



NAT DOC 001

European and North
Atlantic Office

***Guidance and Information Material Concerning
Air Navigation in the North Atlantic Region***

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EUROPEAN AND NORTH ATLANTIC OFFICE OF ICAO

E-mail	:	icaoeurnat@paris.icao.int
Internet	:	www.icao.int/
Fax	:	+33 1 46 41 85 00
Mail	:	ICAO/OACI European and North Atlantic Office 3 bis, Villa Emile Bergerat 92522, Neuilly-sur-Seine, CEDEX FRANCE
PCO e-mail	:	natpco@btconnect.com
PCO web site	:	www.nat-pco.org

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GLOSSARY OF TERMS

AAD	Assigned Altitude Deviation
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ADF	Automatic Direction Finding
AFTN	Aeronautical Fixed Telecommunications Network
AGL	Above Ground Level
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AKD	Altitude Keeping Device
AMSS	Aeronautical Mobile Satellite Services
ASE	Altimetry System Error
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CDU	Control Display Unit
CFL	Cleared Flight Level
CMA	Central Monitoring Agency
CNS	Communication, Navigation and Surveillance
COSPAS	Space System for the Search of Vessels in Distress
CTA	Control Area
CTR	Control Zone
DCPC	Direct Controller Pilot Communications
DME	Distance Measuring Equipment
ELT	Emergency Locator Transmitter
ETA	Estimated Time of Arrival
EUR	European
FAA	Federal Aviation Administration
FIC	Flight Information Centre
FIR	Flight Information Region
FL	Flight Level
FMCS	Flight Management Computer System
FMS	Flight Management System
FTE	Flight Technical Error
GLONASS	Global Orbiting Navigation Satellite System
GMS	Global Positioning System Monitoring System
GMU	Global Positioning System Monitoring Unit
GNE	Gross Navigation Error
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	High Frequency

HMU	Height Monitoring Unit
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IGA	International General Aviation
INS	Inertial Navigation System
IR	Instrument Rating
IRS	Inertial Reference System
ISS	Inertial Sensor System
JAA	Joint Aviation Authorities
LIM/NAT RAN	Limited North Atlantic Regional Air Navigation Meeting
LORAN	Long Range Air Navigation
LRNS	Long Range Navigation System
LUT	Local User Terminal
MASPS	Minimum Aircraft System Performance Specification
MCC	Mission Control Centre
MET	Meteorological
MHz	Megahertz
MNPS	Minimum Navigation Performance Specifications
MNT	Mach Number Technique
MSL	Mean Sea Level
MTT	Minimum Time Track
NAT	North Atlantic
NATS	National Air Traffic Services Limited
NAT SPG	North Atlantic Systems Planning Group
NDB	Non Directional Beacon
NOTAM	Notice to Airmen
OAC	Oceanic Area Control Centre
OCA	Oceanic Control Area
OTS	Organized Track System
PEC	Position Error Correction
PPL	Private Pilot's Licence
PTS	Polar Track Structure
RA	Resolution Advisory
RGCSPP	Review of the General Concept of Separation Panel
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SAR	Search and Rescue
SARPS	Standards and Recommended Practices
SARSAT	Search and Rescue Satellite-Aided Tracking
SATCOM	Satellite Communications
SIGMET	Significant Meteorological Weather
SOTA	Shannon Oceanic Transition Area
SSEC	Static Source Error Connection
SSB	Single Side-band
SSR	Secondary Surveillance Radar

SST	Supersonic Transport
TCAS	Traffic Collision Avoidance System
TGL	Temporary Guidance Leaflet
TLS	Target Level of Safety
TMA	Terminal Manoeuvring Area
TSO	Technical Standard Order
TVE	Total Vertical Error
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	Very High Frequency Omni-directional Range
VSM	Vertical Separation Minimum
WATRS	West Atlantic Route System

LIST OF DEFINITIONS

The following definitions are intended to clarify specialised terms used in this Document.

Altimetry system error (ASE).

The difference between the altitude indicated on the altimeter display, assuming a correct altimeter barometric setting, and the pressure altitude corresponding to the undisturbed ambient pressure.

Altimetry system error distribution.

The distribution of an aggregate altimetry system error.

Assigned altitude deviation (AAD).

The difference between the transponded Mode C altitude and the assigned altitude/flight level.

Automatic altitude-keeping device.

Any equipment that is designed to automatically control the aircraft to a referenced pressure altitude.

Collision risk.

The expected number of mid-air aircraft accidents, in a prescribed volume of airspace, for a specific number of flight hours, due to loss of planned separation. (Note: one collision is considered to produce two accidents).

Flight technical error (FTE).

Difference between the altitude indicated on the altimeter display being used to control the aircraft and the assigned altitude/flight level.

Gross Navigation Error (GNE).

A lateral deviation from a cleared route equal to or greater than 25 NM.

Height-keeping capability.

Aircraft height-keeping performance, which can be expected under nominal environmental operating conditions, with proper aircraft operating practices and maintenance.

Height-keeping performance.

The observed performance of an aircraft with respect to adherence to cleared flight level.

International General Aviation (IGA).

Aircraft not operated under Public Transport regulations e.g. business aircraft.

Non-compliant aircraft.

An aircraft configured to comply with the requirements of the altimetry Minimum Aircraft System Performance Specification (MASPS) which, through height monitoring, is found to have a Total Vertical Error (TVE) or an AAD of 300 m (1 000 ft) or greater, or an ASE deviation of 80 m (245 ft) or greater.

Occupancy.

A parameter of the collision risk model which is twice the count of aircraft proximate pairs in a single dimension divided by the total number of aircraft flying the candidate paths in the same time interval.

Operational error.

Any deviation of an aircraft from its nominally cleared flight path as a result of incorrect action by ATC or the aircraft crew.

Passing frequency.

The frequency of events in which two aircraft are in longitudinal overlap when travelling in the opposite or same direction on the same route at adjacent flight levels and at the planned vertical separation.

Position error.

As for static source error.

RVSM Airspace.

That airspace at and above FL290, where a Vertical Separation Minimum (VSM) of 300 m (1 000 ft) is applied.

Static source error.

The difference between the pressure sensed by the static system at the static port and the undisturbed ambient pressure.

Static source error correction (SSEC).

A correction, which may be applied to compensate for, the static source error associated with an aircraft.

Target level of safety (TLS).

A generic term representing the level of risk that is considered acceptable in particular circumstances.

Total vertical error (TVE).

Vertical geometric difference between the actual pressure altitude flown by an aircraft and its assigned pressure altitude (flight level).

Vertical separation.

Vertical separation is the spacing provided between aircraft in the vertical plane to avoid collision.

FOREWORD

i. BACKGROUND

i.1 This Document is an updated version of the guidance material that was prepared to comply with Recommendation 1.2/8 of the 1976 Limited North Atlantic Regional Air Navigation (LIM NAT RAN) Meeting that required ICAO to issue "Guidance and Information Material concerning Air Navigation in the North Atlantic Region".

i.2 This Edition incorporates full details on Reduced Vertical Separation Minimum (RVSM), implemented in phases in the North Atlantic (NAT) Region since March 1997 and due to be completed circa January 2002. RVSM details which were contained in *NAT DOC 002, "Guidance Material on the Implementation of a 300 m (1000 ft) Vertical Separation Minimum in the Minimum Navigation Performance Specification (MNPS) Airspace of the North Atlantic Region"*, are now contained in this Document. RVSM guidance material was prepared to comply with Recommendation 2/12 and Conclusion 2/17 of the 1992 LIM NAT RAN Meeting.

ii. PURPOSE

ii.1 The guidance and information material contained in this Document concerns flight operations in the NAT Region. It deals primarily with approval for operations in the NAT Region and with the planning and management of such operations. It is addressed mainly to State aviation authorities/administrations and to Air Traffic Services (ATS) Provider States¹ and Operators.

ii.2 Some of the material in this Document will be of interest to pilots; however, more detailed information for pilots is published in the *"North Atlantic MNPS Airspace Operations Manual"* (issued by the European and North Atlantic Office (EUR/NAT) of ICAO) and in the *"North Atlantic International General Aviation Operations Manual"* (issued by the Federal Aviation Administration (FAA)). These two Manuals are produced on behalf of the North Atlantic Systems Planning Group (NAT SPG²) and, although primarily intended for use by pilots, it is important that they are also used by Operators to ensure that aircrew for whom they are responsible are adequately trained and equipped for NAT operations.

ii.3 This guidance material does not contain everything relevant to air navigation in the NAT Region. In particular, it is important that reference be made to State *Aeronautical Information Publications (AIPs)* and/or regulations. For current information on the relevant documents to access and where they can be obtained from each ATC Provider, refer to Appendix D. Appropriate worldwide developments and those of a regional nature, resulting from meetings of the NAT SPG, are reflected in amendments which will be prepared and distributed by the EUR/NAT Office of ICAO.

ii.4 It is intended that this Edition of NAT DOC 001 will assist States to fulfil their responsibilities by ensuring that their aircraft are properly certified to operate in accordance with specified procedures, in particular, with those procedures applicable to MNPS and RVSM operations.

¹ **Provider States:** Those States that provide ATS within the NAT Region, which are: Canada, Denmark, Iceland, Ireland, Norway, Portugal, the United Kingdom and the United States.

² The NAT SPG is a North Atlantic regional planning body established under the auspices of the International Civil Aviation Organisation (ICAO). This Group is responsible for developing the required procedures, services, facilities, plus aircraft and Operator approval standards employed in the NAT Region.

iii. ORGANISATION OF THE DOCUMENT

iii.1 This Document consists of Parts 1 to 9, which provide the requisite guidance for the NAT Region, MNPS and RVSM Airspace; and Appendices A to E, which contain supporting information such as charts, formats of reports and contact details.

iii.2 **Part 1** - provides insight into what comprises the NAT Region and the principal airspaces within it. i.e. MNPS and RVSM Airspace. It also describes the various route structures within and adjacent to the NAT Region.

Part 2 – outlines the main requirements and procedures (including specialised procedures) to be able to operate in the NAT Region.

Part 3 – outlines the main requirements and procedures (including specialised procedures) to be able to operate specifically in MNPS and RVSM Airspace.

Part 4 – covers the regulatory aspects of MNPS and RVSM approvals.

Part 5 – presents, once aircraft are approved, how they are monitored for compliance and the role of the Central Monitoring Agency (CMA).

Part 6 – covers the rules associated with Airspace Reservations.

Parts 7 to 9 – provide short summaries of the main requirements in the NAT Region for: Formation Flying and Missile Activity (Part 7), Manned Balloon Flight (Part 8) and Search and Rescue (SAR) (Part 9).

iv. FUTURE PLANS

iv.1 The Air Traffic Management (ATM) System within the NAT Region is continually reviewed in the light of existing structural system shortcomings, the anticipated evolution of air traffic demand and technological advances in airborne and ground based systems. The major shortcoming affecting the vast majority of the NAT Region is the lack of real-time surveillance that severely limits airspace capacity and imposes significant constraints on aircraft flight profiles.

iv.2 The introduction of satellite Communications, Navigation and Surveillance (CNS) systems will provide the capability to improve the efficiency, integrity and capacity of the NAT ATM system. The NAT SPG aims to take advantage of new technology, in particular Aeronautical Mobile Satellite Services (AMSS), and achieve a smooth evolution from the present ATM system into the future NAT ATM system.

v. CONTACT INFORMATION

v.1 This Document will be placed on a number of 'Web Sites' and made available to users via the Internet. It is accessible (as is the '*North Atlantic MNPS Airspace Operations Manual*') on the following 'Web Site': <http://www.nat-pco.org>. Comments to be addressed to the NAT Programme Co-ordination Office (NAT PCO).

PART 1

1. CONCEPTS AND DEFINITION OF THE AIRSPACE WITHIN THE NAT REGION

1.1 Airspaces Within the NAT Region

1.1.1 The NAT Region comprises the following Flight Information Regions (FIRs) as shown in the chart at Appendix A-1:

- Bodø Oceanic
- Gander Oceanic
- New York Oceanic
- Reykjavik
- Santa Maria Oceanic
- Shanwick Oceanic
- Søndre Strømfjord

1.1.2 Most of the airspace in these FIRs is termed High Seas airspace, within which the ICAO Council has resolved that rules relating to the flight and operation of aircraft apply without exception. Responsibility for the enforcement of these rules rests with the State of Registry of the aircraft or the State of the Operator. The majority of the airspace is Class "A" airspace³, and Instrument Flight Rules (IFR) rules apply to all flights when at/or above FL 60 or 600 m (2000 ft) AGL, whichever is the higher. All remaining airspace in the NAT Region that is not Class "A" is normally classified as Class "G" airspace (where IFR and Visual Flight Rules (VFR) flights are permitted and receive flight information and alerting service if requested).

1.1.3 These airspaces include:

- the New York Oceanic, Gander Oceanic, Shanwick Oceanic, Santa Maria Oceanic areas;
- the Bodø Oceanic FIR when operating more than 100 NM seaward from the shoreline above FL 195;
- Søndre Strømfjord FIR when operating outside the shoreline of Greenland;
- Reykjavik FIR when operating in the Oceanic Sector, or in the Domestic Sector at or above FL 200; and
- the Shannon Oceanic Transition Area (SOTA)⁴.

1.1.4 MNPS Airspace shall be applicable in that volume of the NAT airspace between FL 285 and FL 420 within the Oceanic Control Areas (OCA) of: Santa Maria, Shanwick, Reykjavik, Gander and New York, excluding the area West of 60°W and South of 38°30'N.

³ In Class "A" airspace, IFR flights only are permitted. These are subject to air traffic control services that keep aircraft separated from each other.

⁴ The SOTA is a portion of Shanwick OCA to the South of Ireland within which air traffic services are provided by Shannon Area Control (ACC) Centre. Communications with aircraft are by means of Very High Frequency (VHF), and a Secondary Surveillance Radar (SSR) service is provided. The SOTA remains an integral part of the Shanwick OCA and MNPS procedures and requirements apply.

1.1.5 From circa January 2002, RVSM will be fully implemented within the geographic extent of the NAT Region. When this happens, RVSM levels will be from FL 290 to FL 410 inclusive. MNPS Airspace will then become a full subdivision of RVSM Airspace. At the time this Edition of the Manual was produced however, RVSM was in the second phase of its implementation, between FL 310 and FL 390 inclusive, within MNPS Airspace and designated transition areas only.

1.1.6 All aircraft operating within MNPS Airspace are required to have a specified minimum navigation performance capability and to be in possession of an MNPS approval issued by either the State of Registry or the State of the Operator, as appropriate.

1.1.7 Furthermore, aircraft operating in RVSM Airspace are required to be compliant with the Minimum Aircraft Performance Specification (MASPS) and hold an associated RVSM approval issued by either the State of Registry or the State of the Operator.

1.1.8 Aircraft with MNPS approval only may not cruise at flight levels that are designated for RVSM operations. An RVSM approval issued for the NAT Region does not automatically incorporate the MNPS approval but is valid for operation in RVSM Airspace globally.

1.1.9 Within the NAT Region a volume of airspace can be established for special, usually military, use. Such airspace is known as an "Airspace Reservation". This reservation can either be stationary or moving depending on whether its position remains fixed with relation to the surface of the earth or whether its position in space changes with time (see Part 6).

1.2 Required Navigation Performance

1.2.1 In order to ensure that a particular segment of airspace or route structure is safe to operate in, it is necessary to precisely define the required level of performance of aircraft systems. With regard to horizontal navigation performance, airspace is increasingly being defined in terms of a Required Navigation Performance (RNP) - a concept developed by the ICAO Review of the General Concept of Separation Panel (RGCSPP), with a view to enhancing air traffic system capacity and efficiency. The RNP types specify only the navigation performance accuracy of all the user and navigation system combinations within an airspace: they do not specify any other requirements of the navigation system such as, for example, reliability. The navigational accuracy requirement for a given RNP airspace is expressed as a containment value. For example, in airspace designated as RNP 10, the containment value is 10 Nautical Miles (NM) and is equivalent to the distance from the intended position (on the route centre-line) within which flights would be contained for at least 95% of their total flying time in that specific piece of airspace.

1.3 The MNPS Concept

1.3.1 In the NAT Region, the requirement for a given standard of navigation performance has long been recognised. It was because of such a requirement that the concept of a MNPS was introduced in 1976, to allow for a reduction in track spacing from 120 to 60 NM. In effect, MNPS was the forerunner to RNP, though unlike RNP it not only specifies the position accuracy that an aircraft is required to achieve, but it also takes into account the availability and reliability of navigational information by setting out a requirement for the carriage of specific navigational equipment. (MNPS Airspace as it has been established in the NAT Region would, if RNP were to be applied, be designated RNP 12.6).

1.4 MNPS Operations

1.4.1 ICAO Standards and Recommended Practices (SARPS) for the operation of aircraft state that for flights in defined portions of airspace where, based on Regional Air Navigation Agreements, MNPS operations are prescribed, an aeroplane shall be provided with navigation equipment which:

- a) continuously provides indications to the flight crew of adherence to or departure from track to the required degree of accuracy at any point along that track; and
- b) has been authorised by the State of the Operator or the State of Registry responsible for MNPS operations.

1.4.2 Since its inception in 1965, the NAT SPG has been developing methods and procedures allied to the safe separation between aircraft in the NAT Region. In 1975, the NAT SPG proposed establishing an MNPS to enable a reduction in lateral separation minima for all suitably equipped aircraft. The rationale and foundation for MNPS is based on a mathematical model that expresses a relationship between collision risk and separation.

1.4.3 The integrity of MNPS Airspace is maintained by a series of procedures dealing with the approval and operation of navigation equipment, plus the continuous monitoring of aircraft navigation accuracy within the MNPS Airspace. It is implicit in the concept of MNPS and essential to the application of the lateral separation minimum that all operations in MNPS Airspace, be they by Public Transport, International General Aviation (IGA) or State aircraft, achieve the highest standards of navigation performance accuracy.

1.4.4 An aircraft which is approved for operations within NAT MNPS Airspace shall have a navigation performance capability such that:

- a) the standard deviation of lateral track errors shall be less than 6.3 NM (11.7 km);
- b) the proportion of total flight time spent by the aircraft 30 NM (55.6 km) or more off the cleared track shall be less than 5.3×10^{-4} ;
- c) the proportion of total flight time spent by the aircraft between 50 and 70 NM (92.6 and 129.6 km) off the cleared track shall be less than 13×10^{-5} .

