

# North Atlantic Monitoring

## - *an overview*

North Atlantic Central Monitoring Agency

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# Background – North Atlantic Region

## What we do and how it evolved

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In the beginning (i.e. in preparation for the introduction of RVSM in the NAT Region in 1997) only vertical performance of aircraft was considered significant. In the absence of any surveillance capability and with communications restricted to HF Radio, anxiety was understandably limited by the vertical separation in RVSM airspace.

.1965 – Organised Track System introduced

- 1977 - MNPS introduced
- 1981 - Longitudinal separation reduced to 10 minutes
- 1996 - GPS approved for navigation on NAT; OMEGA withdrawn
- 1997 - RVSM introduced on the NAT
- 2006 - CPDLC overtakes HF as primary communication method
- 2011 - Longitudinal separation reduced to 5 minutes (within the OTS and subject to ADS functionality)
- 2015 - RLAT introduced - Trial currently in progress - half degree separation within the core tracks, subject to RNP/RCP compliance and full ADS/CPDLC operability.



# NAT CMA

- The North Atlantic Central Monitoring Agency is one of 13 Regional Monitoring Agencies established and funded by ICAO to monitor technical and operational safety in the North Atlantic Region.
- Established in 1985, it played a significant role in the determination of operational readiness of the NAT system for the introduction of RVSM.
- Monitors:
  - - aircraft height keeping performance for compliance with RVSM criteria,
  - - aircraft State airworthiness approval status, and
  - - operational performance & risk within & above MNPS (now NAT High Level – HLA) airspace.

# The CMA as a Regional Monitoring Agency

- As the first Regional Monitoring Agency created by ICAO, the NAT CMA was tasked with collecting system performance data (both operational and technical) in preparation for the introduction of RVSM in the NAT Region.
- Initially, two ground based Height Monitoring Units were installed, at Strumble in the UK and Gander in Canada. The Gander unit was withdrawn and dismantled in 2006 and its components used to maintain the remaining unit in the UK.



## *Continued*

- Data from the HMUs provided (for the first time) the significant quantity of aircraft height-keeping performance data required for both the readiness assessment for - and continuing safe operation of - RVSM.
- Monitoring of aircraft height keeping performance continues to this day, across several regions, using ground-based equipment, portable GPS monitoring units and ADS-B. This is a vital task involving every RMA under the provisions of ICAO Annex 6 (Operation of Aircraft).



# Safety & Readiness Assessment

- A safety assessment consists of estimating the risk of collision associated with RVSM and comparing this
- risk to the agreed RVSM safety goal, the Target Level of Safety.
- It should also be noted that currently there is no standard CRM applicable to all airspace. Development and application of a CRM is a complicated activity and should be conducted only by trained and experienced personnel.



## S & R Assessment - continued

- Emerging RMAs that do not have the requisite skills should seek assistance from external sources or established RMAs before adapting a CRM or attempting to conduct risk calculations. Additional guidance can be obtained from previous RGCSP and SASP documentation. It will be necessary to adapt existing CRM parameters to take account of regional variations.
- The responsibility for conducting safety assessments continues after airspace developments are introduced.

# Data collection to monitor airspace safety

- The PIRG will specify the safety reporting requirements for the RMA.
- In North Atlantic airspace – which is RVSM airspace where both random and organised routes exist, varying day by day – risk is monitored in both vertical and horizontal dimensions by analysis of safety occurrence reports received from ANSPs, and occasionally directly from operators.
- Such occurrences are investigated by the reporting agencies, and it is their responsibility to notify aircraft operators and request investigation and response.





# Safety occurrence database

- The REGIONAL SAFETY DATABASE which combines occurrence reports from across the NAT Region is operated by the Central Monitoring Agency, on behalf of the ICAO EUR/NAT office.
- Individual ANSPs submit copies of safety occurrence reports to the CMA
- These are reviewed, classified and entered into the NAT Deviations and Error Monitoring Application (DEMA - created by NavCanada for the CMA in 2006). Summary details of these events are uploaded to the NAT CMA secure website ([www.natcma.com](http://www.natcma.com)) .

