minutes spent on an unexpected/incorrect route involving operations eligible for the reduced lateral separation standard. The estimated lateral risk for the application of the 30NM lateral separation minimum in New York West airspace is 0.09×10^{-9} fatal accidents per flight hour (fapfh). This estimate meets the overall safety goal of 5.0×10^{-9} fapfh.

6.3 NAARMO is developing a process to examine the application of reduced longitudinal separation using the archived ATOP DR&A data. This work is being accomplish along with the development of longitudinal monitoring through the ICAO Separation and Airspace Safety Panel (SASP). The NAARMO expects to provide information on this method to the next GTE meeting.

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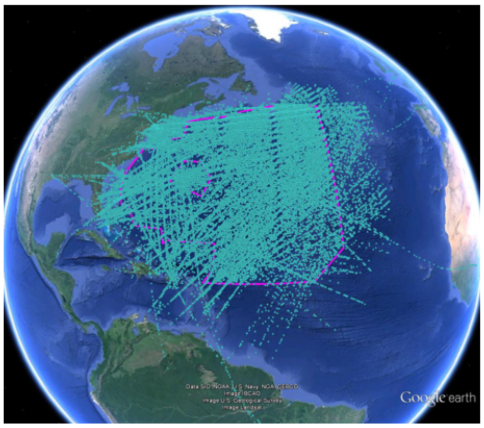
APPENDIX A

DATA LINK PERFORMANCE SUMMARY NEW YORK FIRS JANUARY – JUNE 2019

1. The use of data link in the airspace is summarized in Figure A-1. The percentage of aircraft operations using Future Air Navigation System (FANS)-1/A data link is 65 percent. The percentage of aircraft operations filing RNP4, RCP240 and RSP180 is 45 percent. Most of the observed FANS-1/A operations are traveling in the east-west directions through both the New York West and New York East FIRs.



Av flights/day (Jan-Jun 2019)	**733**
% flights using FANS data link (Jan-Jun 2019)	**65%**
% data link flights filing RNP4/RCP240/RSP180 (Jun 2019)	**45%**
Individual airframes using FANS data link (Jan-Jun 2019)	**4,260**

Figure A-1. Data Link Usage Observed in the New York FIRs – January through June 2019

2. The data link performance observed by media type is provided in **Figure A-2**. The RSP 180 and RCP 240 criteria are used to determine whether the requirements are met for the airspace. These data show the aggregate performance using all the appropriate data link transactions collected during the period. There were 81,410 flight operations using data link during the period. The criteria are found in ICAO Doc 9869, *Performance-based Communication and Surveillance (PBCS) Manual*, *Second Edition*, *2017*. The green colors indicate the specified performance criteria have been met. The red colors indicate the specified performance criteria have not been met. In the table, “ASP” stands for “Actual Surveillance Performance”, “ACP” refers to “Actual Communication Performance”, and “ACTP” refers to “Actual Communication Technical Performance”.

Media Type	ADS-C			CPDLC				
	Count of ADS-C Downlink Messages	ASP 95%	ASP 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%
Performance Criteria		RSP 180			RCP 240			
Aggregate	2,558,922	98.3%	99.3%	151,440	99.4%	99.6%	99.0%	99.3%
SAT	1,947,022	98.0%	99.2%	121,802	99.4%	99.6%	99.1%	99.4%
VHF	609,034	99.3%	99.7%	25,259	99.9%	99.9%	99.5%	99.7%
HF	2,811	68.9%	81.8%	9	0.0%	0.0%	0.0%	0.0%
SAT-VHF				2,398	97.4%	98.2%	94.0%	94.8%
VHF-SAT				1,618	97.0%	99.0%	95.9%	96.6%
SAT-HF				131	90.1%	93.1%	93.1%	93.9%
HF-SAT				192	97.9%	99.0%	96.9%	99.0%
VHF-HF				3	66.7%	66.7%	66.7%	66.7%
HF-VHF				28	96.4%	96.4%	96.4%	96.4%

Figure A-2. Aggregate Data Link Performance Observed in New York FIR – January through June 2019

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APPENDIX B

LARGE LATERAL DEVIATION SUMMARY 2018

1. **Table B-1** provides a high-level summary of the 20 risk-bearing LHDs for calendar year 2018. The table shows which lateral separation standard was applicable to the aircraft involved in the reported event. The four reported events involving aircraft eligible for the 30NM lateral separation are shaded in yellow.

Table B-1. Risk-bearing LLDs for calendar year 2018

LLD Category Code	Aircraft Eligible for Lateral Separation Standard	Lateral Deviation Magnitude (NM)	Tracks / Routes Crossed	Time spent on wrong track/route
A	30NM	10	0	0
A	50NM	25	0	0
A	50NM	3	0	0
A	30NM	9.5	0	0
A	50NM	0	0	0
A	50NM	30	0	0
A	50NM	30	0	0
A	50NM	10	0	0
B	50NM	19	0	0
B	50NM	26	0	0
B	50NM	20	0	0
B	50NM	25	0	0
B	30NM	20	0	0
B	50NM	20	0	0
B	50NM	45	0	9
B	50NM	55	0	3.8
D	50NM	0	0	0
E	50NM	0	0	0
E	50NM	39	1	0
E	30NM	25	1	0
		Totals	**2**	**12.8**

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