1.5 Minimum Aircraft System Performance Specification

1.5.1 In addition to having the capability to maintain high levels of horizontal navigation accuracy it is essential that aircraft are also able to achieve a high standard of vertical navigation performance, particularly at RVSM designated levels within the NAT Region. At a technical airworthiness level, this is achieved by compliance with the altimetry MASPS which, amongst other things, specify requirements for a maximum value of Altimetry System Error (ASE) for two independent altimetry systems comprising an altitude alerting system and an automatic altitude control system. The MASPS were formulated in close liaison with the manufacturers of avionics equipment; all new commercial aircraft types capable of operating at/or above FL 290 are, as a general rule, built to a technical standard that complies with the requirements of the MASPS. For aircraft not compliant at manufacture, service bulletins have been produced by the manufacturers and approved by the appropriate certifying authorities.

1.6 Flight at RVSM Levels

1.6.1 Aircraft which operate at RVSM levels must, in addition to the navigation system requirements set out above, also meet the global height keeping performance specification as developed by ICAO. The global height-keeping performance specification applies to the aggregate of height-keeping errors of individual aircraft and simultaneously satisfies the following four requirements:

- a) the proportion of height-keeping errors beyond 90 m (300 ft) in magnitude is less than 2.0×10^{-3} ;

- b) the proportion of height-keeping errors beyond 150 m (500 ft) in magnitude is less than 3.5×10^{-6} ;
- c) the proportion of height-keeping errors beyond 200 m (650 ft) in magnitude is less than 1.6×10^{-7} ; and
- d) the proportion of height-keeping errors between 290 m and 320 m (950 ft and 1050 ft) in magnitude is less than 1.7×10^{-8} .

1.6.2 The following requirements for ASE were developed to satisfy the global height-keeping performance and form the basis of the altimetry MASPS. They are applicable statistically to individual groups of nominally identical aircraft operating in the airspace. They describe the performance that the groups need to be capable of achieving in service, exclusive of human factors and extreme environmental influences, if the airspace system Total Vertical Error (TVE) requirements are to be satisfied. The narrower tolerance in item b) is specifically to allow for some degradation with increasing age:

- a) the mean residual position error (static source error) of the group shall not exceed ± 25 m (± 80 ft);
- b) the sum of the absolute value of the mean ASE for the group and three standard deviations of ASE within the group, shall not exceed 60 m (200 ft); and
- c) each individual aircraft in the group shall be built to have an ASE contained within ± 60 m (± 200 ft).

1.6.3 The above are for illustrative purposes only. The complete MASPS are complex and include detailed specifications and procedures for the separate aspects of type approval, release from production and continued airworthiness. They are published in the latest version of Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL) No. 6 - Revision 1, "*Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above Flight Level 290 where a 300 m (1,000 ft) Vertical Separation Minimum is Applied*" and in Federal Aviation Administration (FAA) Document '91-RVSM', "*Interim Guidance Material on the Approval of Operations/Aircraft for RVSM Operations*".

1.7 Carriage and Operation of Pressure-Altitude reporting SSR Transponders

1.7.1 All aircraft operating as IFR flights in the NAT Region shall be equipped with a pressure-altitude reporting SSR transponder. Pilots shall operate their aircraft transponders continuously on Mode A. The last assigned SSR code shall be retained for 30 minutes after entry into NAT oceanic airspace, unless otherwise instructed by ATC. Thereafter Mode A shall be selected to Code 2000, except for departing aircraft that shall have their last assigned code retained for 30 minutes. This procedure does not affect use of the special purpose emergency codes 7500, 7600 or 7700, when required.

1.8 Carriage and Operation of Airborne Collision Avoidance System (ACAS) II

1.8.1 ACAS II shall be carried and operated in the NAT Region by all aircraft which meet the following criteria:

- a) with effect from 31 March 2001, all turbine engine aeroplanes having a maximum certificated take-off mass exceeding 15000kg (33000lbs) or authorized to carry more than 30 passengers; and

- b) with effect from 1 January 2005, all turbine engine aeroplanes having a maximum certificated take-off mass exceeding 5700 kg (12500lbs) or authorized to carry more than 19 passengers.

1.9 Use of an Air-to-Air Frequency

1.9.1 The VHF emergency frequency 121.5 is not authorized for routine use; however frequency 123.45 MHz (formerly 131.8 MHz) has been designated for use as the air-to-air communication channel in the NAT and all other ICAO Regions.

1.10 Use of Satellite Communications (SATCOM)

1.10.1 Aircraft equipped with SATCOM should restrict the use of such equipment, for contacting ATC, to emergencies and non-routine messages.

1.11 Time Keeping

1.11.1 Aircraft clock errors resulting in position report time errors can lead to an erosion of actual longitudinal separation between aircraft. It is thus vitally important that prior to entry into the NAT Region, the time reference system(s) to be used during the flight for calculation of waypoint Estimated Times of Arrival (ETA) and waypoint Actual Times of Arrival (ATA) shall be synchronised to Co-ordinated Universal Time (UTC). All ETAs and ATAs passed to ATC shall be based on a time reference that has been synchronised to UTC or equivalent. Acceptable sources of UTC include:

- a) WWV – National Institute of Standards and Technology (NIST-Fort Collins, Colorado). WWV operates 24 hours a day on 2500, 5000, 10000, 15000, 20000 KHz (AM/SSB) and provides UTC voice every minute;
- b) Global Positioning System (GPS) (corrected to UTC) – Available 24 hours a day to those pilots who can access the time signal over their shipboard GPS equipment;
- c) CHU – National Research Council (NRC) – Available 24 hours/day on 3330, 7335 and 14670 KHz (SSB). In the final ten-second period of each minute, a bilingual station identification and time announcement is made. Since April 1990, the announced time is UTC;
- d) BBC – British Broadcasting Corporation (United Kingdom). The BBC transmits on a number of domestic and worldwide frequencies and transmits the Greenwich time signal (referenced to UTC) once every hour on most frequencies, although there are some exceptions; or
- e) any other source shown to the State of Registry or State of Operator (as appropriate) to be an equivalent source of UTC.

1.12 The Route Structure

Characteristics of the Airspace

1.12.1 Within the NAT Region there are both civil and military air traffic operations; civil operations include both supersonic and subsonic commercial flights and IGA traffic.

1.12.2 Due to passenger demands, time zone differences and airport noise restrictions, much of the North Atlantic air traffic contributes to one of two flows: a Westbound flow departing Europe in the morning, and an Eastbound flow departing North America in the evening. The effect of these flows is to concentrate most of the traffic unidirectionally with peak Westbound traffic operating between 1130 and 1800 UTC, and peak Eastbound traffic operating between 0100 and 0800 UTC, both at 30°W.

1.12.3 Additional constraints which include a necessary horizontal separation criteria and a limited economical height band add to congestion in the airspace. Airspace utilisation is improved by strategic use of "opposite direction" flight levels during periods of peak flow. Utilisation is further improved by the application of 'Mach Number Technique' (MNT) whereby aircraft operating successively along suitable routes maintain an appropriate Mach Number for a relevant portion of that flight. Experience has shown that when MNT is used for two or more aircraft operating on the same route, at the same flight level, they are more likely to maintain constant longitudinal separation between each other than when using other methods.

1.12.4 To provide the best service to the bulk of the traffic whilst taking into account the variability of the weather, a system of organized tracks is constructed every 12 hours. All known factors are taken into account in order to accommodate as many aircraft as possible and to offer Operators a choice of economically viable routes as close as possible to their minimum cost paths.

1.12.5 The two most important track systems within MNPS Airspace are the Organised Track System (OTS) and the Polar Track System (PTS), although it is not mandatory to route on either of them specifically. Traffic, which flies on other than these structured tracks, is said to fly on Random Routes. Pilots and Operators should be aware though that, to ensure maximum capacity utilisation, preferential treatment level and route priority is given to aircraft flying along OTS and PTS routes. They should therefore consider either following them, or joining them at a suitable point, if it is operationally feasible.

The Organized Track System (OTS)

1.12.6 After determination of basic Minimum Time Tracks (MTTs), with due consideration for airlines' preferred routeings, airspace restrictions such as Danger Areas, and airspace reservations, the OTS is constructed by the appropriate Oceanic Area Control Centre (OAC). The night-time (Eastbound) OTS is originated by Gander OAC and the daytime (Westbound) OTS by Shanwick OAC (Prestwick), each taking into account tracks that New York, Reykjavik and/or Santa Maria may require in their respective OCAs. In each case, OAC planners consult each other, co-ordinate as necessary with adjacent OACs and domestic ATC agencies and ensure that the proposed system is viable for lateral and vertical separation criteria. They also take into account the anticipated requirements of opposite direction traffic and ensure that sufficient track/flight level profiles are provided to satisfy anticipated traffic demand. The impact on domestic route structures and the serviceability of transition area radars and nav aids are checked before the OTS is finalised.

1.12.7 The agreed OTS is then promulgated as a NAT Track Message via the Aeronautical Fixed Telecommunications Network (AFTN), to all interested agencies. A typical time of publication for the Westbound OTS is 0000 UTC and for the Eastbound OTS is 1200 UTC. This message gives full details of organized track co-ordinates as well as flight levels expected to be in use on each track. All aircraft operating in or above MNPS Airspace are required to carry a copy of the current OTS Message. Its correct interpretation by Operators and pilots is essential to both economy of operation and in minimising the possibility of a misunderstanding which could lead to the use of incorrect track co-ordinates.

1.12.8 Flights which operate outside the OTS, or which join or leave an organized track at some intermediate point, are considered to be random route aircraft.

The Polar Track Structure (PTS)

1.12.9 Like other NAT traffic flows, traffic on the Europe-Alaska axis is predominantly unidirectional. In the Reykjavik CTA the Westbound peak is between 1200 and 1800 UTC and in the Bodø CTA it is between 0900 and 1800 UTC. The Eastbound peak is between 0001 and 0600 UTC in both the Reykjavik and the Bodø CTAs. To facilitate this traffic flow during peak periods and to avoid a multiplicity of random routes, a PTS consisting of 10 fixed tracks has been established in the Reykjavik CTA; five tracks continue into or through the Bodø CTA. The Upper Papa area navigation routes (UP routes) listed in the EUR Air Navigation Plan constitute a continuation of the relevant PTS routes. (Reference should be made to *AIPs Iceland and Norway* for charts and updated information on the PTS).

1.12.10 Although not mandatory, flights planning to operate on the Europe - Alaska axis at FL 310 - 390 inclusive during peak periods are strongly recommended to submit flight plans in accordance with one of the promulgated PTS tracks.

1.13 Other Routes and Route Structures Within or Adjacent to NAT MNPS

General

1.13.1 When NAT MNPS Airspace was introduced, it was recognised that some special procedures and routes were needed. Procedures were required for aircraft suffering partial loss of their full navigational capability (see further on this in Part 3) whilst account had to be taken of those aircraft operating along a number of relatively short-range routes within MNPS Airspace. Further experience showed that account also had to be taken of aircraft not equipped with HF radio. Flights operating along these special routes (shown below) still however need State approval to operate within MNPS Airspace and must meet MNPS requirements.

Routes for Aircraft With only One Long Range Navigation System (LRNS)

1.13.2 Aircraft operating in MNPS Airspace require two functional LRNS (see Part 4). However a number of special routes have been developed for aircraft equipped with only one LRNS. **It is emphasised that these routes are within MNPS Airspace and State approval to flight plan and fly along them is required.** Aircraft which are equipped with normal short range navigation equipment (VOR/DME, ADF) and at least one fully operational LRNS should be considered capable of meeting the MNPS while operating along the routes listed below*:

- | | | |
|----|---|---|
| a) | Stornoway/
Benbecula | - 60°N10°W – 61°N12°34'W – ALDAN – Keflavik (HF is required on this route);
- 61°N10°W - ALDAN – Keflavik (VHF coverage exists and, subject to prior co-ordination with Scottish Airways and Reykjavik, this route can be used by non HF equipped aircraft); |
| b) | Machrihanish/
Glasgow/
Shannon/
Belfast | - 57°N10°W – 60°N15°W – 61°N16°30'W - BREKI - Keflavik (HF is required on this route); |
| c) | Keflavik - GIMLI - DA (Kulusuk) – Søndre Strømfjord – Kuujuuaq; | |

* Routes a) to g) are known as “Blue Spruce” routes and it has been determined that continuous VHF coverage exists on these routes at FL 300 and above except as noted: (see charts in Appendices A-3 to A-5 for VHF coverage in the NAT Region at FL 100, FL 200 and FL 300 respectively).

- d) Keflavik - EMBLA – 63°N30°W – 61°N40°W – Prins Christian Sund;
- e) Prins Christian Sund – 59°N50°W – PRAWN – Nain;
- f) Prins Christian Sund – 59°N50°W – PORGY – Hopedale;
- g) Prins Christian Sund – 58°N50°W – LOACH – Goose Bay;
- h) Cork LASNO – BEGAS – Santiago or Asturias VOR;
Lands End – Gapli (HF is required on this route);
- i) Funchal/Porto Santo – Santa Maria/Ponta Delgada/Lajes;
- j) Lisboa/Porto/Faro – Ponta Delgada/Santa Maria/Lajes;
- k) between Greenland and Canada:
 - Søndre Strømfjord NDB - 67°N60°W - YXP (Pangnirtung);
 - Kook Islands NDB - 66°N60°W - YXP (Pangnirtung);
 - Kook Islands NDB - 64°N60°W - 64°N63°W (LESAM) - Kuujuaq;
- l) between Iceland and Greenland:
 - Reykjaneskoli NDB - 69°30'N22°40'W - Constable Pynt NDB.

The West Atlantic Route System

1.13.3 An extensive network of routes linking points from North America to the Caribbean and South America are defined in the New York OCA to the West of 60°W. This network of traffic flows is known as the West Atlantic Route System (WATRS) and is orientated predominately Southbound between 1100 and 1500 UTC and Northbound between 1900 and 2200 UTC. There are also traffic flows crossing the WATRS that are transiting to or from Europe - the Westbound flow occurring between 1500 and 1800 UTC and the Eastbound flow occurring between 2300 and 0300 UTC.

Supersonic Transport Route Structure

1.13.4 The SST Route structure comprises four fixed tracks: SM, SN, SO and SP. SST flights on these tracks normally operate above MNPS Airspace (FL 450+), the exceptions being in the event of a delayed supersonic acceleration or an emergency descent. In the first case, standard separation is applied by ATC; in the latter case, emergency descent contingency procedures take into account the possible existence of OTS traffic operating below the SST tracks.

1.13.5 Full information on the special contingency procedures for supersonic aircraft flying in the NAT Region can be found in the 'NAT/RAC' Section of the ICAO "Regional Supplementary Procedures", (Doc.7030).

Routes for Aircraft with Short Range Navigation Equipment only

1.13.6 The following routes may be flown by aircraft with short-range navigation equipment (VOR/DME, ADF) only but **State approval for operation within MNPS Airspace is still necessary**.

- a) Flesland - Valdi - Myggenes - INGO - Keflavik (UN623 to VALDI, then G3);
- b) Sumburgh - SIDER - Akraberg - Myggenes (UG11 to SIDER, then G11).

PART 2

2. OPERATIONS WITHIN THE NAT REGION

2.1 Introduction

2.1.1 This Part of the Document outlines the main requirements and procedures (including specialised procedures) needed to operate in the NAT Region. Some or all of this information will apply to flights operating within MNPS Airspace and RVSM airspace (covered specifically in Part 3).

2.1.2 Aircraft operating in the NAT Region may do so either within or outside MNPS Airspace. For operations within MNPS Airspace, a specific approval from the State of Registry or the State of the Operator is required regardless of the category of the Operator. i.e. State, IGA or Public Transport. This Part of the Guidance Material primarily provides information on flight planning and operation of flights to pilots wishing to operate outside MNPS Airspace. i.e. below FL 285 or above FL 420. Pilots wishing to operate above FL 420 should take particular note of the climb/descent provisions in Part 3.

2.1.3 A number of incidents have occurred due to some NAT IGA flights not being in compliance with basic requirements for navigation and communications equipment on oceanic flights or flights over remote areas. Most of these incidents are potentially hazardous to aircraft occupants and to SAR personnel who are sent to find them. Some have resulted in needless alerting on the part of ATC and in expensive search activities on the part of the SAR services.

2.1.4 Reduction or elimination of such incidents, which have generally involved flights considerably off-course or which have not reported their position as required, is needed so that unnecessary expenditure of resources is prevented. In support of this, the NAT SPG first published in October 1990 the "*North Atlantic International General Aviation Operations Manual*". IGA pilots planning to operate across the NAT Region are strongly advised to obtain a copy of the current edition from their State authority or ICAO.

2.2 The NAT Operational Environment

2.2.1 The climate affecting NAT flight operations is demanding throughout the year, with storms or other adverse weather likely to be encountered during any season. It is probable that at least a portion of the route will be affected by adverse weather conditions, at any time.

2.2.2 The lack of suitable alternate aerodromes available to trans-Atlantic flights requires that all significant weather systems along the route be considered during flight planning.

2.2.3 LORAN-C coverage within the NAT Region, for navigation purposes, is incomplete in many areas (see chart at Appendix A-6).

2.2.4 Several high power non-directional radio beacons are located in the NAT Region and are useful to ADF-equipped aircraft. Some of these stations however, including commercial band transmitters, are not monitored for outages or from interference by transmitters on adjacent frequencies, and may be severely affected by atmospheric conditions.

2.2.5 VHF communications coverage extends to line-of-sight distance from facilities in the Azores, Canada, Faroe Islands, Greenland, Iceland, Norway and coastal Europe. Canadian VHF coverage is extended by use of a remote facility in southern Greenland (see charts at Appendices A-3 to A-5).

2.2.6 HF communications are available throughout the NAT Region for ATC purposes and HF is mandatory for flights within the Shanwick OCA. The use of HF by pilots on IGA flights permits proper monitoring of flight progress.

2.2.7 HF equipped flights should be able to receive HF VOLMET broadcasts, which contain continual updates on the meteorological situation at major terminals in Europe and North America, plus SIGMET warnings.

2.2.8 SAR vessels and aircraft are stationed at some locations in the NAT Region although SAR aircraft may not always be available.

2.3 Pilot Qualification Requirements

2.3.1 The minimum pilot qualification for any flight across the NAT is a Private Pilot Licence (PPL). An Instrument Rating (IR) is required if operating at FL 60 or above. Some States require pilots to hold an IR to operate at any altitude in the NAT Region; therefore it is imperative that pilots be acquainted with States varying legislative requirements. Irrespective of the mandatory requirements, it is strongly recommended that all pilots hold a valid IR.

2.3.2 The demanding nature of the NAT operational environment requires that the pilot-in-command has, in addition to cross-country flight time, the following flight experience:

- a) that stipulated by the State of Registry for the pilot-in-command; and
- b) adequate recent flight experience in the use of long-range navigation and communications equipment.

