ICAO

SAFETY
North Atlantic Region

2017 Annual Safety Report

June 2018

DISCLAIMER

This document is produced and disseminated by the North Atlantic Systems Planning Group (NAT SPG). The ICAO European and North Atlantic (EUR/NAT) Office and NAT SPG assume no liability for its content or use therof.

ACKNOWLEDGEMENTS

The North Atlantic Systems Planning Group wishes to extend its thanks to the members of the North Atlantic Safety Oversight Group that contributed to this report.

Executive Summary

The North Atlantic Region's fifth annual safety report is issued by ICAO's North Atlantic (NAT) Systems Planning Group (NAT SPG). As stipulated in its terms of reference, the NAT SPG shall continuously study, monitor and evaluate the air navigation system in the NAT Region in light of changing traffic characteristics, technological advances and updated traffic forecasts. This report is based on data from January to December 2017 and provides basic information on the Region, its safety principles, and its risks. The report also describes some of the NAT SPG's collaborative safety management efforts.

The management of safety in the NAT Region is partly conducted by the use of Safety Key Performance Indicators (Safety KPIs) that have been developed and established by the NAT SPG. A modified list of Safety Key Performance Indicators and a revised definition of targets for many of the Safety KPIs was adopted at the NAT SPG/53 in 2017; new targets are applicable from 2019. For the year 2017, targets were met for the three Safety KPIs that have defined targets.

The use of Strategic Lateral Offset Procedure (SLOP) is an important safety initiative. If there were better utilization of SLOP, the vertical risk would have been significantly improved. The use of SLOP should be encouraged at all NAT related user forums.

The North Atlantic Scenario

The airspace of the North Atlantic, which links Europe and North America, is the busiest oceanic airspace in the world.

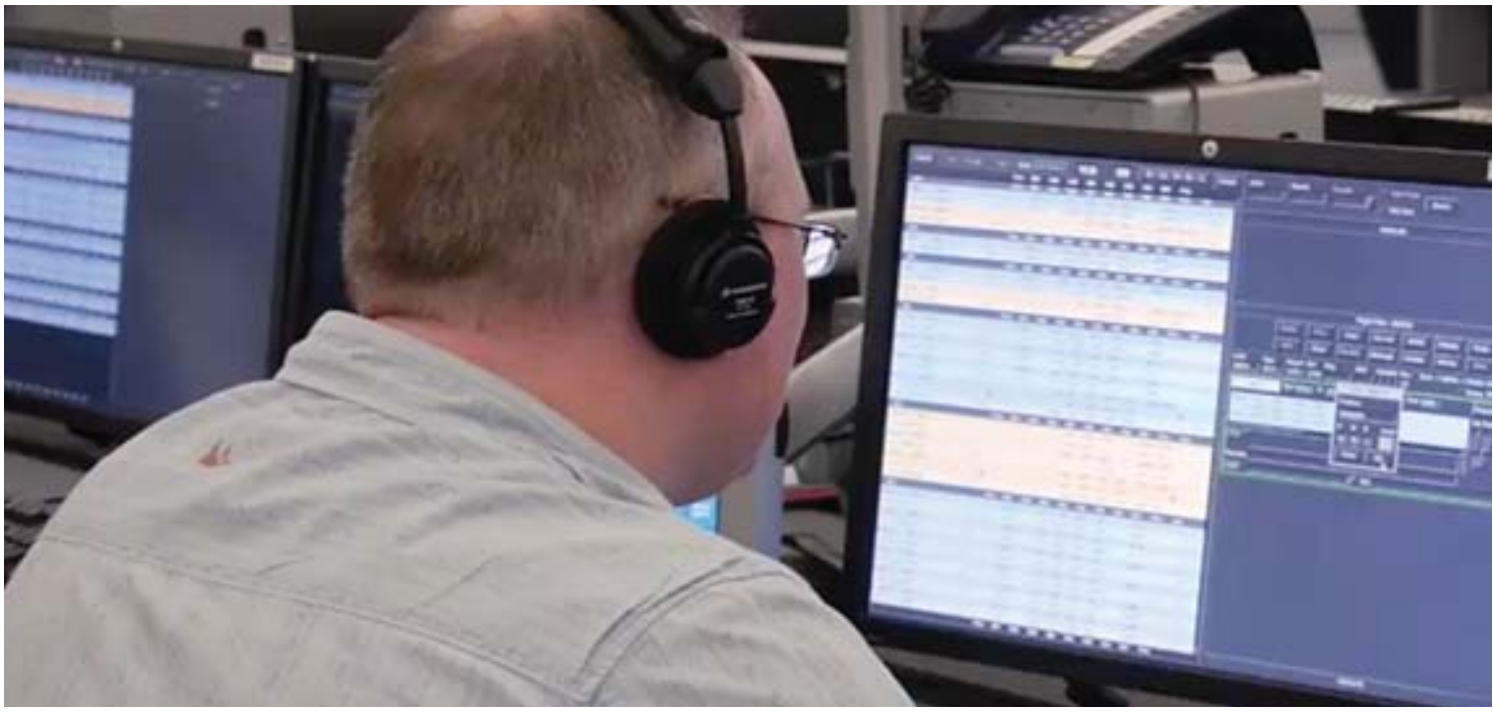
The NAT Economic, Financial and Forecast Group (NAT EFFG) estimates that in 2017, during the peak week of July 15 to July 21, approximately 13,520 flights crossed the North Atlantic.