# The Scrutiny Group looks at this....

L160303I	#####	Lateral Deviation <25nm	A388 W/B OTS "E" cleared (datalink) DOGAL 55/20 55/30 F400 M085 reported (ADS-C) at DOGAL routing towards a 10NM offset (5510N01955W). Crew advised attempting to enter 1NM offset and resumed cleared course (max offset 4NM when corrected).	BAW7W	Shanwick	British Airways
H160302	#####	Vertical LHD	B772 W/B RAN cleared (datalink) 45/30 42/40 40/50 39/60 SELIM M083 coordinated Santa Maria/ New York F380 crossed 40W F370. 2 mins at F370 in New York OCA. ATC coordination error SM/NY.	BAW60T	Crew	Santa Maria
E160301	#####	Horizontal Separation Erosion	B772 E/B OTS"V" (half-deg RLat trk) cleared (OA) 5430N030W 5430N020W VENER NETKI F380 M080 unable connect ADS-C passing 30W and disqualified from RLatSM. L-o-r-s against traffic on Trk"U" and "W".	BAW66V	Shanwick	ADS logon failure
I160301	#####	Intervention	A333 W/B RAN cleared (HF) RESNO 55/20 57/30 F310 M081 requested (HF) reroute after 20W 58/30 60/40 58/50 HOIST. Route coordinated with Gander and issued via HF. At 5547N022W a conformance alert indicated route discrepancy.	DAL135	Shanwick	To review
A160301	#####	Lateral GNE	LI60 E/B RAN cleared 57/30 56/20 RESNO NETKI F410 M075 identified by Shannon radar approaching SUNOT. Crew had reported (HF) RESNO as next position in 56/20 position report. 107NM deviation north of protected profile when identified on radar.	EC-JVM	Shanwick	Gestair Executive (Spain)

# So We Don't Have to Look at This





# NAT ICAO Groups

- Scrutiny Group (SG)
  - Meets Twice a Year to Review recent GNE's, Height Errors and losses of separation
  - Comprises operational ANSP representatives, Regulators, IFALPA, IBAC, and other Specialists with flying, ATC, dispatch, engineering, human factors and risk analysis qualifications and current experience.
  - Non-political working group providing expert analysis and impartial data to higher level regional safety groups.



# Mathematicians Working Group

Reviews the output of the Scrutiny Group and using a process known as Collision Risk Modelling provides a risk estimate in each dimension to determine the health of the NAT system in relation to the established Target Level (s) of Safety.

The Scrutiny Group and the Mathematicians Working Group report to the Safety Oversight Group.



# Safety Oversight Group (SOG)

- Established in 2009 to provide regulatory oversight of the safety performance in the NAT region, as informed by the SG/MWG and CMA.
- Meets bi-annually, after the SG/MWG meetings, and reports to the North Atlantic System Planning Group, which is the highest level regional group. The NAT/SPG reports annually to the Air Navigation Commission at ICAO HQ in Montreal.

# Target Level of Safety

- 1,592,000 flight hours (2015) in the NAT Region
- Target level of safety is an operational threshold
- $5 \times 10^{-9}$  Fatal Accidents per Flight Hour is the lateral and vertical TLS in the region.
  - Lateral performance is currently within TLS although risk remains in excess of the TLS in the vertical dimension.
  - A trial of reduced (30NM/ half-degree) lateral separation in the NAT is currently in progress within the core of the Organised Track System (OTS).
  - More accurate navigation performance is demanded for RLatSM operations, with ADS/CPDLC connectivity established.



# GNE's Common Causes

- Failure of crews to adhere to published procedures by not conducting proper crosschecks of clearances with information in Long Range Navigation System (LRNS)
- Failure of crews to carryout waypoint checks effectively
- Failure of crews to manually check accuracy of waypoints in FMS by referencing the expanded coordinates (lat/long) underlying the abbreviated position displayed.

*of deviations (incident or in progress) greatly improved by ADS and the tactical application of ADS contracts by ATC*



# GNE classification

- Class A (Risk Bearing) – a deviation from the protected lateral profile of 25NM or more, observed at the radar window leaving procedural airspace;
- Class B (Non risk bearing) – as above, but not observed at the radar window; and
- Class C (Non risk bearing) – as above, but below FL290 or above FL410
- NB With the advent of reduced lateral separation minima the above deviation criteria are being reduced to 10NM (from 25NM) in the NAT Region.



# ATC Interventions

- . ADS-C Reports and Conformance Checks Have Allowed Timely Interventions
- . ATC Intervention to Prevent a Gross Navigation Error
- . ATC Prevention of a Lateral Deviation



# Height Deviations

- The NAT currently exceeds the TLS threshold in the vertical dimension
- 300 feet or more
- Of 97 reported LHD events in the NAT in 2015, 43 were attributed to crew errors, 34 to errors by ATC agencies, and 9 to turbulence.
- The remainder were attributable to aircraft performance or technical causes (8), wake turbulence (1) and a single ACAS RA event (attributed to turbulence). One aircraft was found to be not in possession of RVSM Approval.



