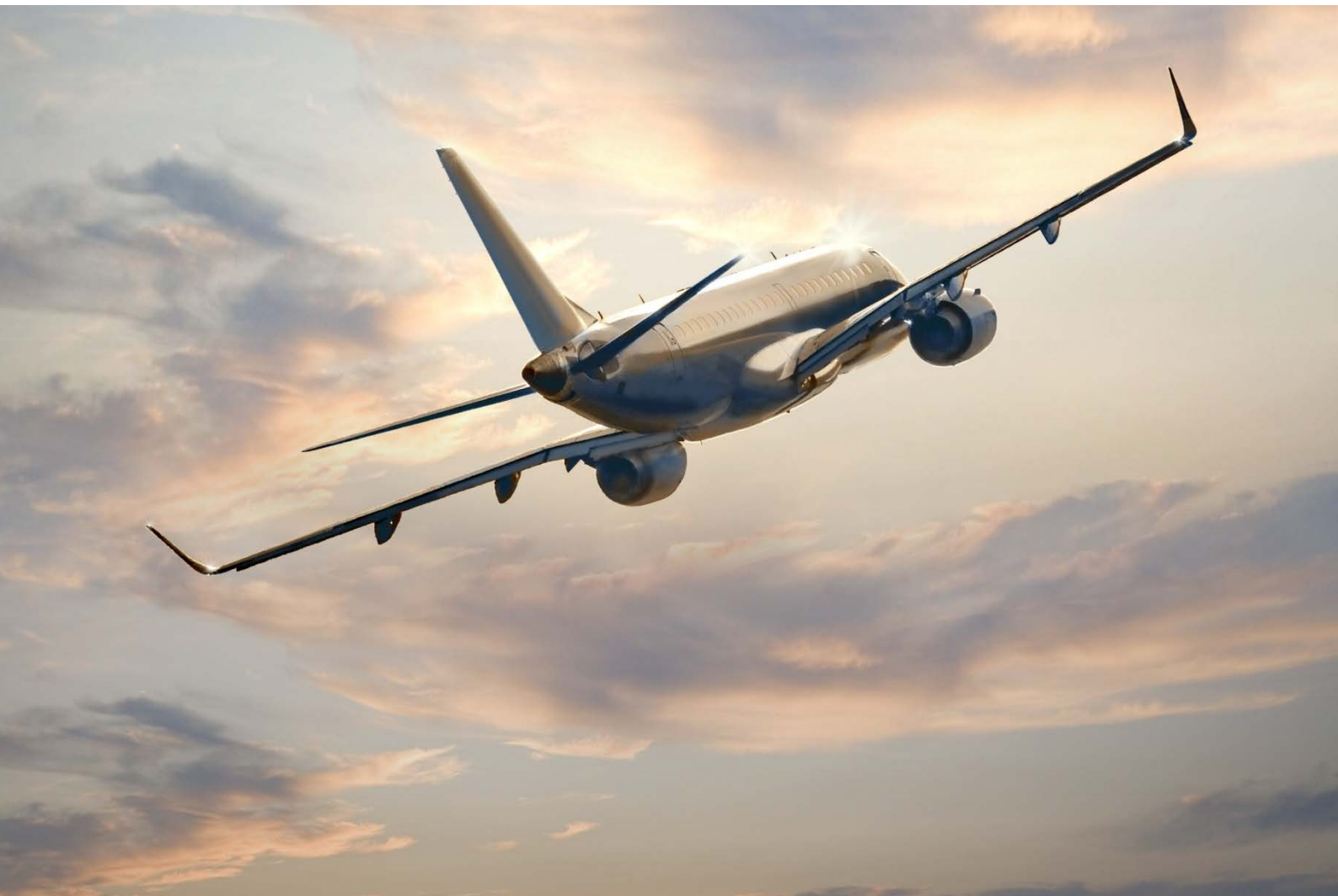




NORTH ATLANTIC SYSTEMS
PLANNING GROUP
(NAT SPG)

Annual Safety Report



Safety Policy

The North Atlantic Systems Planning Group (NAT SPG) aims to achieve the highest level of safety performance and meet regional safety objectives in line with national and international standards, the Global Aviation Safety Plan (GASP), and the Global Air Navigation Plan (GANP). This group is committed to developing, implementing, maintaining and constantly improving strategies and processes while ensuring that all aviation activities take place under a balanced allocation of organizational resources.