The NAT EFFG expects traffic in this Region to grow at an average annual growth rate of 3.9 % over the next 5 years, as shown in **Table 1** below. This projection is down from an estimate of 5.3% growth noted in last year's report. **Figure 1** further illustrates these projections.

The long-term average annual growth rate from 2017 to 2037 is expected to be somewhere between 2.4% and 3.4%. This year's increase is a good illustration of increased demand, and the importance of the safety work of the NAT Safety Oversight Group (SOG). The NAT SOG is responsible to the NAT SPG for safety oversight in the NAT Region.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total	10,386	11,012	11,563	12,682	13,520	13,866	14,515	15,162	15,916	16,341
Year over Year Growth		6.0%	5.0%	9.7%	6.6%	2.6%	4.7%	4.5%	5.0%	2.7%
5-year Year over Year Growth										3.9%

Table 1: Forecasts of aircraft movements in the ICAO NAT Region during the Peak Week of July 15-July 21



Traffic mainly flows in a broadly East-West orientation in a twice daily pattern, whose timing reflects the needs of passengers in North America and Europe, and where a daily organised track system takes account of airspace users' needs and weather patterns.

This core traffic operates for a large part without radar surveillance and increasingly with the use of Automatic Dependent Surveillance-Contract (ADS-C) and Automatic Dependent Surveillance-Broadcast (ADS-B). 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 makes any comparison with the domestic airspace of North America and Europe difficult. NAT core traffic flow is almost exclusively jet transport aircraft that operate in the upper airspace in the en-route phase of flight. This leads to air traffic management and operation that is fundamentally different in concept to typical domestic operations, with a greater focus on strategic rather than tactical techniques.

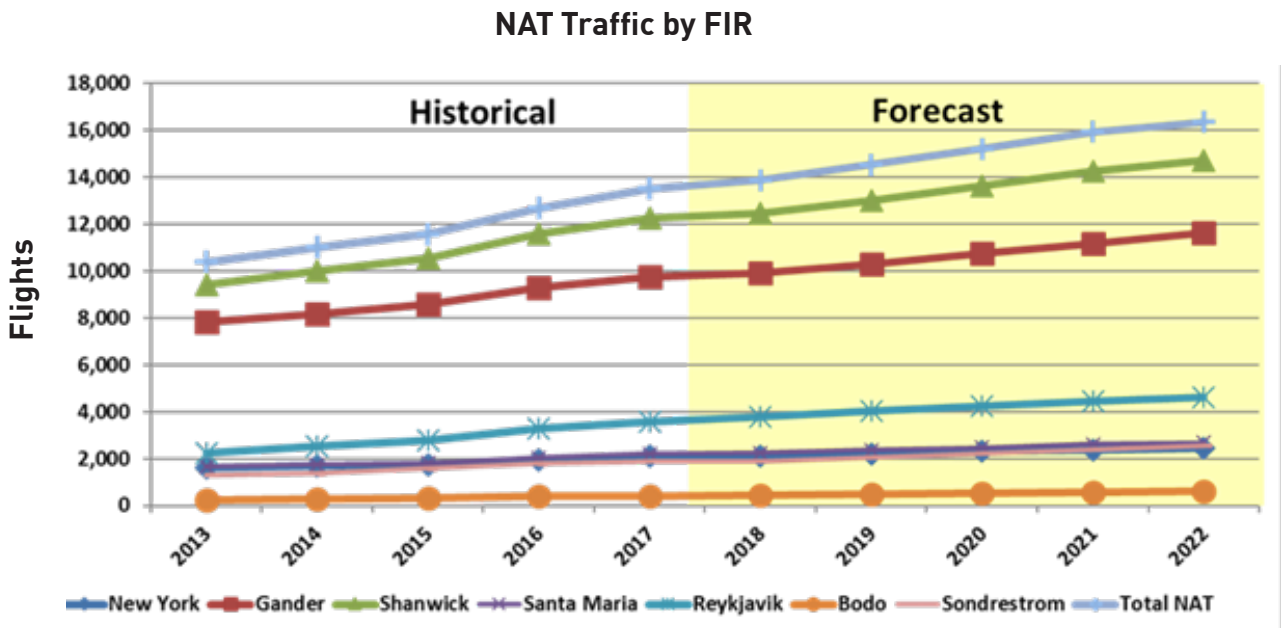


Figure 1: NAT Traffic by FIR

Safety Policy

Safety is the NAT SPG's core business function. The NAT SPG is committed to developing, implementing, maintaining and constantly improving strategies and processes to ensure that all our aviation activities take place under a balanced allocation of organizational resources. The NAT SPG will aim 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).