2.4 Regulatory Requirements for North Atlantic Flights

National Regulations

2.4.1 Pilots must comply with regulations imposed by the State of Registry of the aircraft being flown.

2.4.2 Pilots must also comply with regulations of States in which they land or overfly. In particular, AIPs for these States should be checked prior to departure, for information on NAT operations.

Flight Rules Over the High Seas

2.4.3 ICAO Contracting States have agreed that the flight rules that apply over the High Seas will be those established by ICAO. However, responsibility for enforcement of these rules rests with the State of Registry of the aircraft or State of the Operator. The flight rules are contained in *ICAO Annex 2, (Rules of the Air)*, and procedural aspects are covered in *ICAO "Procedures for Air Navigation - Rules of the Air and Air Traffic Services (PANS RAC)", (Doc.4444)* and the *ICAO "Regional Supplementary Procedures", (Doc.7030)*. Some of the procedural requirements are outlined below (paraphrased):

- all flights which cross international borders must file a flight plan*;
- all flights must file an IFR flight plan when intending to fly in NAT airspace at FL 60 and above in the New York, Gander, Shanwick, Santa Maria and Reykjavik Oceanic FIRs; at FL 60 and above in the Bodø Oceanic FIR beyond 100 NM seaward from the shoreline; and at FL 200 and above in the Sondrestrom FIR;

- while enroute, all changes to IFR flight plans shall be reported as soon as practicable to the appropriate ATS unit as prescribed; and
- an arrival report must be sent to the appropriate ATS unit. When the flight plan cannot be closed by means of the aircraft radio, a message should be sent by another means (i.e. telephone). Failure to close flight plans may result in needless SAR operations.

Note: A copy of United Kingdom Aeronautical Information Circular (AIC) 60/1999, containing 'Instructions for the completion of the ICAO Flight Plan Form to specifically comply with the NAT Requirements', can be found as an Attachment to the "North Atlantic MNPS Airspace Operations Manual".

Operation of Aircraft

2.4.4 In general, ICAO Contracting States have agreed that registered aircraft shall comply with SARPS, as contained in *ICAO Annex 6 (Operation of Aircraft)*, and in the ICAO "*Procedures for Air Navigation Services - Aircraft Operations*", *Volume 1 (PANS OPS)*, (Doc.8168), as a minimum. Some pertinent extracts from the preceding documents follow.

Flight Preparation

2.4.5 Before commencing a flight, the pilot-in-command must be satisfied that the aircraft is airworthy, duly registered, and that appropriate certificates are on board. The pilot-in-command should also ensure that:

- instruments and equipment are appropriate for the operation, considering expected flight conditions;
- meteorological information relevant to the flight is obtained and evaluated with regard to the planned route, destination and for alternative courses of action;
- maps and charts which are current and suitable for the flight, including alternative routes, must be available on the aircraft;
- SAR information, including location of facilities and procedures to be used, should be obtained; and
- NOTAMs should be checked prior to departure with regard to the status of radio navigation aids and aerodrome restrictions.

2.4.6 Night operations can present additional problems that must be provided for. These could include increased navigation difficulties, fatigue, more demanding pilot skills, and other factors.

2.4.7 In addition to national AIPs, commercial publications are available which provide operational information, particularly with respect to the requirements for the carriage of survival equipment.

Equipment Requirements

2.4.8 Life rafts will be carried when single-engined aircraft operate more than 100 NM from shore, and when multi-engined aircraft operate more than 200 NM from shore. They shall contain:

- a) pyrotechnic distress signals;
- b) food and water; and
- c) a VHF survival radio.

2.4.9 On trans-Atlantic flights, an aeroplane shall be equipped with navigation equipment that will enable it to proceed in accordance with the flight plan and to abide by the requirements of ATS as well as MNPS and RVSM when operating in such airspace.

2.4.10 In controlled airspace, flights must be able to conduct two-way radio communications on required frequencies. In the Gander, Shanwick, Santa Maria, Reykjavik, Sondrestrom and New York FIRs, HF radio is required in order to contact ATS units when beyond the range of VHF. Subject to prior arrangement, VHF only flights may be made via Canada/Greenland/Iceland/Europe, provided that the Shanwick OCA is avoided (see applicable AIPs and appropriate sections in Part 3 of this Manual).

Special Requirements for Canadian Departures

2.4.11 Canadian Aviation Regulations specify the requirements for all flights beginning their trans-Atlantic operation from Canada. Since most Eastbound trans-Atlantic flights by light aircraft will commence their oceanic crossing from Canada, specific equipment is mandatory.

2.4.12 Information on equipment requirements may be obtained from:

Transport Canada Safety and Security
Regional Manager, General Aviation
P.O. Box 42
Moncton, New Brunswick
Canada EIC 8K6
Fax: +1 (506) 851 2563

2.4.13 When flying in Canadian Northern Domestic Airspace, VOR bearings may be oriented with reference to true as opposed to magnetic north, due to the large variations in the local earth's magnetic field.

Special Requirements for Flights Transiting Greenland

2.4.14 The elevation of the highest point in Greenland is 13,120 ft above Mean Sea Level (MSL), and the general elevation of the ice cap is 9,000 ft above MSL. Due to low temperatures and high winds, the lowest usable flight level may, under certain conditions, be FL 235 near the highest point, and FL 190 over the ice cap. Information about the lowest usable flight level on published ATS routes can be obtained from Sondrestrom Flight Information Centre (FIC).

2.4.15 High capacity cabin heating systems are needed due to the very low in-flight temperatures encountered, even in the summer.

2.4.16 An Emergency Locator Transmitter (ELT) is required when transiting Greenland due to the very difficult terrain that hampers searches.

2.4.17 Compliance with the regulations is monitored and States of Registry will be informed of any infringements.

2.4.18 An aerodrome Flight Information Service is provided at aerodromes: Narsarsuaq, Nuuk/Godthaab, Kulusuk, Ilulissat/Jacobshavn and Constable Point.

Note: Approach and Tower Control Services are provided within the Thule and Sondrestrom Terminal Control Area/control zone (TMA/CTR).

2.4.19 Only flight information and alerting services are provided within the Sondrestrom FIR below FL 195.

2.4.20 IFR flights within the Sondrestrom FIR below FL 195 must have radio equipment capable of operating on the published HF frequencies for Sondrestrom.

2.4.21 Flights within the Sondrestrom FIR above FL 195 (i.e. Reykjavik or Gander CTAs) and outside VHF coverage of Iceland or Gander must have radio equipment capable of operating on the published HF frequencies for Iceland/Gander.

2.4.22 All aircraft operating within Sondrestrom FIR must carry the following equipment and provisions, in accordance with Danish regulations:

- a) radio and navigation equipment and emergency radio equipment as detailed in *AIP Greenland* and the *Faroe Islands COM 0*;
- b) on all transit flights by single-engined aircraft, and on similar flights by multi-engined aircraft incapable of maintaining the prescribed minimum safe altitude in the event of an engine failure occurring, the following emergency equipment shall be carried:
 - i) signalling equipment such as: an ELT; two signal flares of the day and night type; eight red signal cartridges and a means of firing them; a signal sheet (minimum 1 x 1 m) in a reflecting colour; a signal mirror; and an electric hand torch;
 - ii) survival equipment including: a compass; a knife; one sleeping bag with weatherproof inner lining or one rescue blanket (Astron), per person; four boxes of matches in a waterproof container; a ball of string; and a cooking stove with fuel and the accompanying mess tins;
 - iii) emergency rations equivalent to 2000 calories per person. Rations can consist of: vacuum dried soup, coffee powder, sugar, chocolate, dried fruit, pemmican, or the like.
- c) During winter conditions and when flying over the icecap the following shall additionally be carried: a snow saw or snow shovel; candles with a burning time of approximately 2 hours per person. (The minimum number of candles carried shall be enough to ensure a burning time of 40 hours.); and tent(s) for all on board. If dinghies are carried, the tent(s) need not be carried.

Note: It is recommended that a rifle and ammunition be carried when flying over areas where polar bears can be expected to be found. Personal clothing should be suitable for the climatic conditions along the route to be overflown.

2.4.23 It is recommended that life vests be carried for everyone on-board and that roofed dinghies sufficient to accommodate everyone on board also be carried.

2.4.24 When navigating, precautions should be taken because magnetic variation in Greenland may periodically deviate several degrees due to earth disturbances and because of magnetic deflection from currents in the upper atmosphere.

Special Requirements for Flights Transiting Iceland

2.4.25 The general elevation of mountainous areas in Iceland is approximately 8000 ft above MSL. Due to the great differences in pressure as well as high wind speeds, the lowest usable flight level may, under certain conditions, be FL 120.

2.4.26 An ELT, with its own energy supply independent from that of the aircraft, shall be carried. It should be capable of functioning continuously outside the aircraft for at least 48 hours and which can transmit simultaneously on frequencies 121.5 and 243 MHz.

Note: The frequency of ELTs has been mandated by ICAO to operate in the future only on 406 MHz but with a low powered homing capability on 121.5 MHz. (more details on this are in Part 9).

2.4.27 Aircraft should be equipped with sufficient and appropriate arctic survival equipment.

2.4.28 Aircraft operating in the oceanic sector of the Reykjavik FIR must maintain a continuous watch on the appropriate Iceland Radio frequency. When outside VHF coverage, carriage of an HF transceiver operating on designated frequencies, is mandatory. However, prior approval may be obtained for flight outside VHF coverage without HF equipment. Flights operating under this special approval are responsible for obtaining similar approval for operating in the airspace of adjacent ATC units.

Note: Flights between FL 80 and 195 on the route between Sondrestrom and Keflavik passing through 65°N30°W and Kulusuk are exempted from carrying HF equipment.

2.4.29 Flights between the United Kingdom and Iceland, which are routed at or north of 61°N 10°W, are exempted from carrying HF equipment. However, if the VHF transmitter/receiver at Faroe Islands is unserviceable, prior approval is required from Reykjavik ACC to fly in this region.

2.4.30 Navigation equipment shall be carried which is adequate to navigate in accordance with the flight plan and to enable the aircraft to follow ATC clearances.

2.5 Failure of the Transponder

2.5.1 The pilot should notify ATC of a transponder failure prior to entering that airspace where a transponder is normally required.

2.6 Treatment of ACAS Resolution Advisories (RA)

2.6.1 On being notified that an aircraft, in controlled airspace, is manoeuvring in accordance with an RA, a controller should not issue instructions to that aircraft which are contrary to the RA as communicated by the pilot. Once an aircraft departs from the current ATC clearance in compliance with an RA, controllers cease to be responsible for providing separation between that aircraft and other aircraft affected as a direct consequence of the manoeuvre induced by the RA. However, when circumstances permit, the controller should endeavour to provide traffic information to aircraft affected by the manoeuvre. The controller's responsibility for providing separation for all the affected aircraft resumes when:

- a) the controller acknowledges a report from the pilot that the aircraft has resumed the current clearance; or
- b) the controller acknowledges a report from the pilot that the aircraft is resuming the current clearance and issues an alternative clearance that is acknowledged by the flight crew.

2.6.2 Additional information stating how a pilot should deal with an RA can be found in the “*NAT MNPS Airspace Operations Manual*”.

2.7 Special Procedures to Mitigate Wake Turbulence Encounters in the NAT Region

Note: ATC will not issue clearances for lateral offsets

2.7.1 An aircraft that encounters wake vortex turbulence from another aircraft and needs to deviate, shall notify ATC and request a revised clearance. However, in situations where a revised clearance is not possible or practicable, the pilot may initiate the following temporary lateral offset procedure with the intention of returning to the centre line as soon as practicable:

- a) consider establishing contact with the other aircraft on 123.45 MHz; and
- b) one (or both) aircraft may initiate lateral offset(s) not to exceed 2 NM from the assigned route or track, provided that:
 - i) as soon as it is practicable to do so, offsetting aircraft notify ATC that temporary lateral offset action has been taken and specify the reason for doing so (ATC will not normally respond); and
 - ii) offsetting aircraft notify ATC when re-established on assigned route or track (ATC will not normally respond).

Note: A copy of an ‘Altitude Deviation Report Form’, for use by pilots encountering Wake Vortex incidents, can be found as an attachment to the ‘NAT MNPS Airspace Operations Manual’.

PART 3

3. MNPS AND RVSM AIRSPACE OPERATIONS

3.1 Introduction

3.1.1 This Part of the Guidance Material outlines the main requirements and procedures (including specialised procedures) necessary to operate specifically in MNPS and RVSM Airspace. However, it is stressed, that the information contained here on RVSM applies equally to aircraft operating within RVSM Airspace elsewhere in the NAT Region but outside MNPS Airspace (i.e. within the WATRS area and the Bodø Oceanic FIR), and which are also subject to the rules and procedures outlined in Part 2.

3.1.2 Good navigation practices are essential elements in the application of the MNPS and RVSM concepts. Fundamental differences exist between navigation systems, but the basic procedures for their application have much in common. This part of the Document summarises the key points for operating crews to note. Detailed information on good navigation practices in MNPS Airspace can be found in the “*NAT MNPS Airspace Operations Manual*”.

3.2 Flight Planning

3.2.1 During flight planning, the flight crew should check all conditions that may affect operation in MNPS or RVSM Airspace. These include, but may not be limited to:

- a) reported and forecast weather conditions on the route of flight;
- b) minimum equipment requirements pertaining to height-keeping systems; and
- c) review of the flight plan to ensure correct annotation (in Item 10) for approved MNPS/RVSM flight.

3.3 Pre-flight Procedures at the Aircraft

3.3.1 The following actions should be accomplished during pre-flight:

- a) review of maintenance logs and forms to ascertain the condition of equipment required for flight in MNPS or RVSM Airspace. It should be ensured that maintenance action has been taken to correct defects to required equipment;
- b) during external inspection of the aircraft, particular attention should be paid to the condition of static sources and the condition of the fuselage skin in the vicinity of each static source (this check may be accomplished by a qualified and authorized person other than the pilot, e.g. a flight engineer or by maintenance personnel);
- c) before take-off, the aircraft altimeters should be set to the local altimeter setting (QNH) and should display a known elevation (e.g. an airfield elevation) within the height limits specified in aircraft operating manuals. The two primary altimeters should also agree to within height limits specified by the aircraft operating manual. An alternative procedure using absolute altitude (QFE) may be used instead; and

Note: The maximum height difference between primary altimeters should not exceed 25 m (75 ft).

- d) before take-off, equipment required for flight in MNPS or RVSM Airspace should be operative, turned-on and engaged as necessary, and indications of any malfunction should be resolved.

3.4 Flights at RVSM Levels Prior to Entering RVSM Airspace

3.4.1 Before entering RVSM Airspace, the pilot should review the status of required equipment. The following altimetry equipment should be operating normally:

- a) two primary altitude measurement systems;
- b) one Assigned Altitude Deviation (AAD); and
- c) one altitude-alerting device.

3.4.2 In the event that any of the required equipment fails prior to an aircraft entering RVSM Airspace, the pilot should request a clearance so as to avoid flight in this airspace.

3.5 In-flight Procedures Within RVSM Airspace

3.5.1 The following actions should be accomplished whilst in flight:

- a) emphasis should be placed on promptly setting the sub-scale on all primary altimeters to 1013.2 mbs (or 29.92 inches) when passing the transition altitude and then rechecking for the proper altimeter setting when reaching the initial Cleared Flight Level (CFL);
- b) in level cruise it is essential that the aircraft be flown at the CFL. This requires that particular care be taken to ensure that ATC clearances are fully understood and complied with. Except in the event of an emergency, the aircraft should not intentionally depart from the CFL without a clearance from ATC;
- c) during cleared transition between levels, the aircraft should not be allowed to overshoot or undershoot the old or new flight level by more than 45 m (150 ft);
- d) an automatic Altitude Keeping Device (AKD) should be operative and engaged during level cruise, except when circumstances such as the need to re-trim the aircraft or the onset of turbulence, require disengagement. In any event, adherence to cruise altitude should be accomplished by reference to one of the two primary altimeters;
- e) the altitude-alerting device should be operative and engaged;
- f) at intervals of approximately one hour, crosschecks between the primary altimeters should be made. A minimum of two altimeters must agree within 60 m (200 ft). Failure to meet this condition will require that the altimetry system be reported as defective to ATC;
- g) where possible, the altimetry system being used to control the aircraft should be selected to provide input to the altitude reporting transponder transmitting information to ATC;
- h) if the pilot is notified by ATC of an Assigned Altitude Deviation (AAD) error that exceeds 91 m (300 ft), then the pilot should take action to return to the CFL, as quickly as possible.

3.6 Procedures for Aircraft Suffering Partial Loss of Navigation Capability Before Entry into MNPS Airspace

3.6.1 *ICAO Annex 6, Chapter 7 of Parts I and II*, states a requirement for aircraft to be sufficiently equipped navigationally to ensure that, in the event of the failure of one item of equipment at any stage of flight, the remaining equipment will enable the aircraft to proceed in accordance with MNPS where applicable. For flight in NAT MNPS Airspace, this is interpreted to mean that, while two sets of LRNS equipment have to be carried when operating in the major part of the NAT MNPS Airspace, there are routes on which only one LRNS is sufficient and where the requirement for stand-by equipment is satisfied by the carriage of approved short-range navigation equipment. In the event of an aircraft suffering partial loss of necessary navigation capability prior to entry into oceanic airspace (e.g. only one Inertial Navigation System (INS) or Flight Management System/Inertial Reference System (FMS/IRS) serviceable), the pilot should consider landing at a suitable aerodrome before the boundary, or returning to the departure airfield, or using one of the special routes listed in Part 1. Use of those particular routes following partial loss of navigation capability is subject to the following criteria:

- a) that sufficient navigation capability remains to meet the MNPS, i.e. one LRNS plus short range navigation aids;
- b) that the requirements of *ICAO Annex 6, Chapter 7 of Parts I and II*, with regard to the provision of navigation equipment necessary to enable the aeroplane to be navigated in accordance with its operational flight plan, plus the requirements of ATS, can be met by relying on the use of short range navigation aids in the event of failure of the remaining LRNS;
- c) a revised flight plan is filed with the appropriate ATS unit; and
- d) an appropriate ATC clearance is obtained.

Note: A revised oceanic ATC clearance will be issued after co-ordination between all OACs concerned. Should the OTS at the time of the incident extend to the northern part of the NAT Region, the aircraft concerned may be required to accept a lower than optimum flight level in its revised oceanic clearance, especially during peak traffic periods. This guidance does not relieve the pilot of the obligation to take the best possible course of action under the prevailing circumstances.