Objective

The objective of the NAT SPG member States is to maintain and, where possible, improve the agreed safety standards in all activities supporting the provision of air navigation services in the NAT Region:

- All involved States are accountable for the delivery of the agreed level of safety performance in the provision of air navigation services in the North Atlantic Region.
- All involved States are accountable for the delivery of the agreed level of safety performance in aircraft operations in the North Atlantic Region.
- Safety in the NAT Region is managed through the organization and activities of the relevant implementation and oversight groups established by the NAT SPG, in coordination with the non-member States and observers, to achieve its Safety Objective.

Guiding Principles

The NAT SPG will act to:

- **Clearly** define all accountabilities and responsibilities for the delivery of safety performance with respect to the provision of air navigation services and participation in the NAT SPG and its contributory bodies;
- **Support** the safety management activities that will result in an organizational culture that fosters safe practices, encourages effective safety reporting and communication, and actively manages safety within the NAT Region;
- **Share** safety related data, knowledge and expertise with concerned stakeholders;
- **Disseminate** safety information and NAT operating requirements to stakeholders;
- **Establish and implement** hazard identification and risk management processes in order to eliminate or mitigate the safety risks associated with air navigation services supporting aircraft operations in the North Atlantic Region;
- **Establish and measure** NAT Region safety performance against agreed safety standards; and
- **Continually improve** our safety performance through safety management processes.

All of the NAT member States contribute experts to the NAT SPG, or one or more of its various subgroups, and so support the overall management of safety in the Region. The NAT safety policy is enhanced by the agreement of member States to use the information shared at NAT Safety Oversight Group (NAT SOG) meetings for the purposes of education and for making safety improvements within the Region. This has paved the way for members to discuss and share information and act upon it within the framework of the NAT SPG.

Executive Summary

This North Atlantic Region’s Annual Safety Report (ASR) is issued by ICAO’s North Atlantic (NAT) Systems Planning Group (SPG) and covers performance for the calendar year 2023. The NAT SPG structure was established to study, monitor, and evaluate the air navigation system in the NAT region taking into account changes to technology, changing traffic characteristics and traffic forecasts.

The number of flight hours in the NAT High Level Airspace (HLA) in 2023 was 2,110,330 (see Figure 1). This is an increase from the 1,904,591 flight hours in 2022 and is slightly higher than the previous NAT record set in 2018 (2,087,743 flight hours). The busiest recorded day in 2023 of 13,659 flights was 11.5% higher than the busiest recorded day for 2022 (12,247).

Please note that the 2022 NAT HLA flight hours were amended since the publication of the 2022 ASR, from 1,651,405 to 1,904,591 flight hours, to reflect a revision to the 2022 reported traffic data. The 2022 performance in the Safety Key Performance Indicators (SKPIs) section of this report (see Table 1) were updated to reflect this revision.