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.

Safety Performance

The **Table 2** below, lists the most common event types reported in the NAT High Level Airspace (HLA[1]) . The three most common errors that led to these events are given with their respective frequencies.

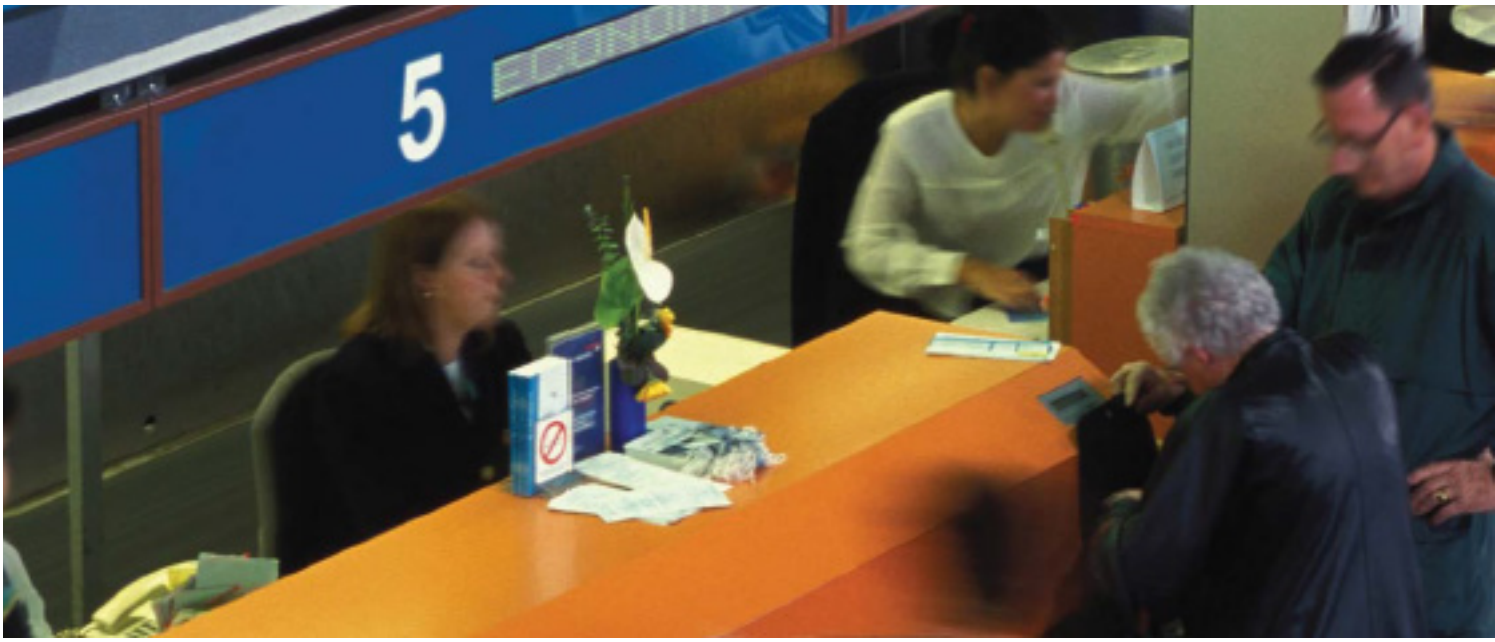
2017 Reported Events		Top 3 errors as defined by the NAT SG
Vertical Large Height Deviations	**91**	Crew Error **(51)**
		Air Traffic Control Error **(25)**
		Other **(15)**
Lateral deviations	**54**	Crew Error **(33)**
		Air Traffic Control Error **(11)**
		Other **(10)**
ATC Interventions and Preventions to prevent a lateral deviation	**139**	n/a

Table 2: Most common errors within the NAT HLA

Air Traffic Control (ATC) interventions and preventions are positive indicators that the ATC system has recognized an error, often through data link equipage capabilities, warning the controllers in sufficient time to take preemptive action.

ATC Interventions are events where the Air Traffic Controller caught and corrected a mismatch between the flight plan protected by ATC and the aircraft crew's intentions before it developed into a deviation. An ATC Prevention is an event where the Air Traffic Controller intervened to prevent a lateral deviation. Underlying causes of all lateral deviations (incipient or actual) are often identical – the magnitude depends upon the timeliness of identification and corrective action.