3.7 Special Provisions for Aircraft Not Equipped for Operations in MNPS Airspace to Climb or Descend Through MNPS Airspace

3.7.1 Some aircraft, particularly the higher performance IGA aircraft, operate at flight levels above the upper limit of MNPS Airspace (above FL 420). Depending on point of departure, such aircraft often require a comparatively brief penetration of MNPS Airspace. In order that non-MNPS equipped aircraft are not unduly restricted in height, provision is made for climb and descent through MNPS Airspace under specific conditions.

3.7.2 Aircraft not equipped for operation in MNPS Airspace may therefore be cleared by the responsible ATC unit to climb or descend through MNPS Airspace provided that:

- a) climb or descent can be completed within the usable coverage of selected VOR/DMEs or within the radar coverage of the ATC unit issuing such clearance;
- b) the aircraft is able to maintain direct controller-pilot communications (DCPC) on VHF; and

- c) MNPS aircraft operating in that part of MNPS Airspace affected by such climb or descent are not penalised by being excluded from operating at their most economical cruising level(s).

3.7.3 In order to improve ATS provided to non-MNPS approved aircraft landing at or departing from an airport which underlies MNPS Airspace, where no established VOR/DME or radar exists and no DCPC are available, and to prevent the development of a critical fuel situation, such an aircraft can be cleared to climb or descend through MNPS Airspace provided that:

- a) the aircraft is equipped with a suitable LRNS to enable it to maintain a random track established by ATC;
- b) descent (or climb) through MNPS Airspace will not be initiated until the aircraft is established on the track cleared by ATC;
- c) the established track will be maintained by the aircraft until it has exited MNPS Airspace and is clear of other known traffic;
- d) descent (or climb) will be expedited in so far as is safely practicable; and
- e) all other traffic at each respective flight level is protected either laterally by 120 NM, or by the applicable minimum longitudinal separation standard.

Note: DCPC is not required for the application of this procedure and MNPS/RVSM approved flights operating in MNPS Airspace during such climbs or descents shall not be penalized by the application of this procedure.

3.8 Special Provisions for MNPS Approved Aircraft that are not RVSM Approved to Climb or Descend Through RVSM Designated Altitudes

3.8.1 An MNPS aircraft not approved for RVSM may be cleared by the responsible ATC unit to climb or descend through RVSM altitudes provided that:

- a) the flight climbs/descends continuously through RVSM levels without stopping at any intermediate level; and
- b) the pilot should "Report Leaving" current level and "Report Reaching" the cleared level.

3.9 ATC Considerations –Particularly in RVSM Airspace

3.9.1 RVSM requires that:

- a) increased vigilance be applied to the issuance of clearances to aircraft and to checking that approved clearances are properly understood and complied with by flight crews;
- b) measures be taken as necessary to cope with the potential concentration of traffic; and
- c) controllers be advised of their responsibilities in respect of the action to be taken:
 - i) when aircraft known to be unsuitably equipped are flight planned into MNPS/RVSM Airspace;

- ii) when informed that an aircraft has lost the capability to maintain its CFL appropriate to MNPS requirements;
- iii) when the pilot requests traffic information to assist in alleviating potential visual perception problems associated with nearby aircraft;
- iv) to safeguard separation between aircraft when advised by the pilot that the AKD ability has degraded below MNPS/RVSM Airspace requirements; and
- v) when the radar displayed altitude (where applicable) differs from the CFL by 90 m (300 ft) or more.

3.10 Contingencies Within MNPS Airspace

3.10.1 This guidance material should enable the pilot and the air traffic controller to better understand what actions to take under certain conditions of equipment failure and during encounters with turbulence. A pilot should notify ATC of any contingency that affects the ability of the aircraft to maintain the CFL (particularly in RVSM Airspace). Together they should co-ordinate a plan of action. Examples of notifiable equipment failures are:

- a) failure of all automatic AKDs onboard the aircraft;
- b) full or partial loss of redundancy of altimetry systems aboard the aircraft;
- c) loss of thrust on an engine necessitating descent; or
- d) any other equipment failure affecting the ability to maintain CFL;

3.10.2 However, it is recognized that both a pilot and controller will use their judgement to determine the action most appropriate to any given situation. For certain equipment failures, the safest course of action may be for the aircraft to continue in MNPS Airspace while the pilot and controller take precautionary action to protect separation. For extreme cases of equipment failure, the safest course of action may be for the aircraft to leave MNPS Airspace after obtaining a revised ATC clearance. If unable to obtain such prior clearance then the pilot should execute a contingency manoeuvre and leave the assigned route or track, as specified in the 'NAT' Section, of the ICAO "Regional Supplementary Procedures" (Doc.7030).

3.11 Contingencies Within RVSM Airspace

3.11.1 The following guidance on contingency procedures to adopt when encountering loss of height keeping equipment, should not be interpreted in any way that prejudices the final authority and responsibility of the pilot-in-command for the safe operation of the aeroplane.

All Automatic Altitude Keeping Devices Fail

3.11.2 If all automatic AKDs fail (e.g. autopilot altitude hold) then the pilot should:

- a) maintain CFL - if necessary through manual control;
- b) watch for conflicting traffic;
- c) if applicable, alert nearby aircraft by:

- i) making maximum use of exterior lights; and
 - ii) broadcasting position, flight level, and immediate intentions, on frequency 121.5 MHz; and
- d) notify ATC of the failure and state the intended course of action. Possible courses of action include:
- i) continuing in RVSM Airspace provided that the aircraft can maintain the CFL; or
 - ii) requesting ATC clearance to climb above or descend below RVSM Airspace, if the aircraft cannot maintain the assigned flight level and ATC cannot establish increased vertical, longitudinal or lateral separation; or
 - iii) executing the appropriate contingency manoeuvre specified in *ICAO Doc.7030* to leave the assigned route or track if prior ATC clearance cannot be obtained and the aircraft cannot maintain the assigned flight level.

3.11.3 ATC should take the following action:

- a) obtain the pilot's intentions;
- b) if the pilot intends to continue in RVSM Airspace, consider establishing increased vertical, longitudinal or lateral separation;
- c) pass traffic information to the pilot;
- d) if the pilot requests clearance to exit RVSM Airspace, accommodate that request as expeditiously as possible;
- e) if increased vertical, longitudinal or lateral separation cannot be established and it is not possible to comply with the pilot's request for clearance to exit MNPS Airspace, then to notify other aircraft in the vicinity and continue to monitor the situation; and
- f) advise adjacent ATC facilities/sectors, of the situation.

Loss of Redundancy in the Primary Altimetry Systems

3.11.4 The pilot should take the following action, if the remaining altimetry system is functioning normally:

- a) couple that system to the AKD;
- b) notify ATC of the loss of redundancy; and
- c) maintain increased vigilance regarding altitude-keeping.

3.11.5 If the pilot reports that the remaining system is functioning normally the ATC controller should acknowledge the situation and continue to monitor progress.

All Primary Altimetry Systems Fail or are Considered Unreliable

3.11.6 The pilot should:

- a) maintain altitude - if necessary by reference to the standby altimeter (should the aircraft be so equipped);
- b) alert nearby aircraft by:
 - i) making maximum use of exterior lights;
 - ii) broadcasting position, flight level and intentions on frequency 121.5 MHz.
- c) notify ATC of the inability to meet RVSM performance requirements, consider declaring an emergency and request clearance to exit MNPS Airspace.
- d) if unable to obtain ATC clearance in a timely manner, to execute appropriate contingency procedures, as specified in *ICAO Doc.7030*, for leaving the assigned route or track and descending below MNPS Airspace (if operationally feasible); or
- e) if not operationally feasible to execute the appropriate contingency procedures and then continue to alert nearby aircraft and co-ordinate with ATC.

3.11.7 ATC should take the following action:

- a) when notified by the pilot that the aircraft cannot meet RVSM performance requirements, attempt to establish increased vertical, longitudinal or lateral separation;
- b) pass traffic information to the pilot;
- c) if unable to establish increased separation, to consider other options, such as advising the pilot of traffic information and requesting the pilot's intentions;
- d) if the pilot requests clearance to exit RVSM Airspace, then to accommodate the request as expeditiously as possible; and
- e) if notified by the pilot of the loss of all acceptable altimetry systems, to notify the pilot of traffic information, advise aircraft in the vicinity and monitor the situation.

Primary Altimeters Diverge by More than 60 m (200 ft)

3.11.8 The pilot should:

- a) attempt to determine the defective system through established trouble-shooting procedures and/or compare primary altimeter displays with those of the standby altimeter (as corrected from correction cards, if applicable);
- b) if the defective system can be determined, couple the functioning altimetry system to the AKD; or
- c) if the defective system cannot be determined, follow the guidance above regarding failure or unreliable altimeter indications of all primary altimeters, in conjunction as appropriate with ATC.

3.12 Encountering Turbulence

3.12.1 Meteorological conditions can cause turbulence that may be detrimental to accurate height-keeping, particularly in RVSM Airspace. If an aircraft reports greater than moderate turbulence and is within 5 minutes of another aircraft at 300 m (1 000 ft) vertical spacing, ATC will endeavour to establish 600 m (2 000 ft) separation by climbing/ descending either aircraft.

3.12.2 Any OAC might request an increase in separation minima due to adverse weather conditions. This could lead to the temporary suspension of RVSM in selected areas.

3.12.3 When encountering greater than moderate turbulence, which affects the aircraft's ability to maintain CFL, the pilot should take the following action:

- a) watch for possible conflicting traffic and make maximum use of exterior lights;
- b) broadcast callsign, position, flight level, nature and severity of turbulence and intentions, on frequency 121.5 MHz (with 123.45 MHz used as a back-up frequency);
- c) notify ATC as soon as possible and request a flight level or/and a Mach number change as necessary; and
- d) if the aircraft cannot maintain the assigned flight level, execute established contingency procedures to leave assigned track or route.

3.12.4 ATC should take the following action:

- a) if possible, establish increased vertical, longitudinal or lateral separation;
- b) accommodate the request for a change in altitude, if possible; or
- c) if neither of the above actions is possible, notify other aircraft in the vicinity and monitor the situation; and
- d) consider suspending RVSM operations in the affected area.

3.13 Crew Training

3.13.1 It is essential that crews obtain proper training for MNPS and RVSM operations. Current navigation systems, because of their precision and reliability, can induce a sense of complacency, which in turn tends to obscure the value of standard procedures, and in particular of cross-checks. Under these circumstances errors occur more easily. To prevent them, a special training programme for flight crews should be devised, which includes instructions on the efficient use of equipment, with emphasis on how to avoid mistakes. Crew members should be trained to develop a meticulous method of using Control Display Units (CDUs), with careful cross-checking at all operational stages, in line with procedures described in the "*NAT MNPS Airspace Operations Manual*".

3.13.2 The Operator should thereafter seek to retain the interest and co-operation of flight crews by ensuring that a high standard of navigation performance be maintained. This may be achieved during ground refresher courses, routine checks, or/and by issuing periodic newsletters that include a focus on fleet navigation performance - hopefully indicating that standards are being maintained or are being improved upon. Newsletters might also include analyses of error reports volunteered by crews (i.e. covering instances

of equipment being mishandled). However, periodic reminders should not be so frequent as to be self-defeating.

3.13.3 Crew training should stress the need for maintaining accuracy along and across track (i.e. the careful application of Mach Number Technique, accurate reporting of positions and the use of accurate time in reporting positions).

3.13.4 The types of navigation systems presented here, with their computers and related displays, provide the ability to fly direct Great Circle routes. This feature can be attractive and useful to crews, and they need not be discouraged from taking advantage of it. However, during initial and refresher training, Operators should point out to crews that: firstly, it is necessary to obtain an ATC clearance for such routes; and, secondly, that the wind effect may be such that the Great Circle path is far from being the minimum time path (the most fuel economical route). Finally, if not properly cleared by ATC, there may be a risk of the aircraft inadvertently entering restricted airspace or crossing political boundaries, without authority.

3.13.5 The following items should also be stressed in flight crew training programmes:

- a) knowledge and understanding of standard ATC phraseology used in each area of operations;
- b) importance of crew members cross-checking each other to ensure that ATC clearances are promptly and correctly complied with;
- c) use and limitations, in terms of accuracy, of standby altimeters during contingency situations. Where applicable, the pilot should review the application of Static Source Error Correction/Position Error Correction (SSEC/PEC) through the use of correction cards;
- d) characteristics of aircraft altitude capture systems which may lead to the occurrence of overshoots;
- e) relationships between the altimetry, automatic altitude control and transponder systems in normal and abnormal situations; and
- f) aircraft operating restrictions related to airworthiness approval.

3.13.6 Finally, crew training should be extended to include instruction on what action should be considered in the event of systems failures. The “*NAT MNPS Airspace Operations Manual*” provides useful assistance in establishing such action.

3.14 Presentation of Navigation Information

3.14.1 A significant proportion of navigation errors result from the use of incorrect data. To minimize the problem, source data must be clearly legible under the worst cockpit lighting conditions and presented in a format suitable for error-free use in the cockpit environment. In this context, the following considerations apply:

- a) on navigation charts, all position co-ordinates, e.g. ramp position, ATC waypoints, radio navaid positions, etc., should ideally be printed in dark blue or black numerals against a white background. Where such co-ordinates would normally appear against a locally tinted background, they should be enclosed in a white box. Absolutely no information should be overprinted on top of position co-ordinates. In situations where groups of position co-ordinates must appear in close proximity to each other, the position to which each set of co-ordinates applies should be clearly indicated by means of a leader;

- b) navigational documents, such as track messages or flight plans, should be double-spaced or "boxed", to minimize the possibility of line slippage when the information is read; and
 - c) it is advisable to provide pilots with a simple plotting chart of suitable scale (1 inch equals 120 NM has been used successfully on NAT routes) in order to facilitate a visual presentation of the intended route that, otherwise, is defined only in terms of navigational co-ordinates.
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PART 4

4. AIRCRAFT APPROVAL PROCESS

4.1 State Responsibility

4.1.1 It is implicit in the concepts of MNPS and RVSM that all operations within each designated airspace achieve the highest standards of navigational performance accuracy. **All flights within NAT MNPS Airspace must have the approval of either the State of Registry of the aircraft, or the State of the Operator. Aircraft operating in RVSM Airspace are required to be compliant with the altimetry minimum aircraft performance specification (MASPS) and hold an issued approval.** Such approvals encompass all aspects of the expected navigation and height-keeping performance accuracy of the aircraft, including that covering: the equipment carried, the installation and maintenance procedures, crew navigation procedures and training.

4.1.2 **RVSM approval for operation in the NAT must include authority to operate in MNPS Airspace. However, an MNPS approval only, authorises an Operator to fly at those flight levels in MNPS Airspace that are not designated for the use of RVSM operations. From circa January 2002, RVSM approval will apply throughout the entire NAT Region. When this happens then an RVSM approval will not necessarily include an MNPS approval, unless an Operator wishes to fly within MNPS Airspace – which itself then becomes a subdivision of RVSM Airspace.**

4.1.3 In the case of approvals for IGA operations, the following points are emphasised:

- a) aircraft MNPS and RVSM approvals constitute a package covering equipment standards, installation, maintenance procedures and crew training;
- b) States' aviation authorities should consider limiting the validity period of approvals; and
- c) States' aviation authorities should maintain detailed records of all NAT MNPS and RVSM approvals.

4.1.4 There are times when MNPS and/or RVSM approval documentation may need to be shown to "suitably authorised persons". e.g. during a ramp inspection or on similar occasions.

4.2 Installation Approvals for Navigation Systems

4.2.1 In most cases, Operators will be able to select equipment for which performance capability has already been established to the satisfaction of a State of Registry. The primary concern will therefore be in establishing that the end product of system performance meets the requirements for navigational performance capability set out in Part 1. Where a completely new navigation system is proposed for use, or where major changes have been made in the technology of an existing system, an evaluation will be necessary, to establish its quality of performance, before authorisation for use as a primary means system can follow.

4.2.2 When an evaluation of a new system is required, an approved system must be carried in addition to the new one being evaluated. Any evaluation programme must provide data on sufficient flights to demonstrate to the satisfaction of the appropriate authority:

- a) the accuracy and reliability required to establish compliance with the appropriate navigation performance specification;

- b) the adequacy of operational procedures;
- c) the adequacy of maintenance arrangements; and
- d) the adequacy of operations and maintenance training programmes.

4.2.3 The amount of flying required to complete an evaluation will vary depending upon the type of installation and the experience of the manufacturer or other Operators with the equipment and the results which have been obtained.

4.2.4 The process of operational approval of a new system, after its airworthiness certification, will generally consist of the following phases:

- a) manufacturers' trials and trials on-board the aircraft in the regional environment concerned, with the basic requirement being met by an existing approved system. Previous valid evaluation programme data may be used;
- b) confirmatory flights by the flight standards organisation of the State of Registry, after establishing that the overall standards of accuracy and reliability appear acceptable; to ensure that adequate operating drills/procedures and training facilities have been developed leading to conditional approval for use in the environment; and
- c) close monitoring of operational use in the designated environment to ensure that the initially approved level of performance is being maintained.

4.2.5 If the performance of a system falls significantly below the requirement during operational use, the State of Registry will need to consider whether remedial action in terms of improvement to the equipment or flight-deck drills is possible, or whether the aircraft may need to be temporarily excluded from the airspace. This latter consideration is of significant importance, as the only alternative might be to increase the separation values currently applied, thus creating a considerable economic burden for other Operators.

4.3 Limitations to the Approval of Equipment

4.3.1 It is necessary, besides establishing total system performance, to take into account the limitation of particular types of navigation and altimetry systems. The need is to ensure that in the event of partial system failure, the remaining equipment is sufficient to enable the aircraft to operate in accordance with the conditions of its original or amended clearance. To assist in meeting this requirement, the necessary equipment to be available and serviceable at entry into the airspace concerned, must be specified.

4.3.2 To simplify regulatory procedures, States may wish to establish performance criteria for routes and/or geographical areas on a worldwide basis. Such an approach will obviate the need for detailed negotiations on each occasion that an Operator may wish to extend its route approvals. In exercising such options, it will be for the States concerned to ensure that Regional specifications of performance are met and that, in cases where no specific requirements have been established, at least the minimum conditions laid down in Part 1, are taken into account.

4.4 Acceptable Means of Compliance for MNPS

General

4.4.1 In developing the application of the concept of MNPS, it was recognised that an indication of an "Acceptable Means of Compliance" would be needed, with specifications in terms of aircraft equipment. However, equipment specification is only one part of the total quality of performance required. Certification for operations in NAT MNPS Airspace requires:

- a) attention to crew training and operating drills as described in the "*NAT MNPS Airspace Operations Manual*";
- b) attention to equipment installation and maintenance procedures;
- c) an assurance that the *ICAO Annex 6 (Operation of Aircraft)* requirement for navigation equipment redundancy is satisfied; and
- d) the use of equipment that is suitable.