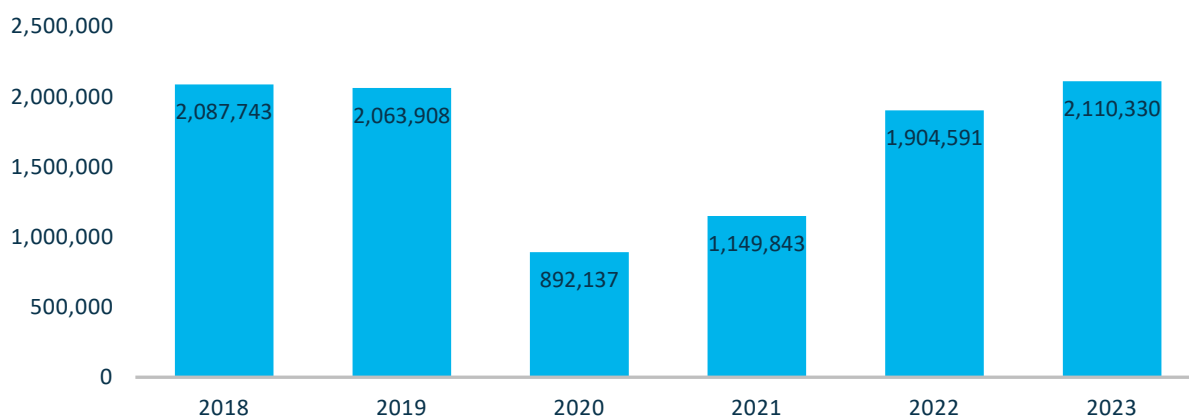


Figure 1 – Annual NAT HLA Flight Hours 2018-2023

Safety Performance in the NAT HLA continues to be monitored by the measures and targets associated with Safety Key Performance Indicators (SKPIs), with targets based on three years of rolling data.

2023 data indicates a reduction in 9 of the 11 agreed SKPIs. This may be attributed to the significant increase of traffic compared to the 2020-2022 period, which was disrupted by Covid-19, and an increase in ANSP’s reporting culture. The low traffic levels from 2020-2022 resulted in exceptional safety performance that may be difficult to match in “normal” traffic years.

In 2023, the Vertical Collision Risk Estimate (CRE) for NAT HLA increased to 20.3×10^{-9} fatal accidents per flight hour (fapfh) from the previous year, primarily due to two longer duration events of 170 and 77 minutes. It should be noted that these events occurred in airspace that did not have ADS-B. The 2023 lateral risk estimate decreased slightly compared to 2022, to 12.7×10^{-9} fapfh, due to a change to the methodology, which accounts for the use of the strategic lateral offset procedure (SLOP). Both the vertical and lateral CREs exceeded the Target Level of Safety (TLS) for operational and technical errors, set at 5×10^{-9} fapfh.

This report includes information on flying hours from Gander, New York East, Reykjavik, Santa Maria and Shanwick. Occurrence reports from Bodø are included in the annual collision risk estimates, however were the flying hours from the Bodø OCA available, this would produce lower collision risk estimates.

The number of events scrutinized in 2023 increased by 26% in comparison to those scrutinized in 2022. The top four common causal factors remained the same as 2022, they were *Flight Plan vs. Clearance*, *Did not adhere to ATC clearances*, *Weather*, and *ATC coordination*.

The North Atlantic Scenario

The airspace of the North Atlantic HLA, which links Europe and North America, is the busiest oceanic airspace in the world. The NAT Region is a pioneer in the implementation of advanced procedures and technology supporting the progress of the global air navigation and aviation safety plans.

The traffic that is considered for the calculations in this report mainly flows in a broadly East-West orientation, in a twice-daily pattern where a daily-organized track system takes account of airspace users’ needs and weather patterns. NAT traffic flow is almost exclusively jet transport aircraft that operate in the en-route phase of flight between 29,000 and 41,000 feet.

Since the Data Link Mandate in 2019, approximately 70% of the NAT traffic has been able to make use of the surveillance capability offered by space based Automatic Dependent Surveillance-Broadcast (ADS-B), augmenting the required use of Automatic Dependent Surveillance-Contract (ADS-C). The number of flights eligible for the separation standards enabled by ADS-B has increased steadily since the capability was introduced.

Communication is, to a large extent, based on satellite-based data link, also referred to as Controller-Pilot Data Link Communications (CPDLC) with High Frequency radio being utilized less often. This leads to air traffic management and operation that is fundamentally different to typical domestic operations, with a greater focus on strategic rather than tactical techniques although, as the NAT embraces new technologies this balance has begun to change.

The number of flight hours in the NAT HLA in 2023 was 2,110,330, which is an increase from the 1,904,591 in 2022. This is slightly higher than the previous record set in 2018, prior to the COVID-19 pandemic. The NAT Economic, Financial and Forecast Group (NAT EFFG) estimated that during the peak week of July 15 to July 21, 2023, approximately 13,659 flights crossed the North Atlantic (see Figure 2). This figure was 12,247 for that same week in 2022.