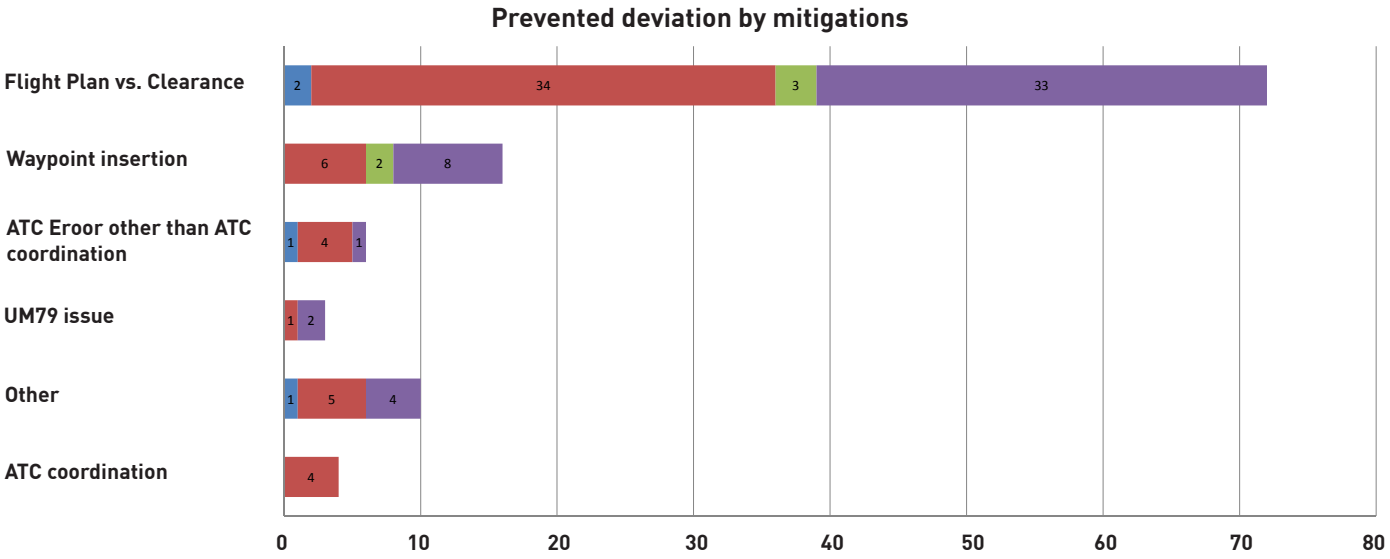
[1] Airspace between Flight Levels 285 and 420 inclusive, formerly Minimum Navigation Performance Specification (MNPS) airspace.



Preventions of Deviations

The NAT Scrutiny Group (SG) categorized 111 events that have occurred in 2017 and in which ATC prevented a deviation. The Group classified the prevented deviation events according to the implemented mitigations which were identified as being responsible for the prevention.

The results of this classification are presented in **Figure 2**, demonstrating inter alia 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.



	Flight Plan vs. Clearance	Waypoint insertion	ATC Error other than ATC coordination	UM79 issue	Other	ATC coordination
Controller detected	2		1		1	
Next Next+1 position report	34	6	4	1	5	4
Pre boundary conformance check	3	2				
UM137/DM40	33	8	1	2	4	

Figure 2: Prevented lateral deviations by mitigations for January-December 2017

Safety Key Performance Indicators (Safety KPIs)

The NAT SPG has established Safety Key Performance Indicators (Safety KPIs) for the ICAO NAT Region. Targets are reviewed annually by the NAT SOG.

For 2017 performance monitoring, the NAT SPG agreed to amend and modify certain KPIs and related targets, to better reflect current improvements in data systems and for revision of data collection techniques. The revised Safety KPIs distinguish between aircraft utilizing data link and aircraft not utilizing data link, as data indicates that more than 80% of aircraft operating in NAT airspace are equipped and using data link.

In addition, substantial changes were agreed upon on the way many of the safety targets are defined. Targets for nine of the Safety KPIs now rely on the previous three years rolling average. Safety performance, as of the beginning of 2018, will be measured from the baseline of the average performance of 2015, 2016 and 2017. This means that for 2017 performance measurements, there are only defined targets for three out of the twelve reported Safety KPIs. For those three, the safety targets were met in 2017.

The NAT Region's performance in 2017 as demonstrated with defined Safety KPIs is shown in **Table 3**. As explained above, due to a revised method for target setting, nine of the Safety KPIs do not have targets, however for comparison purposes, the 2016 performance information and the baseline average (which will apply for 2018 performance) are provided.