## Height Deviations - Major Operational Causes

- Conditional clearances
- Failure of crews to climb or descend because of a misinterpretation of clearance
- Crews fail to change flight level before or at specified longitude
- Poor R/T phraseology
- Entry at oceanic boundary at flight planned rather than cleared flight level
- Operational errors are the primary contributor, of which
- Note: Report Leaving/Report Reaching



# Erosion of Longitudinal Separation

- NAT Procedures are minimum of 10 min. in-trail based on assigned Mach no, except where R Long SM applies
- Crews must adhere to assigned Mach number – no tolerance
- ETAs Updated
- All NAT providers use automated ground ATC systems that depend on accurate reports of progress
  - Therefore timely reports are critical



# Regulatory Approval

- Both aircraft and operators are required to be in possession of operational approvals from their States of Registry (or State of the operator where this is different from the SoR).
- Such approvals cover not only airworthiness and RVSM approval, but also to ensure compliance with required Communication, Navigation and Surveillance equipment and performance standards to operate in certain parts of the airspace.



# Required Navigation Performance

- Oceanic and remote continental airspace is currently served by two navigation applications, RNAV 10 and RNP 4. Both rely primarily on GNSS to support the navigation element of the airspace. In the case of RNAV 10, no form of ATIS surveillance is required. In the case of RNP 4, ADS contract (ADS-C) is used.
- A unique aspect of the RNP navigation specifications is that the accuracy is one of the performance characteristics that is monitored.



# Required Communication Performance

- A statement of communication performance necessary for a particular operation or service.
- Operationally derived and not based on any specific techniques, technologies and/or architecture.
- Defined for an operational communication transaction (two-way)
- Includes both human and technical elements
- Applies to both voice and data link communications





# Required Surveillance Performance

- Defines high-level surveillance system performance requirements.
- Operationally derived and not based on any specific techniques, technologies and/or architecture.
- Includes both ground and airborne systems.
- Supports a particular ATM application (e.g. reduced separation)

# RSP - *continued*

<b>RSP specification</b>	<b>Intended uses for which surveillance type is applicable</b>
<b>400</b>	<ul style="list-style-type: none"><li>- ADS-C or FMC WPR is the normal means of surveillance</li><li>-- <u>Lateral separation <math>\geq</math> 50 NM</u></li><li>-- <u>Time-based longitudinal separation (10 min or greater)</u></li></ul>
	<ul style="list-style-type: none"><li>- Technology other than HF voice radio provides an alternative means of surveillance, e.g. position reporting via satellite voice</li><li>-- Lateral separation = 30 NM</li><li>-- Reduced longitudinal separation minima</li></ul>
<b>180</b>	<ul style="list-style-type: none"><li>- ADS-C is the normal means of surveillance</li><li>-- Lateral separation = 30 NM</li><li>-- Reduced longitudinal separation minima</li></ul>

# RCP / RSP is not the same as RNP

Item	RNP	RCP / RSP
<b>Specifications</b>	exclusive to aircraft and operator	end-to-end system requirements
<b>Monitoring and alerting</b>	real time monitoring and alerting	real-time monitoring and alerting post-implementation monitoring (statistical) and corrective action
	aircraft and operator	shared between aircraft and ATSP / ATSU



# Enroute Monitoring

- ICAO Circular 343 requires monitoring of the following airspace features in order to satisfy the assumptions in the modelling:
- a) The variation of aircraft speed estimates as done by the ATC system must be monitored.
- b) No more than 2 percent of aircraft pairs should be within 5 NM of the separation standard.
- c) No more than 4 percent of aircraft pairs should be within 10 NM of the separation standard.
- d) No more than 6 percent of aircraft pairs should be within 15 NM of the separation standard.
- e) RCP 240 and RSP 180 are assumed with appropriate monitoring as described in Doc 10038 (PBCS Manual)

# References

- NAT Doc.007 (formerly the MNPSA Ops Manual)
- ICAO Doc.9574 – RVSM Manual
- ICAO Doc.9937 – RMA Manual
- Global Operational Datalink Document (GOLD)
- Oceanic Errors Safety Bulletin (OESB)
- DVD “*On the Right Track*”
- Sample Oceanic Check List
- Contingency procedures
- Data link guidance material
- Volcanic Ash



# QUESTIONS?