Figure 2 – Peak Traffic Flow 15 to 21 July against total NAT HLA Flight Hours 2018-2023

Safety Performance Monitoring and Measurement

Collision Risk Estimates

The estimated risk of a mid-air collision, referred to as Collision Risk Estimate (CRE), is reported in terms of fatal accidents per flight-hour (fapfh) and is calculated in the lateral and vertical planes. The model used for computation essentially assumes each aircraft is a box having a fixed x, y, and z orientation and approximates the risk of collision by integrating the crossing rate over the period when two boxes are close to each other in each dimension.

Estimates of Vertical and Lateral Collision Risk for 2023 in the NAT HLA are based on risk bearing events reported to the NAT Central Monitoring Agency (CMA) for the period January to December 2023. Flight activity data from five NAT Oceanic Control Areas (OCAs) was used in deriving an estimate of Vertical and Lateral Collision Risk. The risk estimates were calculated for the Middle zone (Gander and Shanwick OCAs), the North zone (the Reykjavik OCA), and the South zone (the New York East and Santa Maria OCAs) and then combined to derive a total risk estimate for NAT HLA.

The Vertical Collision Risk Estimate for 2023 was estimated to be 20.3×10^{-9} fatal accidents per flight hour (fapfh) for all of the NAT HLA, which is higher in comparison to the 2022 estimate. This increase in collision risk estimate in the vertical dimension is mostly attributed to two longer duration events, 170 and 77 minutes. It should be noted that these events occurred in airspace that did not have ADS-B. If these two events had not happened, that would bring the risk down to 5.3×10^{-9} fapfh.

The 2023 NAT HLA Lateral Collision Risk Estimate was estimated to be 12.7×10^{-9} fapfh, which represents a slight decrease compared to 2022. The main contributions were the two longer duration events, 170 and 77 minutes in the South zone. If these two events had not happened, the lateral risk estimate would reduce to 3.2×10^{-9} fapfh.

Figure 3 shows the relationship between the CREs and the Target Level of Safety (TLS) for the NAT HLA over the last several years. The vertical and lateral CREs are greater than the TLS for operational and technical errors of 5×10^{-9} fatal accidents per flight hour (fapfh).

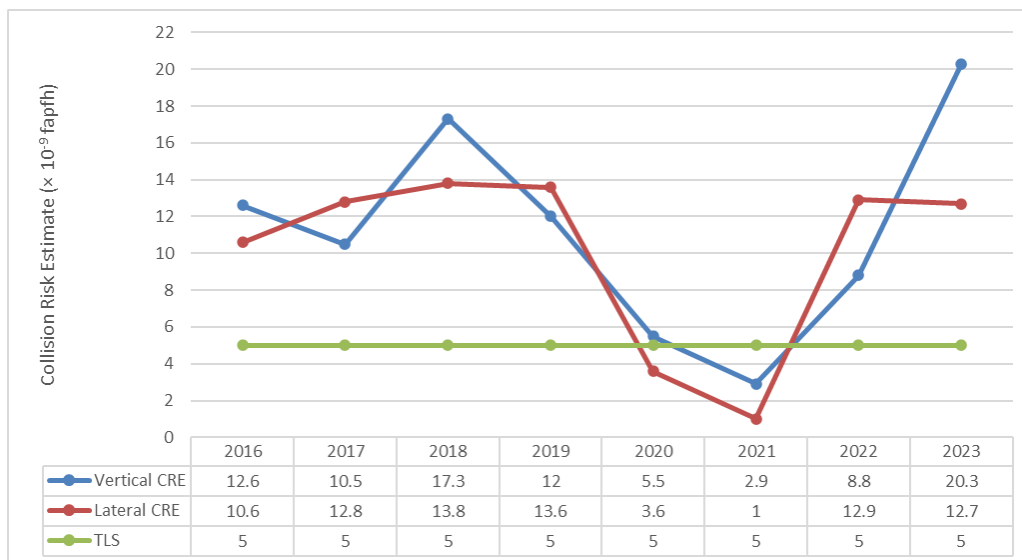


Figure 3 – Collision Risk Estimates in the NAT HLA (2016-2023)