Safety KPI		Target		2016 Performance	2017 Performance
i	Number of accidents	0		0	0
ii	Number of fatal accidents	0		0	0
iii	Number of fatalities related to aviation fatal accidents	0		0	0
		Target for 2018 performance	2015-2016-2017 baseline[1]	2016 Performance	2017 Performance
iv	Rate of LHD events (No. of LHD events divided by No of flight hours flown in the NAT region), involving operations with Data Link in use	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	3.45×10^{-5}	3.19×10^{-5}	3.71×10^{-5}
v	Rate of LHD events (No. of LHD events divided by No. of flight hours flown in the NAT region), involving operations with Data Link not in use	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	6.60×10^{-6}	4.48×10^{-6}	8.72×10^{-6}
vi	Percent of Long Duration LHD events[2]	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	2.73%	5.7%	0.0%
vii	Rate of minutes that aircraft, with Data Link in use, spent at the wrong flight level (Amount of minutes spent at the wrong flight level divided by total duration of flights in minutes)	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	0.15	0.2	0.1
viii	Rate of minutes that aircraft, with Data Link not in use, spent at the wrong flight level (Amount of minutes spent at the wrong flight level divided by total duration of flights in minutes)	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	0.51	0.9	0.2
ix	Rate of GNE events[3] (No. of GNE events divided by No. of flight hours flown in the NAT region) , involving operations with Data Link in use	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	1.79×10^{-5}	1.79×10^{-5}	1.80×10^{-5}
x	Rate of GNE events (No. of GNE events divided by No of flight hours flown in the NAT region), involving operations with Data Link not in use	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	3.01×10^{-6}	0.56×10^{-6}	5.45×10^{-6}
xi	Rate of losses of separation (vertical) (No of losses of separation events divided by No. of flight hours flown in the NAT region)	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	1.40×10^{-5}	1.23×10^{-5}	0.13×10^{-5}
xii	Rates of losses of separation (lateral) (No of losses of separation events divided by No. of flight hours flown in the NAT region)	Reduction over previous rolling three-year period of performance compared to 2015-2016-2017 baseline	6.50×10^{-6}	8.95×10^{-6}	9.27×10^{-6}

[1] While 2015 performance contributed to the 2015-2016-2017 baseline, those figures are not reported in Table 3. Therefore, the baseline, when compared to only 2016 and 2017 performance, may not be intuitive.

[2] Long Duration LHD event means an event exceeding 20 minutes, based on a threshold established after review of historical data reported to the NAT CMA.

[3] Gross Navigation Error (GNE) is a deviation of 10NM or greater.

Table 3: Modified NAT Safety KPIs (beginning 2017)

Large Height Deviations (LHDs)

The NAT SPG has targeted vertical risk specifi¬cally for the last several years through an emphasis on reducing LHD events. A NAT Vertical Risk Reduction Implementation Plan was agreed and targets for vertical risk established:

a. Long Duration Large Height Deviations (LD LHDs) in the vertical dimension are defined as those events which occur for 20 minutes or more;

b. The definition of LD LHD be reviewed annually in order to maintain improvement in reduction to LHDs;

c. A target is to reduce the number of LHDs in the NAT RVSM airspace over a three year rolling average;

d. A target is to reach a total number of LHD events within the NAT RVSM airspace by 2018 not exceeding 85 per year;

e. A target is to reduce the total number of minutes associated with the three longest LHDs within the NAT RVSM airspace;

f. A target is to eliminate the number of LD LHD events within the NAT RVSM airspace by the end of 2018; and

g. The NAT SOG request trend-specific action when any adverse trend develops.

In 2017, there were 80 LHDs events at RVSM levels and 108 in the entire NAT airspace, which includes the High Level Airspace (HLA) (shown in parentheses in the text in **Table 4** below). This is a decrease from last year. Based on the three year rolling average (2013-2015). The Region is on target for meeting the 2018 goal.

LHD Data		2010	2011	2012	2013	2014	2015	2016		2017	2018 (Long Term Target)
# OF EVENTS	# of LHDs within RVSM (within entire NAT)	115 (138)	88 (107)	128 (163)	102 (128)	92 (116)	100 (120)	82 (105)		80 (108)	85
	# of LD LHD (10 min+) within RVSM[1]	13	14	15	3	5	6	8[2]	# of LD LHD (20 min+) within RVSM	0	0
	# of LHD (< 10 min) within RVSM	102	74	113	99	87	94	74[3]	# of LHD (<20 min+) within RVSM	80	
TIME	# of LHD Minutes within RVSM	621	707	718	217	266	260	333	# of LHD Minutes within RVSM		149
	# of LD LHD (10 min+) within RVSM	409	582	564	42	171	170	284	# of LD LHD (20 min+) within RVSM		0

[1] Beginning in the 2017 reporting period, the time threshold for an LD LHD will be 20 minutes as agreed by NAT SOG/15
[2] Including 6 events of duration 11-19 minutes
[3] Including 2 events of duration 11-19 minutes

Table 4: LHD Summary Report

A deviation that results in a loss of separation is considered to be risk bearing. Collision Risk Estimates include only risk bearing LHDs in NAT HLA.

In **Figure 3** below, this "risk bearing" factor is compared to all LHDs in HLA in historical context. It is also compared to the number of LHDs attributed to aircrew and ATC errors.

There were 64 operational risk-bearing LHDs during 2017, resulting in a total duration of 147 minutes at the incorrect flight level and 30 uncleared flight levels crossed. The two longest duration events accounted for a total of 19% of the total time spent at the wrong flight level. Removing these two events would reduce the overall vertical risk by 18% from 46.1 to 37.9 x 10^{-9} fapfh.