4.4.2 This section addresses only one of these aspects, namely the navigation equipment fits that justify consideration.

4.4.3 It is unsatisfactory for NAT MNPS Airspace operations to rely on intermittent updates of aircraft position. The standard requires for navigation equipment that continuously provides indications to the flight crew of adherence to or departure from track, to the required degree of accuracy, at any point along that track. To this end, it is highly desirable that the navigation system in use is coupled to the auto-pilot so that continuous steering guidance is provided.

The Horizontal Navigational Performance Requirement

4.4.4 There are two navigational requirements for aircraft planning to operate in NAT MNPS Airspace. One refers to track-keeping accuracy and the other refers to stand-by equipment with comparable performance characteristics (*ICAO Annex 6, Chapter 7 of Parts I and II*, refers). **To justify consideration for State approval for unrestricted operation in NAT MNPS Airspace, an aircraft needs to be equipped with two fully serviceable Long Range Navigation Systems (LRNS).**

INS, ISS, IRS and FMCS Equipments

4.4.5 Extensive experience has been gained, both in the NAT Region and worldwide, in the use of Inertial Navigation Systems (INS), Inertial Sensor Systems (ISS), Inertial Reference Systems (IRS) and Flight Management Computer Systems (FMCS). ISS/IRS, when coupled with a FMCS for automatic flight guidance, have clearly demonstrated a capability to meet the MNPS. Some aircraft may carry two IRS (or ISS) but only one FMCS. Such an arrangement may meet track keeping parameters but does not provide the required redundancy (in terms of continuous indication of position relative to track or of automatic steering guidance) should the FMCS fail; therefore, in order to obtain MNPS certification, dual FMCS is required to be carried. For example: a single INS is considered to be a LRNS; and an FMCS with inputs from one or more IRS/ISS is also considered to be a LRNS.

Global Navigation Satellite System (GNSS) Equipment

4.4.6 The emergence of GNSS raises the following issues for users, ATS Providers, States of Registry and safety regulators:

- a) **System Safety.** A low level of GNSS-based navigation is not expected to affect overall system safety. However, the inherent extremely high horizontal accuracy of GNSS will eventually increase the probability of collision, following a loss of vertical separation. To mitigate such an effect, it is expected that appropriate operational procedures will have to be considered. This will be necessary when a significant proportion of aircraft in the NAT use GNSS for navigation. Monitoring the use of GNSS in such airspace is therefore required in order to identify when appropriate operational procedures might be needed and to ensure that system safety is not adversely affected. States of Registry are therefore required to provide details of GNSS approvals to the North Atlantic Central Monitoring Agency (CMA). (See Part 5)
- b) **Institutional Considerations.** Whilst the NAT SPG should be cognisant of institutional considerations, it is the responsibility of individual States to resolve such concerns. States may wish to take account of the following institutional aspects:
- i) **Legal Issues.** As the use of GNSS increases, there will be a greater dependence by a large number of users on a small number of infrastructure providers. States concerned may wish to review the relevance of their national legislative requirements in the context of the provision of ATS to GNSS-equipped aircraft;
 - ii) **Liability Issues.** For safety-critical applications such as navigation, ATS Providers should, on an individual basis, consider reviewing the extent of their liability towards GNSS users or third parties, in the event of a disrupted system or service; and
 - iii) **Regulatory Issues.** State Regulation of the operational use of navigation satellite services is expected to take account of the ground and space domains, as well as the airborne domain. States should therefore satisfy themselves that their individual regulatory requirements are met in respect of each of these three domains.

Note: More information on the carriage of GNSS is contained in the “North Atlantic MNPS Airspace Operations Manual”. Included is: information on carriage of GPS as a single LRNS, pre-departure checks (such as use of a Fault Detection and Exclusion Availability Prediction Programme) and types of GPS failure encountered.

LORAN-C Equipment

4.4.7 LORAN-C equipment, with an integral navigation computer, has an acceptable performance accuracy; although use of this equipment entails a limited MNPS approval, thus restricting operation of an aircraft to routes on which unambiguous ground wave cover is available (see chart at Appendix A-6).

DOPPLER Equipment

4.4.8 The use of Doppler equipment (having a capability of displaying drift, ground speed and cross track error) has been approved, on occasions, in conjunction with a single INS, for operations in NAT MNPS Airspace. Such approvals, however, are considered to be at the lowest acceptable level of navigation fit suitable for the MNPS. DOPPLER requires that continuous attention be paid to in-flight assessment of, and compensation for, systematic errors, in order to guard against failure of the other single navigation aid. Thus, future installations of DOPPLER plus one other long-range navigation aid cannot be recommended for unrestricted MNPS operations.

Aircraft equipage

4.4.9 To justify consideration for State approval for unrestricted operations in MNPS Airspace, an aircraft will be required to be fitted with the following navigation equipment:

- a) **Two** fully serviceable LRNSs. A LRNS may be one of the following:
 - i) One Inertial Navigation System (INS);
 - ii) One Global Navigation Satellite System (GNSS); or
 - iii) One navigation system using the inputs from one or more IRS or any other sensor system complying with the MNPS requirement.
- b) Each LRNS must be capable of providing a continuous indication to the flight crew of the aircraft position relative to desired track.

Note 1: *Only two GNSSs currently exist: the Global Positioning System (GPS) and the Global Orbiting Navigation Satellite System (GLONASS).*

Note 2: *A GPS installation must be approved as follows:*

If the two required LRNSs are both GPS, they must be approved in accordance with FAA Notice 8110.60 or equivalent JAA or national documentation and their operation approved in accordance with FAA HBAAT 95-09 or equivalent national or JAA documentation. If GPS serves as only one of the two required LRNSs, then it must be approved in accordance with FAA TSO-C129 as Class A1, A2, B1, B2, C1 or C2, or with equivalent national or JAA documentation.

Note 3: *Equivalent approval material for GLONASS is under development and must be available prior to approving any GLONASS equipped aircraft for MNPS operations.*

4.4.10 It is highly desirable that the navigation system employed for the provision of steering guidance is capable of being coupled to the auto-pilot.

4.5 Acceptable Means of Compliance for RVSM

General

4.5.1 A minimum aircraft performance specification (MASPS) for RVSM was developed in accordance with the conclusions of the ICAO Review of the General Concept of Separation Panel (RGCSP)/6 Meeting. This was to satisfy the requirement that the system risk due solely to technical height keeping performance, i.e. performance exclusive of human factors errors and extreme environmental influences, should be less than 2.5×10^{-9} fatal accidents per flight hour. The requirements, which form the basis for development of the MASPS, are stated in Part 1 and the full requirements of the MASPS are published in the latest version of *JAA Temporary Guidance Leaflet (TGL) No.6 - Revision 1, "Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above Flight Level 290 where a 300 m (1,000 ft) Vertical Separation Minimum is Applied"*, and in FAA Document '91-RVSM', "*Interim Guidance Material on the Approval of Operations/Aircraft for RVSM Operations*".

Equipment and Functional Requirements

4.5.2 The following features or equipment are considered to be essential elements of aircraft intended to operate in RVSM Airspace:

- a) at least two altitude measurement systems meeting the MASPS requirements;
- b) a static source error correction (SSEC)/position error correction (PEC) must be applied automatically;
- c) a secondary surveillance radar (SSR) altitude-reporting transponder with the capability for switching to operate from either altitude measurement system;
- d) an altitude deviation warning system that shall signal an alert when the altitude displayed to the flight crew deviates from selected altitude by more than a nominal value. This nominal value shall not be greater than 91.4 m (300 ft). For aircraft whose application for type certification was made after 1 January 1997, the nominal value should not be greater than ± 60 m (± 200 ft). The overall equipment tolerance in implementing this nominal threshold value shall not exceed 15.2 m (50 ft); and
- e) an automatic altitude-keeping device which is required to be capable of controlling altitude within ± 20 m (± 65 ft) of the selected altitude, when the aircraft is operated in straight and level flight, under non-turbulent, non-gust conditions.

Group and Individual Aircraft Approvals

4.5.3 Aircraft approvals will be applicable to an individual aircraft or to a group of aircraft that are nominally identical in aerodynamic design, and to items of equipment contributing to height-keeping accuracy.

4.5.4 When grouping similar aircraft together, from the viewpoint of approval or evaluation of height-keeping standards or requirements, it must be recognized that aircraft with closely similar or apparently identical type or series designations are in some cases substantially different in aerodynamic design and avionic equipment. Conversely, aircraft with different series designations can be identical in all characteristics contributing to height-keeping ability.

4.5.5 It is therefore necessary to ensure that all individual aircraft deemed to comprise a group are of nominally identical design and build with respect to all details that could influence the accuracy of height-keeping performance. All aircraft of the same group must have been designed and assembled by one manufacturer. The airframes' pitot/static systems must be installed in an identical manner and position, and, if required, the same correction actions must be embodied to meet RVSM requirements. All aircraft in a group must have the same altimetry, altitude-hold, and altitude-alert systems as originally installed and must be able to meet compliance with RVSM requirements. Any variation in the above from initial installation must have been or will require clearance by the airframe manufacturer or recognized design organization to show that RVSM compliance has not been impaired.

4.5.6 This should not be taken to exclude approval by similarity, but, where there are differences, the possible influence of all these details should be assessed before granting approval or extending approval to cover such variations.

4.6 RVSM Approval

4.6.1 In the same manner that the MNPS approval process includes a number of operational type requirements as well as an equipment certification process: to be considered for RVSM approval, not only must the individual aircraft of an Operator's fleet be compliant with the RVSM MASPS but also the Operator has to ensure that crews have been trained in procedures specific for operation in RVSM Airspace, as defined in the ICAO "*Regional Supplementary Procedures*", (Doc.7030). In this respect, like MNPS approval, RVSM approval comprises two elements: airworthiness certification and operational scrutiny. It should be noted that an RVSM approval for the NAT will always include an MNPS approval and this will be valid for global RVSM operations. However, such a dependency will not be the case from circa January 2002 (see relevant statements at the beginning of this Part of the guidance material).

4.7 Database of State MNPS and RVSM Approvals

4.7.1 In order to adequately monitor NAT MNPS Airspace, State aviation authorities shall maintain a database of all MNPS and RVSM approvals that they have granted for operations within MNPS Airspace. In addition, data on RVSM approved airframes is input into a central database, maintained by the NAT CMA (see below). The CMA database facilitates the tactical monitoring of aircraft approval status and the exclusion of non-approved users.

4.8 Notification of issue of NAT RVSM approval

4.8.1 It is an ICAO requirement that States issuing NAT RVSM approvals should notify the CMA of each approval. The established procedure to facilitate the transfer of RVSM approvals data from State databases to the NAT CMA database, involves each State informing the NAT CMA of any new approvals, by completing a CMA Form F2 and transmitting it by the most expeditious method available. Additionally, any permanent withdrawal of approval for any reason should be notified using the CMA Form F3. Both forms and notes to aid their completion are at Appendix C.

PART 5

5. MONITORING OF AIRCRAFT SYSTEMS PERFORMANCE

5.1 The Monitoring Process

5.1.1 To ensure compliance with minimum navigation and height-keeping performance specifications, ICAO has established procedures for systematic and periodic monitoring of the actually achieved aircraft systems performance. Formal reporting by pilots, Operators and ATS Providers, of specified deviations from assigned track or flight level supports this.

5.1.2 The monitoring process comprises four distinct actions:

- a) monitoring of aircraft navigation performance by the Operator in co-operation with flight crews;
- b) monitoring of Operators by the State having jurisdiction over those Operators in order to ensure that acceptable operating procedures are being applied by the Operator while conducting authorised flight operations;
- c) monitoring of actual aircraft systems performance in normal flight operations, as observed by means of radar by the ATC units of States providing service in the NAT Region, and by other specialist systems designed to measure the technical height-keeping performance of aircraft; and
- d) monitoring done on the basis of position and occurrence reporting.

5.1.3 Because of the large variety of circumstances existing in the relationship between States of Registry and their Operators engaged in NAT operations, it is not expected that all States will be able to make similar or identical arrangements. It is however expected that all States concerned will make maximum effort to comply effectively with their responsibilities and in particular to co-operate with requests for information about a particular incident from an ATS Provider or from the NAT CMA.

5.2 Monitoring Navigation Capability

Monitoring by the Operators

5.2.1 Decisions regarding the monitoring of aircraft navigation performance are largely the prerogative of individual Operators. In deciding what records should be kept, Operators should take into account the stringent requirements associated with the MNPS. Operators are required to investigate all occurrences of GNEs (errors of 25 NM or greater), and it is imperative, whether these are observed on ground radar or by the flight crew, that the cause(s) of track deviations be established and eliminated. **Therefore, it will be necessary to keep complete in-flight records so that an analysis can be carried-out.**

5.2.2 Operators should review their documentation to ensure that it provides all the information required to reconstruct any flight, if necessary, some weeks later. Specific requirements could include:

- a) details of the initial position inserted into the equipment plus the original flight planned track and flight levels;
- b) all ATC clearances and revisions of clearance;

- c) all reports (times, positions, etc.) made to ATC;
- d) all information used in the actual navigation of the flight: including a record of waypoint numbers allocated to specific waypoints, plus their associated ETAs and ATAs;
- e) comments on any problems (including that to do with navigation) relating to the conduct of the flight, plus information about any significant discrepancies between INS/IRS displays, other equipment abnormalities and any discrepancies relating to ATC clearances or information passed to the aircraft following ground radar observations;
- f) sufficient information on accuracy checks to permit an overall assessment of performance. Records of terminal (i.e. residual) errors and of checks made against navigation facilities immediately prior to entering oceanic airspace; and
- g) details of any manual updates made to IRS/INS units.

5.2.3 It is also important that for any forms which are used make it easy to examine key factors. Therefore, documentation might include, for each flight, a question calling for crew assistance in this regard: e.g. "Did a track error of 25 NM or more occur on this flight? Yes/No."

5.3 Monitoring of the Operator by the State

5.3.1 Decisions regarding the monitoring of Operators by the State may be taken unilaterally, but hopefully there will be a co-operative process regarding those specifications to be achieved by the Operator during planning, and when reviewing achieved performance. Much of this process will be concerned with procedures approved by the flight operations inspectorate and confirmed by means of monitoring, to ensure compliance.

5.4 Direct Action by ATS Provider States in the Monitoring Process

5.4.1 An integral part of the monitoring function is the role played by the ATS of Provider States and covers the following:

- a) acquisition of data on operational errors. Radar observed deviations at the oceanic boundaries as well as pilot reports of errors in mid-ocean are the main contributors to the monitoring of horizontal navigation performance;
- b) acquisition of data encompassing operational height-keeping errors, or deviations from a cleared level, due to turbulence or for other reasons;
- c) requests to Operators of aircraft for an investigation in the event that a GNE is observed or reported;
- d) the forwarding of data to the NAT CMA, which includes:
 - reports on GNEs;
 - height deviations of 90 m (300 ft) or more from the cleared flight level;
 - intervention action to prevent a GNE;
 - erosions of longitudinal separation in excess of 3 minutes;
 - ETA/ATA discrepancies of 5 minutes or more;

- flights by unauthorised aircraft; and
- e) provision of data collections on navigational performance to confirm that actual navigation equipment performance complies with the requirements for aircraft operating in MNPS Airspace.

Note: When a United States registered aircraft is involved which is not clearly identified as an air carrier or military Operator, a copy of the initial error signal should be sent to the company/agency which submitted the ICAO Flight Plan, requesting that the full flight plan details plus the name of the pilot-in-command be sent to KRWAYAYX, Attention AFS 430.

5.5 Monitoring of Gross Navigation Errors

5.5.1 Radar stations capable of monitoring the boundaries of the NAT Region collect data on flights within MNPS Airspace, together with that on non-MNPS Airspace flights. The former data provides a direct input into the risk modelling of MNPS Airspace, whilst the latter provides a wider appreciation of navigation in the NAT Region and allows follow-up action to be taken on a larger sample of flights believed to have experienced navigation errors.

5.5.2 The data collection process comprises two parts:

- a) continuous collection of all deviations of 25 NM or more (i.e. GNEs); and
- b) collection of data on deviations of between 15 and 25 NM as required.

5.5.3 When a GNE has been detected by the ATS Provider State or has been reported to ATC by the pilot, that ATS Provider unit will, in co-operation with the Operator, investigate its cause. It is important that all agencies react promptly to reports of GNEs. Investigations should be made at once so that consideration can be given to the need for swift remedial action. In order that deviation reports can receive prompt attention, each airline/Operator should nominate a person to be responsible for receiving reports and to initiate investigations; the name and full address of this individual should be notified to each relevant ATS administration.

5.6 Monitoring of Height-Keeping Performance

Monitoring of Operational Height-keeping Performance

5.6.1 The introduction of RVSM Airspace into the NAT Region has increased the necessity for consistent and accurate reporting by pilots and ATC units, of deviations of 90 m (300 ft) or more from a CFL for any cause..

Monitoring of Technical Height-keeping Performance

5.6.2 The NAT RVSM programme, from the outset, required confirmation that the RVSM MASPS were being met and would continue to be met in future years. A technical height-keeping programme was therefore initiated, employing two height monitoring units (HMU) at Strumble (United Kingdom) and Gander (Canada), along with a number of portable GPS monitoring units (GMU). The programme met its initial objectives and continues to produce data as part of an integrated monitoring programme intended to establish RVSM Airspace on a global basis.

5.7 Monitoring of ACAS II Performance

5.7.1 ACAS II can have a significant effect on ATC. Therefore, there is a continuing need to monitor the performance of ACAS II in the developing ATM environment.

5.7.2 Following an RA event, or other significant ACAS II event, pilots and controllers should complete an ACAS II RA report. Aircraft Operators and ATS authorities should forward completed reports through established channels.

5.8 Overall Navigation (and Systems) Performance

5.8.1 All information relating to horizontal and vertical navigation (and systems) performance within the NAT Region is provided to the NAT SPG via the CMA. Regular statistical assessments of system safety determine whether or not the overall target level of safety (TLS) is being met. On those occasions that summary statistics show that the TLS, in either the horizontal or vertical planes, has been exceeded, the NAT SPG is informed; in which case the NAT SPG will take appropriate action. It is the responsibility of the NAT SPG Scrutiny Group to make recommendations on an annual basis as to how safe operations can be maintained, unless there is a continued degradation in safety. The introduction of modern technology into aircraft systems has led to a gradual reduction in the statistical risk of collision in the NAT, in spite of the continual increase in traffic.