Safety benefit of the use of Strategic Lateral Offset Procedures (SLOP)

The NAT SOG recognizes the safety benefit of the use of Strategic Lateral Offset Procedures (SLOP) to distribute traffic between the centreline of a route and up to 2 NM right of centreline. The application of the random selection of the offset greatly reduces collision risk in the airspace. The desired distribution for the region is 33.3% for each option, evidence suggests many operators apply different interpretations of SLOP.

The following table shows the SLOP distributions by the average of the five top and bottom conforming operators for 2023.

	Centerline	1-Mile Right Offset	2-Mile Right Offset
Top Five	39%	34.2%	26%
Bottom Four	62.25%	31.25%	7.25%

Table 1 – SLOP distributions for 2023

Note: These figures are compiled from the average of the five best conforming operators and the four least conforming operators to SLOP as provided by the NAT Mathematicians Working Group (NAT MWG).

Safety Key Performance Indicators (SKPIs)

The NAT SPG has established SKPIs and associated targets for the NAT HLA. The NAT HLA performance for the last 4 years is shown in the table below. The 2023 figures are shown in green when the performance meets the targets and in red otherwise. Please note the 2022 performance has been updated to reflect the revision to the 2022 traffic data.

Safety KPI	Target	Previous rolling three-year period of performance (2020-2021-2022)	2020 Performance	2021 Performance	2022 Performance	2023 Performance	
NAT.SKPI.01	Number of accidents	0	n/a	0	0	0	
NAT.SKPI.02a	Number of LHD events divided by number of flight hours flown in the NAT HLA	Reduction over previous rolling three-year period of performance	4.80×10^{-5}	4.71×10^{-5}	4.61×10^{-5}	5.09×10^{-5}	4.50×10^{-5}
NAT.SKPI.02b	Overall time of LHDs at unprotected flight level divided by total duration of flights in minutes	Reduction over previous rolling three-year period of performance	6.74×10^{-7}	5.23×10^{-7}	6.23×10^{-7}	8.75×10^{-7}	2.16×10^{-6}
NAT.SKPI.03a	Number of Lateral deviations divided by number of flight hours flown in the NAT HLA	Reduction over previous rolling three-year period of performance	5.50×10^{-5}	6.39×10^{-5}	4.87×10^{-5}	5.25×10^{-5}	8.67×10^{-4}
NAT.SKPI.03b	Overall time of lateral deviations on an unprotected profile divided by total duration of flights in minutes	Reduction over previous rolling three-year period of performance	7.16×10^{-7}	8.20×10^{-7}	6.10×10^{-7}	7.18×10^{-7}	2.33×10^{-6}
NAT.SKPI.04	Number of losses of separation events divided by number of flight hours flown in the NAT HLA	Reduction over previous rolling three-year period of performance	7.27×10^{-6}	5.60×10^{-6}	5.22×10^{-6}	1.10×10^{-5}	1.47×10^{-5}
NAT.SKPI.05a	Number of coordination errors divided by number of flight hours flown in the NAT HLA	Reduction over previous rolling three-year period of performance	1.91×10^{-5}	2.91×10^{-5}	1.83×10^{-5}	9.98×10^{-6}	1.61×10^{-5}