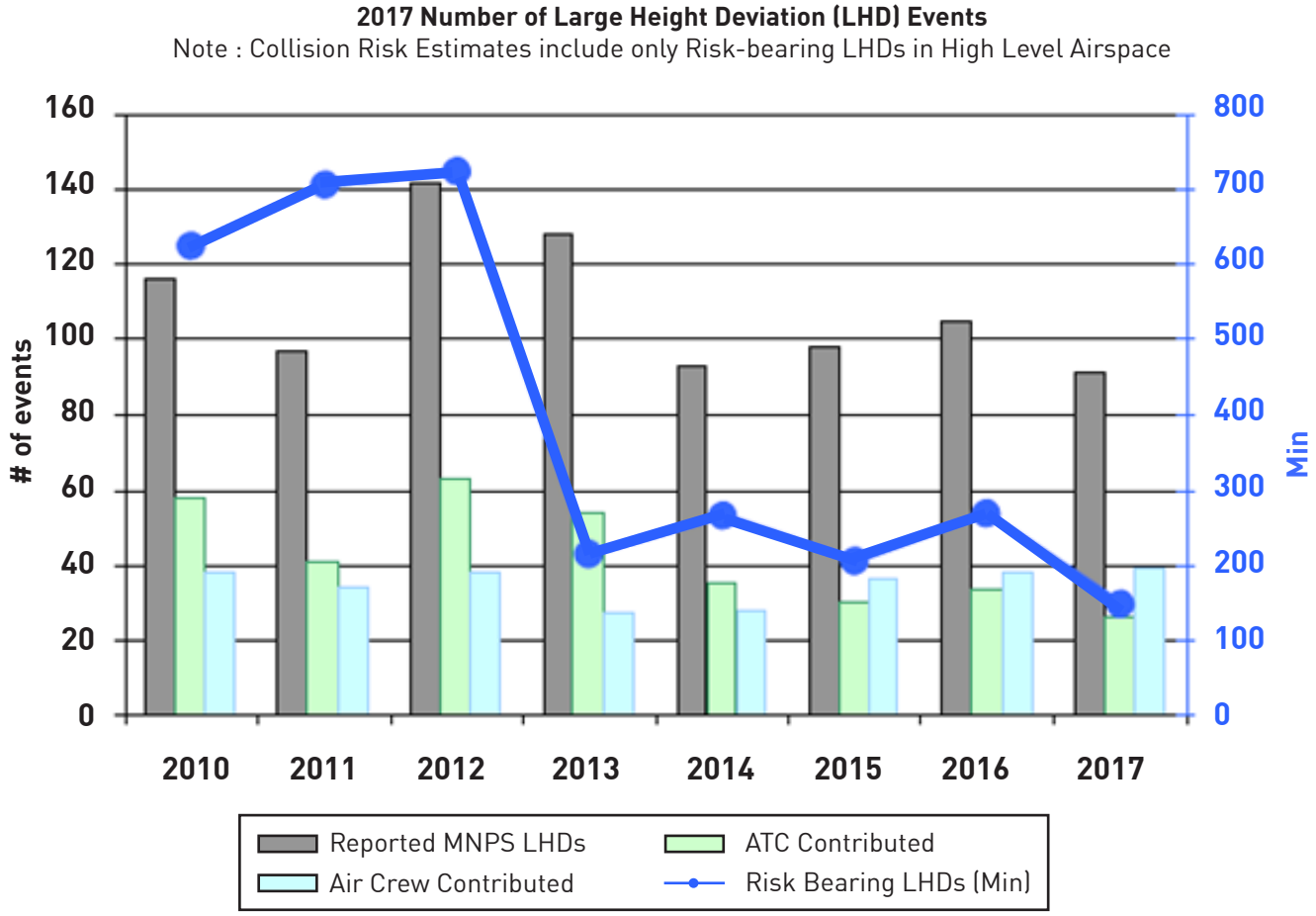


Figure 3: 2017 Number of Large Height Deviations Events

Alignment with the Global Aviation Safety Plan

The 2017-2019 GASP sets out a continuous improvement strategy for States and Regions to implement through the establishment of core, and then more advanced, aviation safety systems. The target dates and the broad objectives are set out below:

Target Date	Broad Objective
(a) Near-Term (by 2017)	Effective Safety Oversight
(b) Mid-Term (by 2022)	ICAO State safety program implementation
(c) Long-Term (by 2028)	Predictive risk management

All North Atlantic provider States have met the near-term objective of the GASP and are working toward the mid-term and long-term objectives, particularly in the areas of proactively managing risks through the identification and control of existing or emerging safety issues. 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 Region's safety policy (presented previously in this report) is enhanced by the agreement of member States to use the information shared at North Atlantic 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.

The NAT SPG assigned the task of reviewing the current Safety KPIs and proposing new safety KPIs and targets to the NAT SOG. This is an on-going task for the NAT SOG which the group revisits at each of its meetings. The NAT Central Monitoring Agency (CMA), which is the Regional Monitoring Agency for the NAT region, collects NAT event data and uses it along with the North Atlantic Scrutiny Group (NAT SG) and the North Atlantic Mathematicians Working Group (NAT MWG) to assess safety performance within the Region.

The NAT reporting requirements have gradually expanded to meet the needs of system risk assessment, understanding of operational errors, and informing the safety assessments involved with reductions in separation.