5.9 Tactical Monitoring of MNPS and RVSM Approvals

5.9.1 Experience with the monitoring process indicates that a proportion of GNEs and other operational errors are attributable to aircraft operating in MNPS/RVSM Airspace without the required approvals. It was for this reason that in 1990, to make random checks more effective, the NAT SPG introduced a programme of tactical monitoring to help identify aircraft operating within MNPS Airspace without the required approval. In 1997, this procedure was extended to RVSM approvals, and currently Canada, Iceland and the United Kingdom participate in this programme. Pilots who are uncertain of or are unable to confirm their approval status, are issued with a clearance to operate outside MNPS/RVSM Airspace and a report is forwarded to the CMA for follow-up action.

5.10 Operational Error Reporting and Central Monitoring Agency (CMA) Activities

Background

5.10.1 In March 1980, the NAT SPG realised that after implementation of a 60 NM lateral separation minima, special importance would have to be placed on monitoring and assessment of navigation performance. It was therefore agreed that there was a need to collect, collate and circulate to States participating in the monitoring programme, data regarding navigation performance in the NAT Region. To meet this requirement, the NAT CMA was established.

5.10.2 In the early 1990s, as a consequence of the planned implementation of RVSM in NAT MNPS Airspace, the NAT CMA took on the responsibility for monitoring height-keeping performance. Initially, this was limited to collating data on operational errors but when the technical height-keeping programme came into being, the CMA became the data collection and collation centre. It has also become responsible for setting the target monitoring requirements for the RVSM approval process. Information about the CMA and current monitoring targets can be accessed through the Internet at: <http://www.nat-pco.org>, or by faxing a request to +44(0)20 7832 5562.

Responsibilities

5.10.3 The CMA operates on behalf of the NAT SPG by United Kingdom National Air Traffic Services Limited (NATS) and is responsible for the collection, collation and dissemination of all data relevant to horizontal and vertical navigation (and systems) performance in the NAT Region. It provides participating States, ICAO and other selected Operators and organisations with a quarterly summary of information to keep them abreast of system safety, and with any other information pertinent to safe aircraft operations in the NAT. The CMA is responsible for informing NAT ATS Provider States on points of safety, either directly or through the NAT SPG organisational mechanism.

5.10.4 The content of the CMA quarterly report may vary but will generally include the following:

- a) a table of MNPS GNEs eligible for inclusion in the risk analysis and which have occurred since the previous scrutiny exercise. This is termed TABLE ALPHA and is presented in two parts, the first listing "Eta" errors (errors of 30 NM or more) and the second listing "risk bearing errors" together with appropriate weightings (see Appendix C);
- b) a table of MNPS GNEs eligible for scrutiny but not included in the risk analysis and which have occurred since the previous scrutiny exercise. This is termed TABLE BRAVO;
- c) a table of NAT GNEs which have occurred in non-MNPS Airspace and which have been reported since the previous scrutiny exercise. This is termed TABLE CHARLIE;
- d) graphical representations of the previous twelve months' results, in respect of GNEs of 30 NM or more (Eta), and of risk bearing errors, in terms of MNPS traffic that operates in the OTS, and random traffic, related to the MNPS criteria;
- e) tables of altitude deviations of 90 m (300 ft) or more in the NAT reported to the CMA;
- f) a graphical representation of the previous twelve months' results in respect of time spent at an incorrect flight level;
- g) a table of reports received by the CMA on intervention action taken to prevent GNEs; and
- h) any other information considered relevant and worthy of dissemination.

Follow-up Action on Observed and Reported GNEs

5.10.5 Different administrative arrangements exist within those States participating in monitoring programmes although follow-up action on GNEs should, in general terms, be as indicated in the following paragraphs.

5.10.6 For aircraft operating within MNPS Airspace:

- a) the observing ATC unit should, if at all possible, inform the pilot of the aircraft concerned of the observed error and also that an error report will be processed; any comment made by the pilot at the time of notification should be recorded;
- b) the Operators (including military) and any other relevant ATC units should be notified of the observed deviation, either directly by the observing ATC unit or by an agency designated by the State concerned, using the speediest means available (facsimile, AFTN, etc.) and with the least possible delay. This should be followed as soon as possible by a

written confirmation. (For message and letter formats, see Appendix C). All notifications should be copied to the CMA; and

- c) the appropriate State of Registry or the State of the Operator will be sent a copy of the written confirmation along with a covering letter by the CMA.

5.10.7 For aircraft operating outside MNPS Airspace:

- a) the observing ATC unit should, if at all possible, inform the pilot of the aircraft concerned of the observed error and also that an error report may be processed; any comment made by the pilot at the time of notification should be recorded;
- b) where the observed deviation from track is 50 NM or more, the procedure detailed in the previous paragraph (covering aircraft operating within MNPS Airspace) will be followed (see Appendix C); and
- c) where the observed deviation from track is 25 NM or more but less than 50 NM, the observing ATC unit, or other agency designated by the State, should notify the CMA of the deviation with the least possible delay (facsimile, AFTN etc.) using the appropriate message format shown at Appendix C. This should be followed as soon as possible by a written confirmation where this is deemed necessary. The CMA will then advise the State of Registry.

Note: The procedures outlined in Appendix B are used by Canada to monitor their MNPS Airspace.

Further Follow-up Action by the Operator and/or State of Registry

5.10.8 Subsequent follow-up action on observed deviations of 25 NM or more, notified in accordance with the above provisions, should initially be conducted between the Operator and a designated agency of the State having responsibility for the ATC unit which observed the deviation, on the understanding that:

- a) the errors outlined in sub-paragraph c) above (i.e. deviations 25 NM or more but less than 50 NM occurring outside MNPS Airspace) will not normally require further action;
- b) the State of Registry or the State of the Operator concerned should be requested to conduct a further investigation if deemed necessary;
- c) all correspondence should be copied to the CMA; and
- d) the EUR/NAT Office of ICAO will assist in those cases where no response is obtained from either the Operator concerned or the State of Registry.

Follow-up Action on Observed and Reported Altitude Deviations

5.10.9 Height monitoring by the NAT CMA includes the monitoring of technical height-keeping accuracy and operational errors in the vertical plane.

5.10.10 For monitoring technical height-keeping accuracy, a hybrid system comprising Height Monitoring Units (HMUs) and GPS Monitoring Systems (GMSs) is employed. The HMU element consists of two ground-based HMUs: one at Gander (Canada) and the other near Strumble (United Kingdom). The

GMS consists of portable GMUs, GPS reference stations, access to Mode C and MET information, post-flight processing facilities and logistic support. All data collected by the system is analysed and collated by the CMA.

5.10.11 The NAT CMA will take follow-up action in the following circumstances:

- a) when reports are received from height monitoring systems indicating that aircraft altimetry system performance may not be compliant with the airworthiness requirements. i.e. measurements which are in magnitude equal to, or greater than, the following criteria:
 - Total Vertical Error (TVE) : 110 m (350 ft);
 - Altimetry System Error (ASE) : 90 m (300 ft); or
 - Assigned Altitude Deviation (AAD) : 90 m (300 ft);
- b) when reports are received from ATS Provider units, or other sources, that detail **for any reason** operational errors that have resulted in an aircraft being at a level 90 m (300 ft) or more from its cleared flight level. Follow-up action with the appropriate State of Registry will normally only be taken when the information contained in the reports is not sufficiently comprehensive to determine the cause of the deviation; and
- c) after receiving reports from ATS Provider units - which should be initiated for all instances of height deviations of 90 m (300 ft) or more, in the format illustrated in Appendix C. Deviations of the stated magnitude, resulting from turbulence, TCAS manoeuvres or contingency action should be reported in addition to those caused by pilot or ATC errors. These reports are taken into account when compiling the annual risk in RVSM Airspace and MNPS Airspace, for the NAT Region.

Other Reports to the CMA

5.10.12 Details of the following occurrences should also be reported to the CMA by the ATS Provider units:

- a) erosions of longitudinal separation between aircraft within MNPS Airspace, in excess of 3 minutes;
- b) occasions when action is taken to prevent a GNE;
- c) discrepancies of 5 minutes or more between an ETA/ATA at a waypoint; and
- d) occasions when an Operator is suspected of not being in possession of an MNPS/RVSM approval.

Reporting Format

5.10.13 Reporting action on any of those occurrences stated above should be taken using the reports and methods contained in Appendix C.

PART 6

6. AIRSPACE RESERVATIONS

6.1 Introduction

6.1.1 The NAT SPG has agreed to the following:

- a) applicable definitions regarding airspace reservations;
- b) principles governing the establishment and management of airspace reservations; and
- c) specific values to be used in the NAT Region in order to keep controlled flights separated from airspace reservations.

6.2 The Management of Airspace Reservations

6.2.1 Prior to requesting an airspace reservation, the requesting agency shall obtain full information on the likely effect of such a reservation on air traffic. Such information shall include areas of high traffic density that may exist in the vicinity or at the planned location of the airspace reservation, and information on peak periods of traffic operating through such areas. In the light of that information, the requesting agency should, to the extent possible, select the location, time and duration so that this will have the least effect on normal flight operations conducted in the area concerned.

6.2.2 In specifying the extent of a requested airspace reservation and its duration, the requesting agency shall limit the size of the area to the absolute minimum required to contain the activities intended to be conducted within that area, taking due account of:

- a) the navigation capability of aircraft or other vehicles within the reservation;
- b) the means available to monitor those activities so as to guarantee that they will be confined within the airspace reservation; and
- c) the ability to interrupt or terminate activities.

6.2.3 The necessary protection required for aircraft likely to be operating in the vicinity of the area, will be ensured by the ATC unit in whose airspace the airspace reservation is established and, for this reason, the requesting agency should not add any protective value to the size of the area requested. The duration of the airspace reservation shall be limited, taking a realistic account of preparation of the activities and the time required to vacate the reservation after the completion of the activities.

6.2.4 The actual use of the temporary airspace reservation shall be based on appropriate arrangements made between the ATS unit responsible for the airspace, or special agents acting on its behalf, and the requesting agency. Such arrangements should *inter alia* cover:

- a) the start of use of the airspace reservation;
- b) the termination of its use; and
- c) emergency provisions in case of unforeseen events affecting the activities to be conducted within the airspace reservation.

6.2.5 When an airspace reservation extends into the area of responsibility of more than one ATS unit, the requesting agency shall negotiate this airspace reservation simultaneously with all ATS units concerned, or the special agents acting on their behalf. The arrangements concluded shall be covered by common arrangements applicable to all parties concerned.

6.2.6 If an airspace reservation, even though contained within the area of responsibility of one ATS unit only, is likely to affect the provision of ATS by adjacent ATS units in their areas of responsibility, the ATS unit directly affected by that airspace reservation shall ensure that necessary co-ordination with other concerned ATS units is made in a timely manner.

6.2.7 The ATS unit responsible for the provision of ATS in the airspace covered by the airspace reservation shall ensure that all traffic operating under its responsibility will not approach within the specified values of the limits (horizontal and vertical) of the temporary airspace. Where necessary, such values shall be uniform and shall be established in accordance with agreements reached between the ATC authorities concerned for airspace reservations in a given area.

6.2.8 Moving airspace reservations will not be approved in MNPS Airspace for non-MNPS approved aircraft. For formation flights in an airspace reservation, at least one of the aircraft in the formation must meet MNPS in order to satisfy the MNPS requirement (see Part 7).

6.2.9 A formation flight will be considered as a non-RVSM flight regardless if one or all the aircraft in the formation are RVSM approved.

6.3 Specific Values for Use in the NAT Region

6.3.1 The following are stated in the form of separation minima and have been taken from the ICAO NAT “*Regional Supplementary Procedures*”, (Doc.7030) and 4th Edition of the “*Application of Separation Minima North Atlantic Region*” Document, .

6.3.2 The horizontal separation minima relating to airspace reservations, to be used by ATC, are divided into lateral and longitudinal minimum values (the latter being only stated for moving airspace reservations), as follows.

Separation Minima Between Moving Temporary Reservations

6.3.3 Lateral separation shall be:

- a) 60 NM between the closest tracks of any aircraft for which the airspace is reserved, provided all aircraft or formation flights meet the MNPS; or
- b) 120 NM between the closest tracks of any aircraft for which the airspace is reserved, except that in the New York OCA west of 60°W, 90 NM shall be applied.

Note: A formation flight with at least one of the aircraft in the formation meeting MNPS is deemed to meet the requirement for the application of 60 NM in a) above.

6.3.4 Longitudinal separation shall be 60 minutes.

Separation Minima Between Stationary Temporary Airspace Reservations

6.3.5 Lateral separation shall be:

- a) 60 NM between the boundaries of stationary temporary airspace reservations, provided the requesting agencies have guaranteed to confine their activities to the requested airspace, except that in the New York OCA west of 60°W, 45 NM shall be applied; or
- b) 120 NM between the boundaries of the airspace reservations, if no guarantees have been given, except that, in the New York OCA west of 60°W, 90 NM shall be applied.

Separation Minima Between Moving Temporary Airspace Reservations and Other Aircraft

6.3.6 Lateral separation shall be:

- a) 60 NM between the track of an aircraft operating under the control of the ATC unit concerned and the closest track of any of the aircraft for which the airspace is reserved, provided all aircraft meet the MNPS requirements and a portion of the route of the aircraft is within, above or below MNPS airspace; or
- b) 60 NM between the track of an aircraft operating under the control of the ATC unit concerned and the track of a formation flight for which the airspace has been reserved, provided at least one aircraft in the formation and the aircraft operating under the control of the ATC unit meet the MNPS requirements, and a portion of the route of the aircraft is within, above or below MNPS airspace; or
- c) 120 NM between the track of an aircraft operating under the control of the ATC unit concerned and the closest track of any of the aircraft for which the airspace is reserved, except that in the New York OCA west of 60°W, 90 NM shall be applied.

6.3.7 Longitudinal separation shall be 60 minutes.

Separation Minima Between Stationary Temporary Airspace Reservations and Other Aircraft

6.3.8 Lateral separation shall be:

- a) 30 NM between the track of an aircraft operating under the control of the ATC unit concerned or as part of a moving airspace reservation and the nearest limit of the reserved airspace, provided the aircraft meets the MNPS requirements and a portion of the route of the aircraft is within, above or below MNPS airspace and the requesting agency has guaranteed to confine its activities to the requested airspace; or
- b) 60 NM between the track of an aircraft operating under the control of the ATC unit concerned or as part of a moving airspace reservation and the nearest limit of the reserved airspace, provided the aircraft meets the MNPS requirements and a portion of the route of the aircraft is within, above or below MNPS airspace and the requesting agency has not guaranteed to confine its activities to the requested airspace; or
- c) 60 NM between the track of an aircraft operating under the control of the ATC unit concerned or as part of a moving airspace reservation and the nearest limit of the reserved airspace, when the aircraft does not meet the MNPS requirements and the requesting agency

has guaranteed to confine its activities to the requested airspace, except that, in the New York OCA west of 60°W, 45 NM shall be applied; or

- d) 120 NM between the track of an aircraft operating under the control of the ATC unit concerned or as part of a moving airspace reservation and the nearest limit of the reserved airspace, when the aircraft does not meet the MNPS requirements and the requesting agency has not guaranteed to confine its activities to the requested airspace, except that in the New York OCA west of 60°W, 90 NM shall be applied.

6.3.9 Minimum longitudinal separation may be applied between aircraft operating under the control of the ATC unit concerned and the first and last aircraft operating within a moving airspace reservation.

6.3.10 The vertical values used to separate aircraft under the control of an ATC unit from the lower or upper limit of airspace reservations shall be those specified in ICAO *“Rules of the Air and Air Traffic Services” (Doc.4444), Part III.*

PART 7

7. FORMATION FLYING BY STATE AIRCRAFT AND MISSILE ACTIVITY IN THE NAT REGION

7.1 Definition of a Formation Flight

7.1.1 More than one aircraft, which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation and position reporting, are defined as a formation flight. Separation between aircraft within a formation flight remains the responsibility of the flight leader and the other pilots within it. This includes during transition periods when aircraft within the formation are manoeuvring to attain separation from each other in order to effect individual control, and during join-up and break-away.

7.2 Provisions

7.2.1 A formation shall file an appropriate ICAO flight plan for an operation although an ATC clearance will only be issued to the formation leader.

7.2.2 All aircraft within a formation shall operate so that the wing aircraft maintain a distance of not more than 1 NM laterally or longitudinally and a vertical displacement of not greater than 30 m (100 ft), from the flight leader.

7.2.3 A formation flight will be considered as one aircraft by ATC for separation purposes. If at least one of the aircraft participating in the formation flight is MNPS approved, the entire formation flight is considered to be approved for operation in NAT MNPS Airspace. Formation flights will be considered as non-RVSM flights regardless of whether one or all aircraft in the formation are RVSM approved.

7.2.4 Formation flights operating within RVSM Airspace will only be approved by means of an airspace reservation.

7.3 Agencies Concerned With the Co-ordination and Conduct of Rocket/Missile Firing Activities In the NAT Region

7.3.1 A list of addresses of those State agencies concerned with the co-ordination and conduct of rocket/missile firing activities in the NAT Region, is at Appendix E. The list is updated periodically on the basis of information provided by States.

PART 8

8. MANNED BALLOON FLIGHT IN THE NAT REGION

8.1 Co-ordination Requirements

8.1.1 Balloon Operators are responsible for co-ordinating flights within the NAT Region, with the civil aviation authorities of the States concerned.

8.1.2 As considerable co-ordination is required by the ATS authorities of those States concerned, balloon Operators are encouraged to co-ordinate any balloon operations as soon as possible prior to their taking place. As a guideline, such co-ordination should commence at least four months prior to any proposed flight or launch opportunity.

8.2 Communications Requirement

8.2.1 Within the NAT Region, manned balloons shall have a communication capability in accordance with *ICAO Annex 2 (Rules of the Air)*.

8.3 Operating Altitudes

8.3.1 Manned balloon flights authorized to operate in the NAT Region must operate outside NAT MNPS Airspace.

PART 9

9. SEARCH AND RESCUE (SAR) IN THE NAT REGION

9.1 Use of Emergency Locator Transmitters (ELT)

9.1.1 The COPSAS/SARSAT⁵ System employs near-polar orbital satellites to detect and locate signals from ELTs. A number of countries, including Canada, France, Norway, Spain, United Kingdom and the United States, have established Local User Terminals (LUT) and associated Mission Control Centres (MCC) in the NAT Region or close by. An appropriate (usually the nearest) LUT will receive a signal from an ELT and will transmit it on to the nearest MCC. The MCC will identify the aircraft's position and then co-ordinate with other MCCs to inform relevant Rescue Co-ordination Centres (RCCs) best able to deal with the incident. RCCs should react promptly in sending their SAR forces to deal with an emergency.