Safety KPI	Target	Previous rolling three-year period of performance (2020-2021-2022)	2020 Performance	2021 Performance	2022 Performance	2023 Performance
NAT.SKPI.05b Overall time of coordination errors spent at unprotected profile divided by total duration of flights in minutes	Reduction over previous rolling three-year period of performance	1.04×10^{-6}	2.80×10^{-6}	3.00×10^{-7}	2.63×10^{-8}	1.37×10^{-6}
NAT.SKPI.06a Collision Risk Estimate (CRE) in the vertical dimension	5×10^{-9} fapfh	n/a	5.50×10^{-9}	2.90×10^{-9}	8.80×10^{-9}	20.3×10^{-9}
NAT.SKPI.06b Collision Risk Estimate (CRE) in the lateral dimension	5×10^{-9} fapfh	n/a	3.60×10^{-9}	1.00×10^{-9}	12.9×10^{-9}	12.7×10^{-9}
NAT.SKPI.07 Regional Effective Implementation (EI) score in ANS for NAT provider States	-Maintain 85% or above until 2026 -Reach 95% by 2030	n/a	n/a	89.21%	88.58%	85.15%

Table 2 – Safety Key Performance Indicators (SKPIs) and associated targets (2020-2023)

Scrutiny of events

Note1: Numbers in brackets are the 2022 figures.






The NAT Scrutiny Group (NAT SG) carried out the scrutiny of 369 (292) events which were reported to the NAT CMA as occurring in the NAT High Level Airspace (HLA) of the Oceanic Control Area (OCA) of Shanwick, Santa Maria, Reykjavik, New York East, Gander and Bodo during the year 2023. These events were categorized as follows:

- 95 (97) Large Height Deviations (LHDs)
- 183 (100) actual lateral deviations, including:
 - 44 (38) GNEs and
 - 77 (36) ATC Interventions, when the Air Traffic Controller (ATCO) caught and corrected a lateral deviation before it developed into a GNE.
- 34 (19) Coordination events, where coordination between two Units had not been correctly carried out, leading to a vertical, lateral or time event.
- 6 (6) Longitudinal Loss of Separation events.
- 94 (100) Prevented events, where the ATCO prevented a deviation or an uncoordinated flight profile from entering the airspace of another ANSP.

Note 2: It is important to note that the sum of the values will not equal to the total number of events as one event can be counted in one or more dimensions.

It is worth noting that ATC interventions and preventions are positive indicators that the ATC system has recognized an error. This is often through data link equipage capabilities where a warning to the controllers is received in sufficient time to take pre-emptive action. Underlying causes of all lateral deviations (incipient or actual) are often identical – the magnitude depends upon the timeliness of identification and corrective action.

The review of these 369 events from 2023 showed (Figure 4) that the top 10 contributing issues allocated to all events were (Arrows indicate relative position from 2022 report):

1. *Flight Plan vs. Clearance* – Aircraft were flying, or intending to fly the planned route instead of the cleared route contributed in 91 (25%) events. In most cases (62 out of the 91), deviations did not actually occur as they were prevented by an ATCO. 
2. *Did not adhere to ATC clearances* - A crew, for no identifiable reason, operated a flight profile different to the ATC clearance (e.g. changed vertical profile or routed to a different waypoint which was not contained in the clearance or the filed flight plan or due to contingency) contributed in 49 (13%) events. 
3. *Weather* - Weather conditions experienced during the flight contributed in 47 (13%) events. 
4. *ATC coordination* - An error occurring during the coordination between two ATC sectors or ANSPs contributed in 44 (12%) events. 
5. *Crew-Other* - Crew action not matching the other causal factors contributed to 44 (12%) events. 

6. *Crew CPDLC message* - Crew misunderstanding or misreading a CPDLC message or actioning it incorrectly, contributed in 35(9%) events. ▲
7. *ATC Pertinent message not actioned* - ATC did not respond to pertinent message which could have mitigated an event contributed in 29 (8%) events. ▲
8. *Incorrect Weather Contingency action* - Crew deviated from their assigned clearance to avoid adverse meteorological conditions, but did not follow the correct procedures for in-flight contingencies in Oceanic Airspace contributed in 24 (7%) events. ▲
9. *Dispatch* - Flight plan issues contributed to 19 (5%) events. This includes incorrectly filed flight plans and multiple flight plans for a single flight. ▲
10. *Equipment (Other)* – Non-specified equipment issues contributed to 18 (5%) events. These events related specifically to the application of FLY-BY and FLY-OVER waypoints at LASNO. ▲