Formal reporting requirements have been introduced through the Conclusions of the NAT SPG.

In order to ensure that the necessary data would be available for informed discussions of future developments; the NAT SPG recognized that these reporting responsibilities needed to be organised and easily accessible. Therefore, in 2015 the NAT SPG developed and endorsed the NAT Consolidated Reporting Responsibilities Handbook (NAT Doc 010). This document compiles relevant reporting requirements and guidance previously agreed to by the NATSPG member States as outlined in the conclusions from its first meeting in 1965 through its 53rd meeting in June 2017.

NAT Regional Priorities

A number of Air Navigation Service (ANS) initiatives are on-going in the NAT Region.
In line with the safety policy and as stipulated in the terms of reference and the work structure of the NAT SPG, it is imperative that acceptable safety arguments are provided in relation to system developments in the NAT Region. The agreed policy is as stated above, to maintain and where possible improve the agreed safety standards in all activities. In this regard, the safety work that provides confidence that upcoming initiatives do not negatively affect the safety of the ICAO NAT Region, is ongoing.
Work undertaken by the NAT Regional subgroups on a number of significant initiatives took place in the ICAO NAT Region in 2017, including:

a. Reduced Lateral Separation Minima between Future Air Navigation System (FANS) equipped aircraft (RLatSM);

b. The NAT Data Link Mandate (DLM) implementation (Phase 2B); and

c. Definition and Components of safety cases in support of changes to the NAT air navigation system requiring NAT SPG approval.

Following are short summaries of the projects, stipulating how the NAT States will collaboratively ensure or have ensured (depending on the status of the project) the safe implementation and application on a regional level.

Reduced Lateral Separation Minima between FANS equipped aircraft (RLatSM)

An operational trial of RLatSM was based on suitably equipped aircraft assigned half degree track spacing making position reports via ADS-C and equipped with CPDLC. The goal of RLatSM is to decrease fuel cost to airlines by providing the opportunity for more optimal flight profiles within the NAT and without negative impact on collision risk.

The RLatSM Phase 1 trial commenced November 12, 2015 in the Gander and Shanwick Oceanic Control Areas (OCAs). NAV CANADA, overseen by Transport Canada, led the project in conjunction with United Kingdom's NATS. The implementation of Performance-Based Communications and Surveillance on 29 March 2018 moved RLatSM from the trial phase to the operational phase. Half degree tracks will be published based on fleet equipage and demand.

Safety Improvements with Data Link in the NAT Region

In June 2014, the NAT CMA began to record information related to the use of data link with each safety occurrence report. **Figure 4** provides a sample of this evaluation from occurrence reports contributing toward vertical operational risk. The results show that the time spent at the wrong flight level and the number of flight levels crossed incorrectly have decreased by 14 and 56 percent, respectively, for risk-bearing events reported via data link for calendar year 2017 compared to 2014 baseline. As more aircraft are equipped with data link capability, we expect this trend to continue.