9.1.2 The COSPAS/SARSAT System will detect transmissions, throughout the NAT Region, on three particular frequencies, namely: 121.5, 243 and, more recently, 406 MHz. Location accuracy is normally better than 5 km when tracking signals from ELTs operating on 406 MHz and 20 km when operating on the other frequencies. The maximum waiting time between ELT activation and satellite detection should not exceed 90 minutes in the NAT Region and will normally be much quicker than this.

9.1.3 The COSPAS/SARSAT System will detect transmissions, throughout the NAT Region, on three particular frequencies, namely: 121.5, 243 and, more recently, 406 MHz. Location accuracy is normally better than 5 km when tracking signals from ELTs operating on 406 MHz and 20 km when operating on the other frequencies. The maximum waiting time between ELT activation and satellite detection should not exceed 90 minutes in the NAT Region and will normally be much quicker than this.

9.1.4 In the future, more robust ELTs operating on 406 MHz as a primary frequency and with a low power output frequency of 121.5 MHz, for homing purposes only, will be required to be carried. ICAO have already stated (in January 1999) a policy for the mandatory carriage of such ELTs to be as follows:

- a) on-board new aircraft, fitment of 406 MHz ELTs should take place by 1 January 2002; whereas
- b) for existing aircraft the requirement is to retrofit with the new ELTs before 1 January 2005.

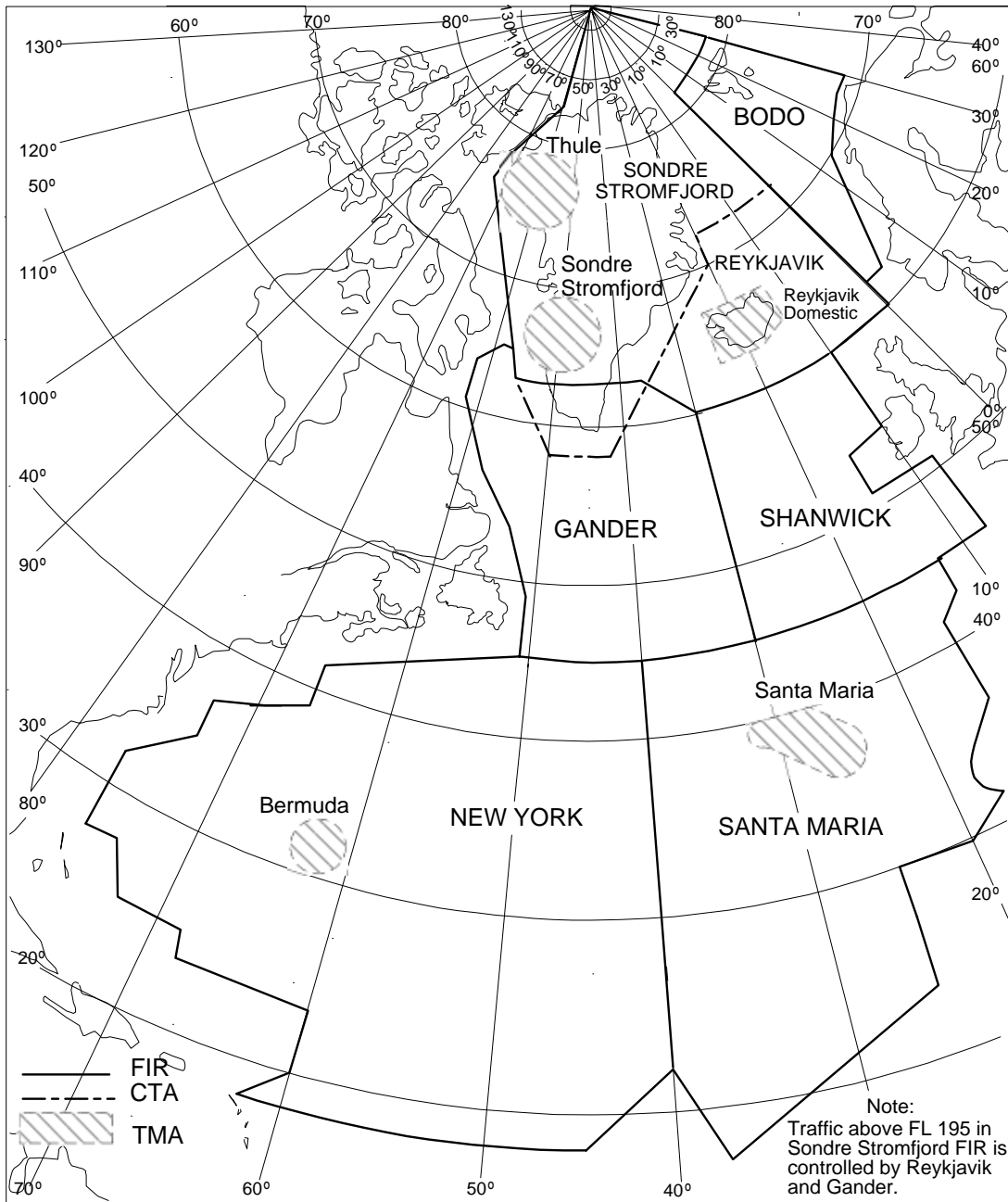
9.1.5 ICAO has also proposed that processing by the COSPAS/SARSAT System of the 121.5 and 243 MHz signals should subsequently be discontinued from 1 January 2008.

⁵ space system for search of vessels in distress/search and rescue satellite aided tracking

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APPENDIX A-4	-	VHF AIR/GROUND COMMUNICATIONS COVERAGE EXISTING IN THE NAT REGION AT FL 200
APPENDIX A-5	-	VHF AIR/GROUND COMMUNICATIONS COVERAGE EXISTING IN THE NAT REGION AT FL 300
APPENDIX A-6	-	LORAN-C COVERAGE CHART
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APPENDIX C-1 TO C-23	-	TYPES OF FORMS AND CORRESPONDENCE TO BE USED IN REPORTS AND FOLLOW-UP ACTION ON OBSERVED AND REPORTED DEVIATIONS
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APPENDIX E-1 / E-2	-	LIST OF ADDRESSES OF AGENCIES IN THOSE STATES CONCERNED WITH THE CO-ORDINATION AND CONDUCT OF ROCKET/MISSILE FIRING ACTIVITIES IN THE NAT REGION

APPENDIX A CTA/FIR CHART FOR THE NAT REGION



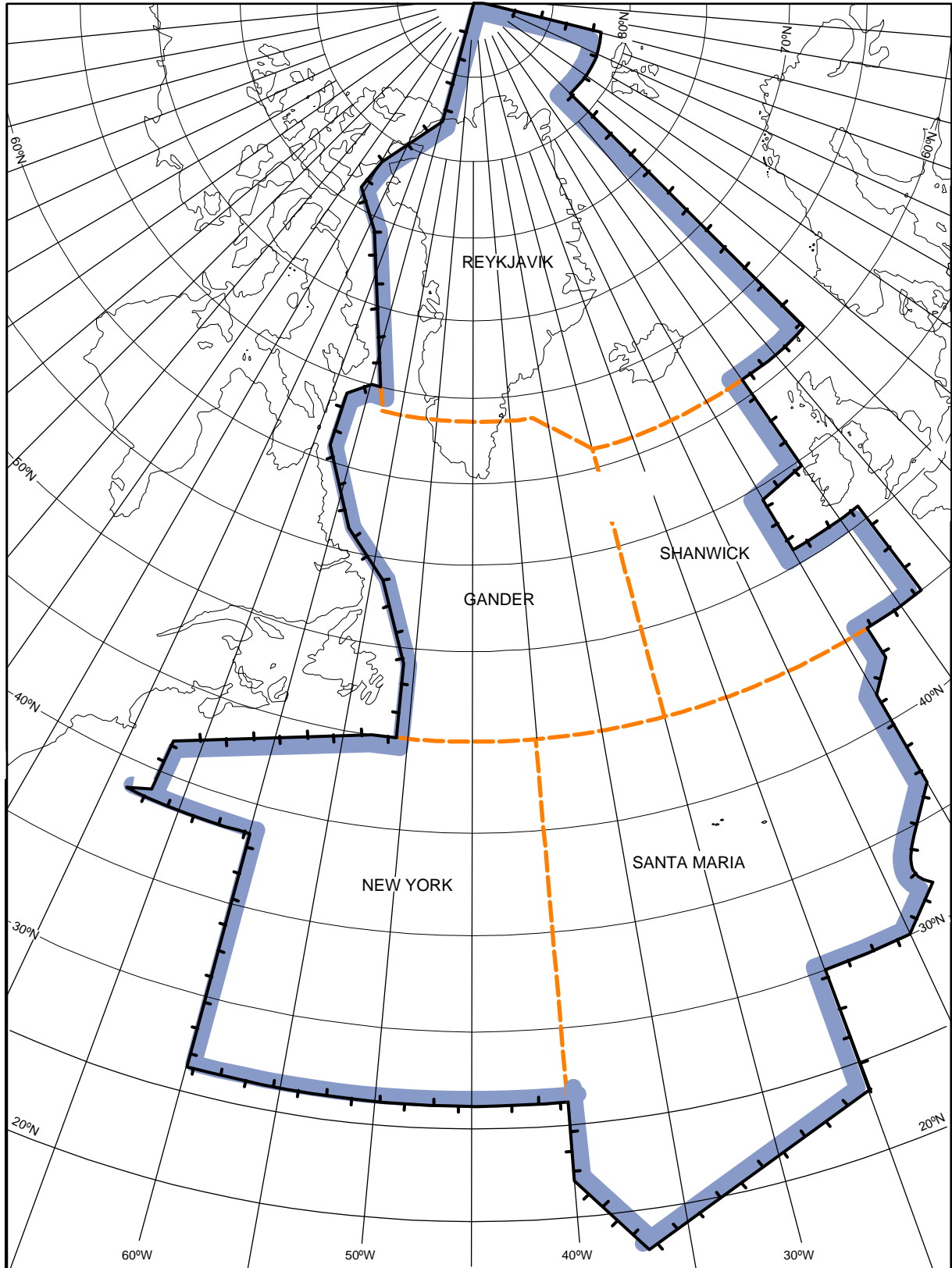
CTAs/FIRs

1. Søndre Strømfjord
2. Bodø Oceanic
3. Reykjavik
4. Gander Oceanic
5. Shanwick Oceanic
6. New York Oceanic
7. Santa Maria Oceanic

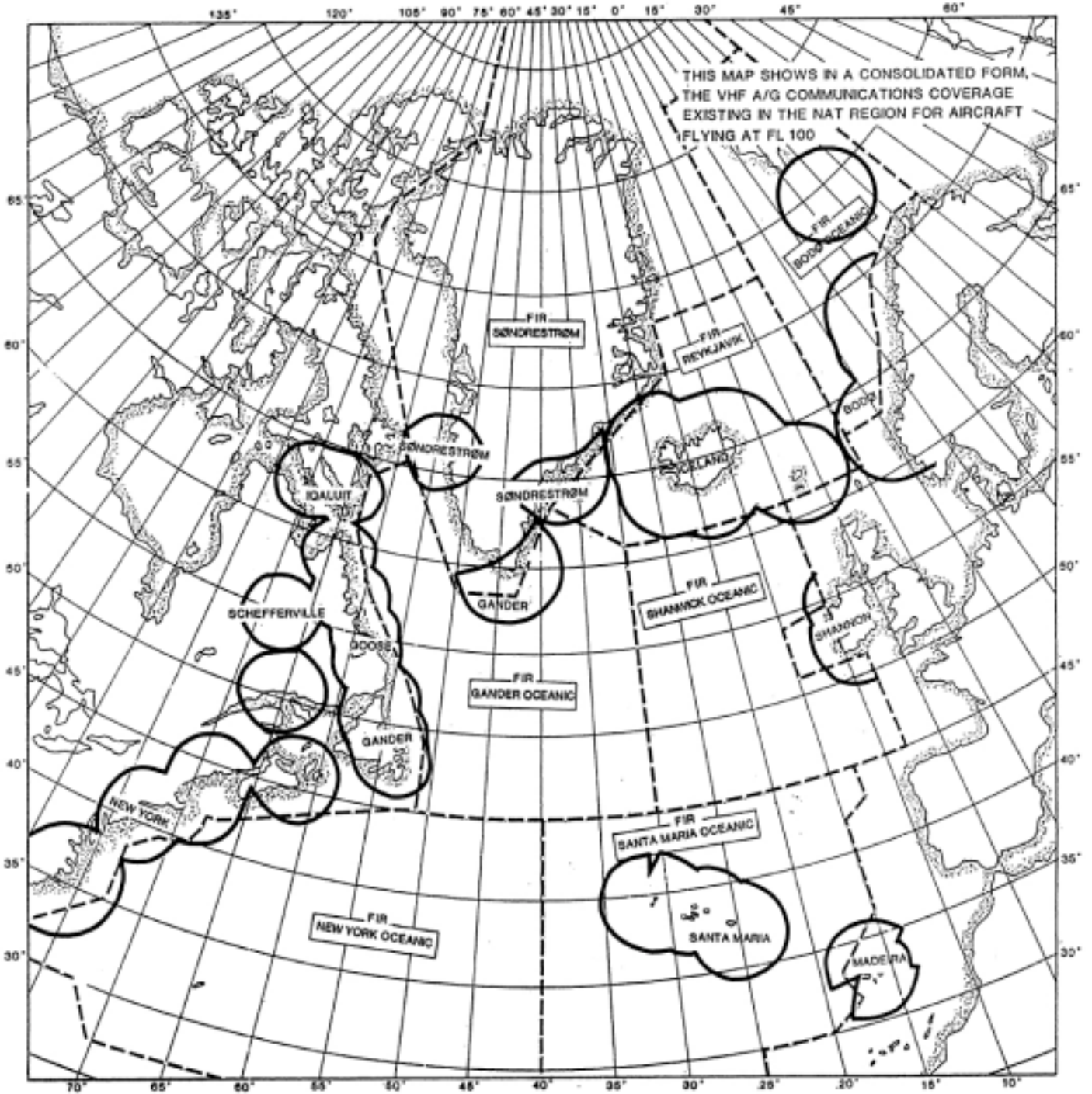
TMAs

- A. Reykjavik Domestic
- B. Bermuda
- C. Santa Maria
- D. Thule
- E. Søndre Strømfjord

NAT MNPS AIRSPACE CHART (FL 285 – FL 420)

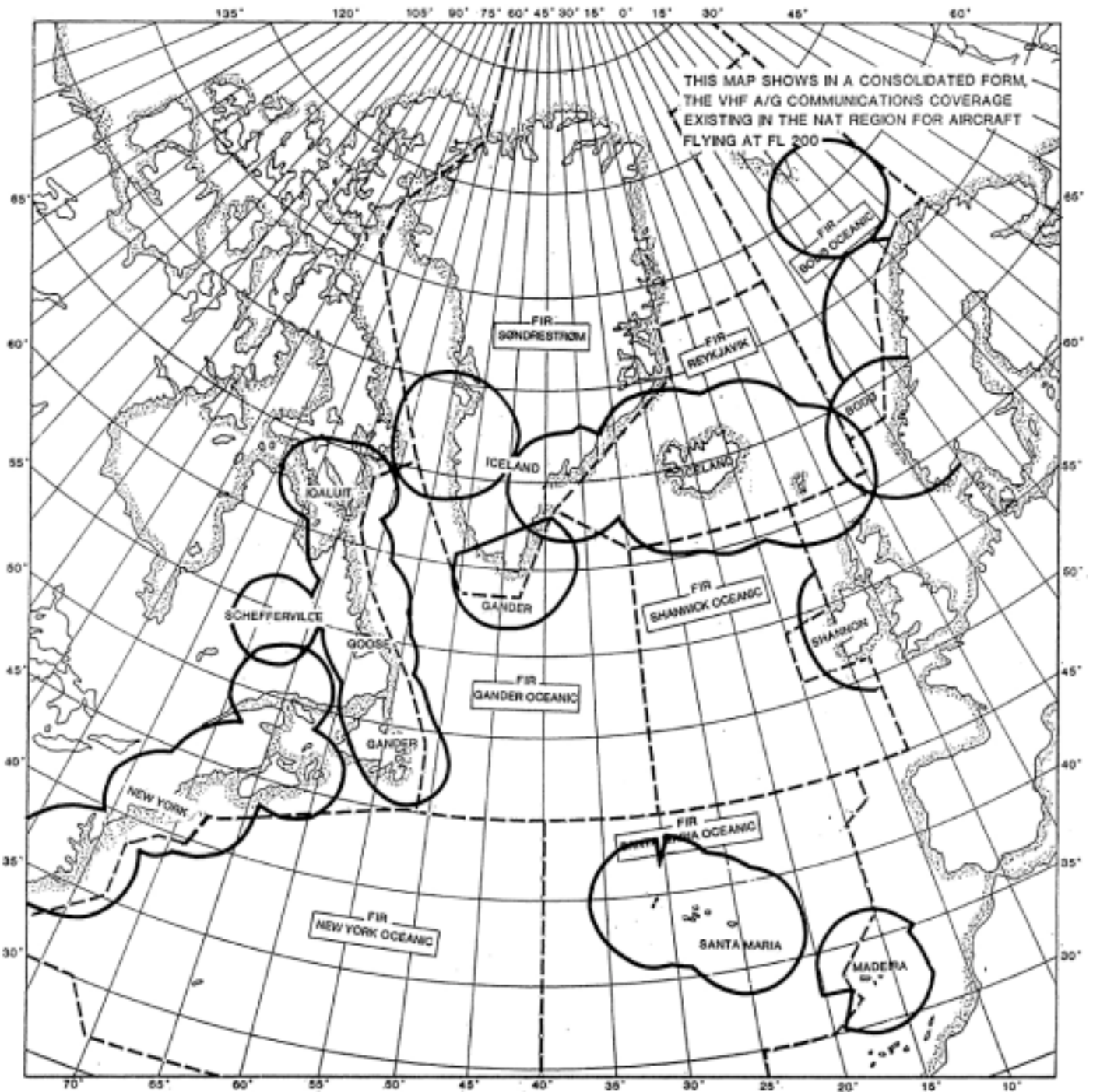


**VHF AIR/GROUND COMMUNICATIONS COVERAGE
EXISTING IN THE NAT REGION AT FL 100**



The VHF coverage provided by the QAQATOQAQ and KULUSUK stations in Greenland (Søndre Strømfjord) serves Søndre Strømfjord FIC only (below FL 195).