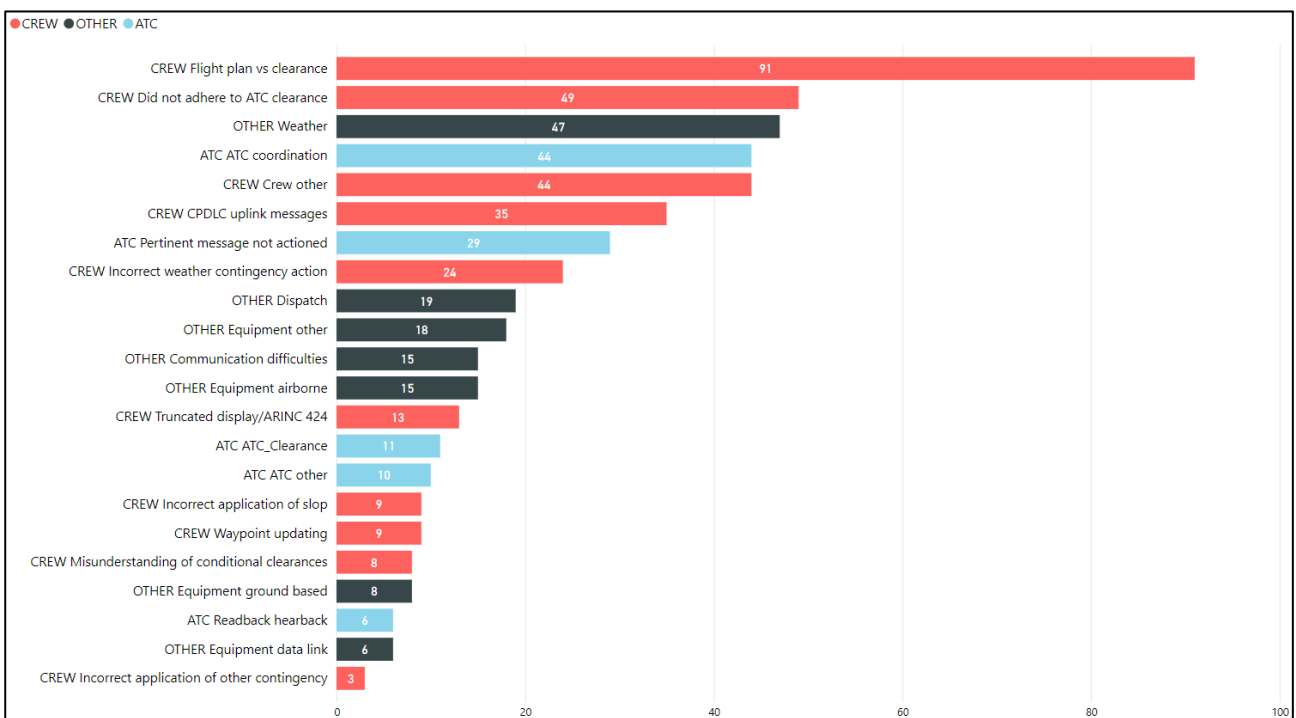


Figure 4 – Contributing issues to events in the NAT HLA in 2023

Prevented deviations for all event types were classified according to the implemented mitigations used to avert a deviation. The results of this classification are presented in Figure 5, demonstrating that the practice of requiring position reporting of “NEXT and NEXT +1” and the “CONFIRM ASSIGNED ROUTE” CPDLC message sets (UM137/DM40) are proving to be of benefit.

Further information can be found in the OESB (<https://www.icao.int/EURNAT/Pages/EUR-and-NAT-Document>) and on the NAT CMA (link) website (<https://natcma.com>).