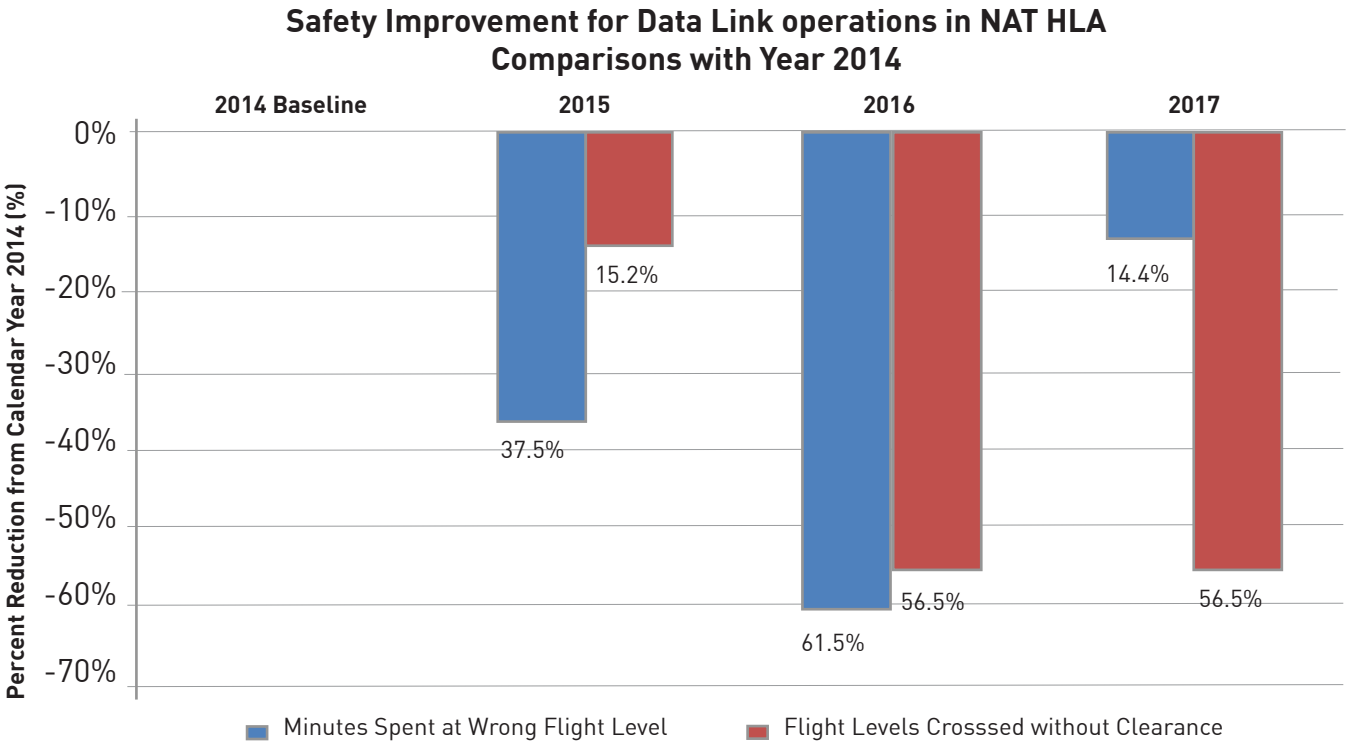


Figure 4: Safety Improvement with Data Link

Definition and Components of safety cases in support of changes to the NAT air navigation system requiring NAT SPG approval

The NAT SPG identified the need for a clear definition of the contents of safety cases prepared to support changes to the NAT air navigation system so that safety planning can be conducted in such a way that safety arguments and supporting documentation are presented by or through the NAT Implementation Management Group to the NAT SOG in a manner that fulfils the NAT SOG's requirement to review safety cases.

Therefore, the NAT SPG developed the definition of a safety case that, in part, states that a safety case :

- documents safety arguments relating to a proposal for a change in a specific FIR or multiple FIRs affecting operations in more than one NAT FIR;
- references evidence, and;
- includes the assessment of safety risk associated with the proposed change, risk controls and/or mitigations, and a monitoring plan to ensure that the effectiveness of the risk controls and mitigations is verified.

A change may relate to the introduction of new operational concepts, new or modified procedures, novel separation minima, or the introduction of new systems. A safety case may be prepared by NAT IMG and/or a designated sub-group or project team within the NAT IMG working structure, or by one or several NAT Air Navigation Service Providers, and is owned by the change advocate.

A Look Ahead

The NAT SPG is laying the groundwork towards enabling a seamless separation approach throughout the NAT Region. As such, the NAT SPG is planning to coordinate through the working structure all required procedures, analyses, and planning documents related to Air Traffic Service (ATS) surveillance-enabled services using space-based Automatic Dependent Surveillance–Broadcast (SB ADS-B) planned for March 2019. The ANSPs providing services in the Gander and Shanwick OCAs, NAV CANADA and NATS, have begun coordinating on a common implementation strategy. Some of the prospective features for SB ADS-B include:

a. flights would continue to be planned and cleared on conflict free flight profiles from oceanic entry to exit between the Gander and Shanwick OCAs;

b. Surveillance-enabled longitudinal separation between a pair of ADS-B equipped aircraft would be applied if both flights have active CPDLC connections with the appropriate ATS unit(s);

c. the application surveillance-enabled separation could be used to permit one ADS-B equipped aircraft to climb or descend to or through the level of another ADS-B equipped aircraft;

d. surveillance separation could be applied between same direction aircraft only while they were operating on the same exact track;

e. surveillance separation could be applied between opposite direction ADS-B equipped aircraft provided that they have both passed a common point;

f. the application of surveillance separation could be tactically initiated between ADS-B equipped aircraft pairs operating on the same exact non-NAT Organised Track System (OTS) track.

Conclusion

The NAT Region continues to make progress toward achieving its safety targets, although LHDs and vertical risk continue to be of specific concern. At the same time, the Region also continues to conduct the safety analyses and operational trials necessary to introduce new technologies and procedures intended to increase the efficiency of the busy oceanic airspace.

Glossary

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)
DLM	Data Link Mandate
FANS	Future Air Navigation System
fapfh	Fatal Accidents Per Flight Hour
GASP	Global Aviation Safety Plan
GNE	Gross Navigation Error
HLA	High Level Airspace
ICAO	International Civil Aviation Organization
KPI	Key Performance Indicator
LD LHD	Long Duration LHD
LHD	Large Height Deviation
MNPS	Minimum Navigation Performance Specification
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
OTS	Organised Track System
RVSM	Reduced Vertical Separation Minimum
SLOP	Strategic Lateral Offset Procedure
TLS	Target Level of Safety

— END —

International Civil Aviation Organization (ICAO)
European and North Atlantic (EUR/NAT) Office

3 bis villa Émile Bergerat
92522 Neuilly-sur-Seine Cedex, France
Tel.: +33 1 46 41 85 85
Fax: +33 1 46 41 85 00
E-mail: icaoeurnat@paris.icao.int