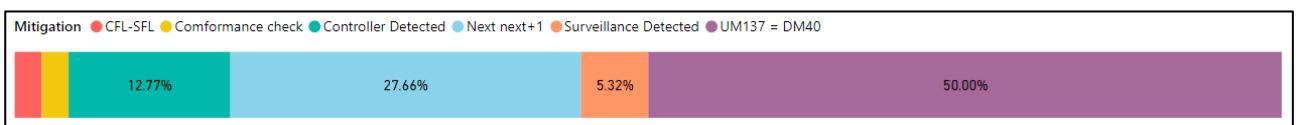


Figure 5 – Mitigations used for prevented deviation events in 2023

NAT regional priorities

The NAT region remains committed to enhancing safety, efficiency, and sustainability in air traffic management services. The region has embraced a new vision statement that underscores collaboration and innovation as key drivers toward achieving optimal air traffic management. The NAT Systems Planning Group (NAT SPG), at its 59th meeting, endorsed the following refined NAT Vision Statement:

“Through collaboration and by leveraging innovation, the NAT SPG leads the way for the provision of safe, secure, efficient, sustainable and resilient Air Traffic Management Services to ensure an optimized seamless service.”

The NAT vision reflects the continued, but ever-changing priorities of the region to adapt to the needs of aviation while maintaining a safe operating environment.

In 2023, efforts continued towards the removal of Oceanic Clearances in its ambition to create global harmonization and seamless boundaries. At NAT SPG/59, the removal dates were agreed, following the AIRAC cycle, of 21 March 2024 for all NAT ANSPs except Shanwick, and 9 April 2024 for Shanwick. Due to technical challenges and in order to ensure safe integration, the removal dates have been modified to early December 2024 for Canada, Norway and the United Kingdom.

Focus continues on the safe, sustainable and manageable integration of commercial space operations (CSO) and other new and re-emerging entrants into the NAT airspace. Safety remains paramount in the integration of CSO and the risk management efforts must prioritize the safe coexistence of CSO with civil aviation operations, ensuring harmonious integration while mitigating potential risks. The NAT SPG recently endorsed new operational guidance material for integration of CSO, developed by the NAT New Entrant Readiness Project Team.

There has been a concerning escalation of reported safety, capacity and environmental effects related to GNSS jamming and spoofing affecting the NAT region, with ANSPs reporting an increase in ADS-B and ADS-C issues that may be attributed to GNSS jamming or spoofing earlier in the flight. Recognizing the seriousness of these events, ICAO has been actively developing recommendations and guidance concerning GNSS Radio Frequency Interference (RFI).

As we look beyond 2024, the NAT region remains committed to advancing safety, efficiency, and sustainability in air traffic management. Through collaborative endeavours and innovative solutions, the region is poised to overcome challenges, to realize its' vision of an optimized and seamless airspace environment.

Appendix A

ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
ANS	Air Navigation Service
ATC	Air Traffic Control
ATS	Air Traffic Service
CPDLC	Controller-pilot data link communications (data link)
CSO	Commercial Space Operations
EFFG	Economic, Financial and Forecast Group
fapfh	Fatal Accidents per Flight Hour
GANP	Global Air Navigation Plan
GASP	Global Aviation Safety Plan
GNE	Gross Navigation Error
GNSS	Global Navigation Satellite System
HLA	High Level Airspace
ICAO	International Civil Aviation Organization
KPI	Key Performance Indicator
LD LHD	Long Duration LHD
LHD	Large Height Deviation
NAT	North Atlantic
NAT CMA	North Atlantic Central Monitoring Agency
NAT EFFG	North Atlantic Economic, Financial and Forecast Group
NAT MWG	North Atlantic Mathematicians Working Group
NAT SG	North Atlantic Scrutiny Group
NAT SOG	North Atlantic Safety Oversight Group
NAT SPG	North Atlantic Systems Planning Group
OCA	Oceanic Control Area
RFI	Radio Frequency Interference
SKPI	Safety Key Performance Indicator
SLOP	Strategic Lateral Offset Procedure



International Civil Aviation Organization

European and North Atlantic Office, Paris (EUR/NAT)

3 bis Villa Emile Bergerat

92522 Neuilly-sur-Seine Cedex

France

Tel.: +33 1 46 41 85 85

Fax: +33 1 46 41 85 00

E-mail: icaoearnat@icao.int

<http://www.icao.int/EURNAT>