**VHF AIR/GROUND COMMUNICATIONS COVERAGE
EXISTING IN THE NAT REGION AT FL 200**



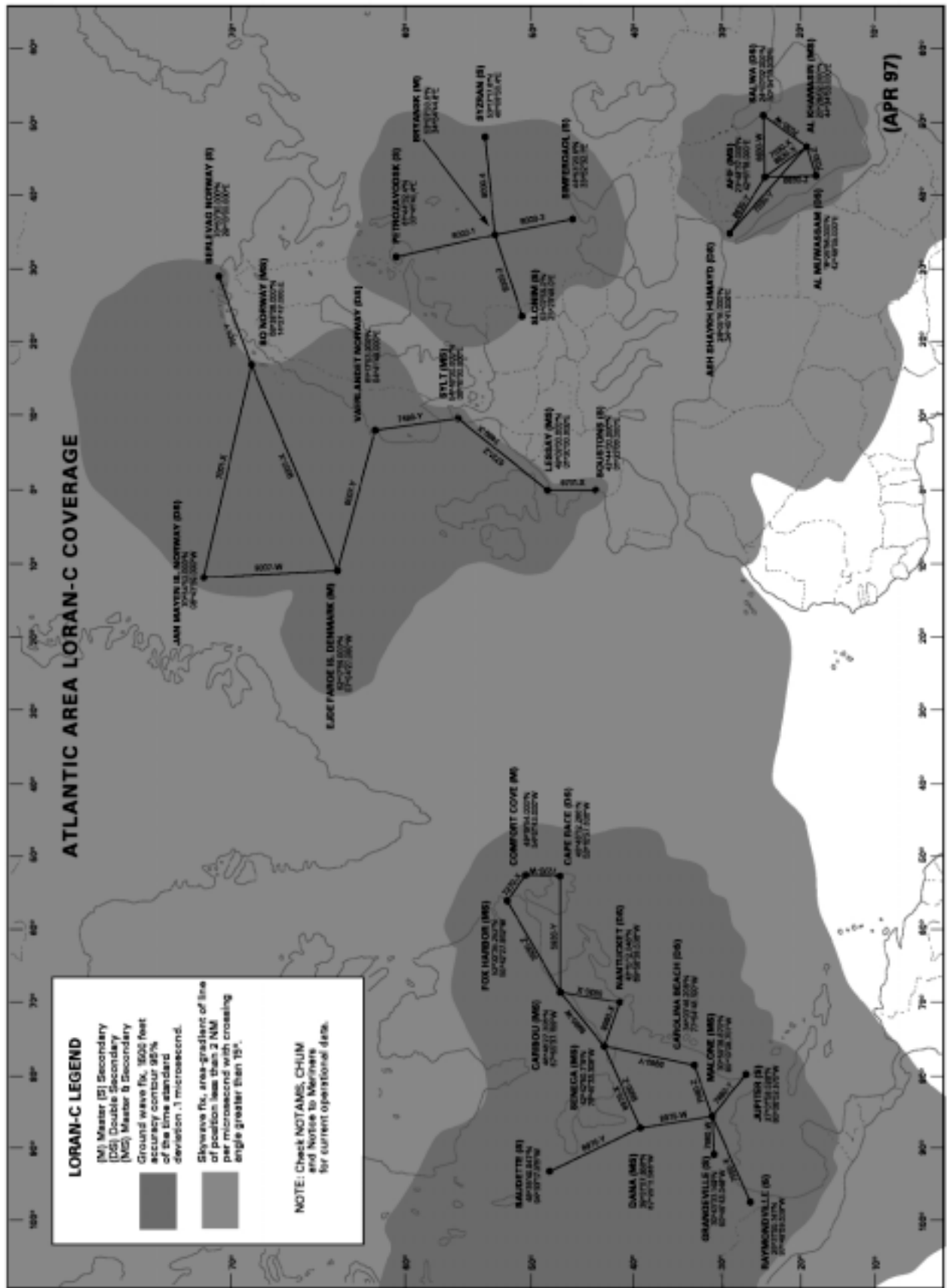
The VHF coverage provided by the QAQATOQAQ and KULUSUK stations in Greenland (Søndre Strømfjord), serves Søndre Strømfjord FIC only (below FL 195).

**VHF AIR/GROUND COMMUNICATIONS COVERAGE
EXISTING IN THE NAT REGION AT FL 300**



The VHF coverage provided by the QAQATOQAQ and KULUSUK stations in Greenland (Søndre Strømfjord), serves Søndre Strømfjord FIC only (below FL 195).
Available to flights above FL 195 in emergency only.

LORAN-C COVERAGE CHART



APPENDIX B

DESCRIPTION OF THE MONITORING METHOD USED BY CANADA

Note: The method described here closely resembles those used by other ATC units. It is included for information.

Participating Units: Gander, Moncton and Montreal Area Control Centres.

1. Centre Procedures

1.1 A member of the control staff monitors westbound target aircraft entering radar coverage within the NAT area.

1.2 The target aircraft is radar identified and the position determined by range and azimuth from the radar station.

1.3 If the measured distance off track is less than 25 NM, no further action is taken.

1.4 If the measured distance off track is 25 NM or more, the details are logged for subsequent action by supervisory staff, and the pilot of the observed aircraft is informed of the apparent deviation, whenever this is possible. Any comments by the pilot at the time are recorded.

2. Action by supervisory staff for processing gross error reports in MNPS Airspace

2.1 Messages are sent to the Operator, the CMA and Ottawa ATS Head Office.

2.2 For deviations of 25 NM or more, a letter is sent to the Operator concerned, as soon as possible, providing relevant details and requesting the Operator to investigate and comment on the apparent deviation. A copy of the letter is also forwarded to ATS Ottawa and the CMA. The Operator is requested to reply to the CMA with a copy to ATS Ottawa.

3. Action by supervisory staff for processing gross error reports outside MNPS Airspace

3.1 When the observed deviation from track is 25 NM or more, but less than 50 NM, ATS Ottawa and the CMA are notified of the deviation with the least possible delay (AFTN, facsimile). This is followed as soon as possible by a written confirmation where this is deemed necessary.

3.2 When the observed deviation from track is 50 NM or more the procedures detailed in Section 2 are followed.

4. Action by ATS Ottawa Headquarters

4.1 Letters sent by the ACCs to Operators, together with replies, are reviewed. The State of Registry of the aircraft concerned may be notified of the circumstances of the observed deviation.

APPENDIX C
TYPES OF FORMS AND CORRESPONDENCE TO BE USED IN REPORTS
AND FOLLOW-UP ACTION ON OBSERVED AND REPORTED DEVIATIONS

CONTENTS

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**REPORT FOR THE INITIAL NOTIFICATION TO AN OPERATOR
AND THE CMA OF AN OBSERVED DEVIATION OF 25 NM OR MORE**

The following format should be used for messages serving as an initial notification of an observed deviation of 25 NM or more from track.

This format should be followed regardless of the means of communication needed to transmit the report.

1. GROSS NAVIGATION ERROR REPORT
2. REPORTING AGENCY
3. DATE
4. TIME
5. AIRCRAFT IDENTIFICATION AND OPERATOR
6. AIRCRAFT TYPE
7. ATC CLEARED TRACK (including positions prior to radar cover)
8. RADAR OBSERVED or REPORTED POSITION (in latitude and longitude)
9. CLEARED FLIGHT LEVEL
10. CREW COMMENTS WHEN NOTIFIED
11. OTHER COMMENTS
12. REQUEST^{1*} (insert 6-letter ICAO location indicator of Company/Agency which filed flight plan)/
PROVIDE COPY OF FULL FLIGHT PLAN INCLUDING NAME OF PILOT-IN-COMMAND TO
KRWAYA ATTENTION AFS 430.
13. PLEASE ACKNOWLEDGE RECEIPT

^{1*} Applicable only to United States registered aircraft that are not clearly identified as an air carrier or military Operator.

**LETTER TO AN OPERATOR REQUESTING AN INVESTIGATION
INTO A GROSS NAVIGATION ERROR**

Dear Mr/Ms,

States responsible for the provision of air traffic services in the North Atlantic Region have been instructed by ICAO to monitor and notify Operators and States concerned of aircraft deviations of 25 NM or more from assigned track so that they may take prompt and effective action to prevent a repetition.

A gross navigation error has been reported in respect of the following flight:

Aircraft Identification :	Type :
Departure :	Destination :
Date :	Cleared Track :
	(including coordinates from 30°W onwards)
Flight Plan Track :	
Actual Track :	
(if known)	
Cleared flight level :	

The notification should then contain information on the following:

- radar observed or reported position in latitude and longitude plus time of observation;
- action taken by ATC (if any).

Comments by crew on being notified of error:

Other comments:

Detailed explanation should be provided on the attached Error Investigation Form and an investigation of this gross navigation error is requested. In your reply, you are also requested to indicate the corrective action taken. A copy of your reply should be sent to:

North Atlantic Central Monitoring Agency
National Air Traffic Services Limited
One Kemble Street
London WC2B 4AP
United Kingdom

Yours faithfully,

(Signature)

SAMPLE OF ERROR INVESTIGATION FORM

(Name and address of reporting agency):				
<i>Please complete Parts 2 and 3 (and Part 4 if applicable) of this investigation form. A copy, together with copies of all relevant flight documentation (fuel flight plan, ATC flight plan and ATC clearance) should then be returned to the above address and also to: the North Atlantic Central Monitoring Agency, National Air Traffic Services Limited, Room T8G7, One Kemble Street, London WC 2B 4AP, England</i>				
Part 1 - General Information				
Operator's name				
Aircraft identification				
Date/Time of observed deviation				
Position (latitude and longitude)				
Observed by (ATC unit)				
Aircraft flight level				
Part 2 – Details of Aircraft Navigation Equipment				
Number Type	INS	GNSS	IRS/FMS	OTHER (please specify)
Single				
Dual				
Triple				
Model No.				
Navigation system Programme No.				
State which system coupled to auto pilot				
Aircraft Registration and Model/Series				

Part 3 - Detailed Description of Incident

Please give your assessment of the actual track flown by the aircraft and the cause of the deviation (continue on a separate sheet if required).

Part 4 – Only to be Completed in the Event of Partial or Full Navigation Failure

Indicate the number of equipment units which failed	INS			GNSS			IRS/FMS			OTHER			
Circle estimated longitude at which equipment failed	60°W	55°W	50°W	45°W	40°W	35°W	30°W	25°W	20°W	15°W	10°W	5°W	0° E/W
Give an estimate of the duration of the equipment failure	Time of failure: Time of exit from MNPS: Duration of failure in MNPS:												
At what time did you advise ATC of the failure													

Thank you for your co-operation

COVERING LETTER TO STATE OF REGISTRY

Dear Mr/Ms,

NORTH ATLANTIC - GROSS NAVIGATION ERROR

Please find attached a copy of a letter that has been sent in respect of a North Atlantic gross navigation error attributed to an aircraft registered in your State. You will note that the Operator has been requested to provide an explanation of the incident. This is in accordance with the North Atlantic monitoring procedures set out in ICAO document NAT DOC 001, prepared and distributed by the ICAO European and North Atlantic Office. Should the Operator fail to reply to the request, a further letter will be sent to you seeking your assistance in obtaining the information requested.

ICAO Document 7030, (Regional Supplementary Procedures) contains a definition of the North Atlantic Minimum Navigation Performance Specification Airspace (NAT MNPS Airspace), in Chapter 2, para 2.2 and of the required navigation performance in Chapter 2, para 2.1, in accordance with the requirement of Annex 6, Parts I and II, para 7.2.2.

The Guidance Document (ICAO NAT Doc 001) explains how the State of Registry, or if appropriate the State of the Operator, should carry out the approval of aircraft intended for operation in the NAT MNPS Airspace and includes consideration of crew competence and of the equipment fitted.

It would be appreciated if you would confirm that the flight in question was in possession of approval to operate in NAT MNPS Airspace (at RVSM levels*), indicating whether the approval was for the whole of the NAT MNPS Airspace or only for the special routes described in NAT DOC 001.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

* include or delete as required

COVERING LETTER TO STATE OF REGISTRY*

Dear Mr/Ms,

NORTH ATLANTIC - GROSS NAVIGATION ERROR

Please find attached a copy of a letter that has been sent in respect of a North Atlantic (NAT) gross navigation error attributed to an aircraft registered in your State. You will note that the Operator has been requested to provide an explanation of the incident. This is in accordance with the NAT monitoring procedures set out in the ICAO NAT DOC 001, prepared and distributed by the ICAO European and North Atlantic Office.

Should the Operator fail to reply to the request a further letter will be sent to you seeking your assistance in obtaining the information requested.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

* To be used when aircraft/Operator is known to be RVSM/MNPS approved

**LETTER IN RESPECT OF A DEVIATION > 50 NM
OUTSIDE MNPS AIRSPACE**

Dear Mr/Ms,

NORTH ATLANTIC - GROSS NAVIGATION ERROR

Please find attached a copy of a notification of a North Atlantic gross navigation error attributed to an aircraft registered in your State.

This aircraft was operating outside MNPS Airspace (ICAO Doc.7030 - NAT/RAC, Chapter 2 refers). However, as the navigation error was in excess of 50 NM, the NAT monitoring procedures as set out in the ICAO NAT DOC 001, require that a full investigation of the circumstances be carried out.

Should the Operator fail to reply to the request for information a further letter will be sent to you seeking your assistance.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

**LETTER TO A STATE OF REGISTRY IN RESPECT OF
A DEVIATION >25 NM BUT <50 NM OUTSIDE MNPS AIRSPACE**

Dear Mr/Ms,

NORTH ATLANTIC - GROSS NAVIGATION ERROR

Please find attached a copy of the notification of a North Atlantic gross navigation error attributed to an aircraft registered in your State.

As this aircraft was operating outside MNPS Airspace (ICAO Doc.7030 - NAT/RAC, Chapter 2 refers) and the observed deviation was less than 50 NM no further action is called for by the NAT monitoring procedures set out in the ICAO NAT DOC 001, prepared by the ICAO European and North Atlantic Office.

However, should you decide to investigate the circumstances of the incident, it would be appreciated if you would advise this Office of your findings. This information would be of interest in fulfilling our responsibilities as the monitoring agency of navigation errors in the North Atlantic Region.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

**REPORT TO THE CMA OF AN EROSION OF
LONGITUDINAL SEPARATION IN EXCESS OF 3 MINUTES**

1. EROSION OF LONGITUDINAL SEPARATION REPORT
 2. REPORTING AGENCY
 3. DATE
 4. FIRST AIRCRAFT IDENT AND OPERATOR
 5. AIRCRAFT TYPE
 6. MACH NO./POSITION/TIME/ALTITUDE
 7. SECOND AIRCRAFT IDENT AND OPERATOR
 8. SECOND AIRCRAFT TYPE
 9. MACH NO./POSITION/TIME/ALTITUDE
 10. CREW COMMENTS WHEN NOTIFIED (IF APPLICABLE)
 11. REMARKS
-

**REPORT TO THE CMA OF A SIGNIFICANT DIFFERENCE
BETWEEN ATA AND ETA**

<i>PRIORITY</i> FF	<i>ADDRESSEE</i> EGGAYFYG		
<i>FILING TIME</i>	<i>ORIGINATOR</i>		
ATTENTION NAT CMA			
REPORT OF SIGNIFICANT DIFFERENCE - ESTIMATE/REPORTED TIME (To be completed when ATA differs from ETA by FIVE minutes or more)			
REPORTING AGENCY:		DATE:	

REPORTED AIRCRAFT					
AIRCRAFT IDENT:			OPERATOR		
TYPE:		MACH No:		FL:	
POSITION:		ETA A/C ATC		ATA	

NEAREST ADJACENT AIRCRAFT AT SAME LEVEL					
SAME ROUTE/TRACK - AHEAD					
POSITION:	(As above)	MACH No:		ATA	
SAME ROUTE/TRACK - BEHIND					
POSITION:	(As above)	MACH No:		ETA	

CREW COMMENTS (If appropriate):

Reason for Deviation:

ADDITIONAL INFO (for example weather, etc):

Previous Position and ETA

Previous Position and ATA

OTS or Random Flight

PLEASE ACKNOWLEDGE RECEIPT

SIGNATURE SHANWICK/GANDER WATCH MANAGER

ITALICS NOT FOR TRANSMISSION

**REPORT TO THE CMA OF ATC INTERVENTION
TO PREVENT A GROSS NAVIGATION ERROR**

1. REPORT OF ATC INTERVENTION TO PREVENT A GROSS NAVIGATION ERROR
2. REPORTING AGENCY
3. DATE
4. TIME
5. AIRCRAFT IDENT AND OPERATOR
6. AIRCRAFT TYPE
7. ATC CLEARED TRACK
8. AIRCRAFT REPORTED TRACK
9. ACTION TAKEN BY ATC
10. CREW COMMENTS WHEN NOTIFIED

When complete send to:

North Atlantic Central Monitoring Agency
National Air Traffic Services Limited
One Kemble Street
London WC2B 4AP
United Kingdom

Fax: +44 (0)20 7832 5562
AFTN: EGGAYFYG

**REPORT TO THE CMA OF AN ALTITUDE DEVIATION OF 300 FT OR MORE,
INCLUDING THOSE DUE TO TCAS, TURBULENCE AND CONTINGENCY EVENTS**

1. REPORT OF AN ALTITUDE DEVIATION OF 300 FT OR MORE
 2. REPORTING AGENCY
 3. DATE AND TIME
 4. LOCATION OF DEVIATION
 5. RANDOM/OTS ¹
 6. FLIGHT IDENTIFICATION AND TYPE
 7. FLIGHT LEVEL ASSIGNED
 8. OBSERVED/REPORTED FINAL FLIGHT LEVEL² MODE "C"/PILOT REPORT¹
 9. DURATION AT UNCLEARED FLIGHT LEVEL
 10. CAUSE OF DEVIATION
 11. OTHER TRAFFIC
 12. CREW COMMENTS WHEN NOTIFIED
 13. REMARKS ³
-
1. State one of the two choices.
 2. In the case of turbulence, state extent of deviation from cleared flight level.
 3. In the event of contingency action, indicate whether prior clearance was given and if contingency procedures were followed.

When complete send to:

North Atlantic Central Monitoring Agency
National Air Traffic Services Limited
One Kemble Street
London WC2B 4AP
United Kingdom

Fax: +44 (0)20 7832 5562
AFTN: EGGAYFYG

**REPORT TO THE CMA REGARDING A NON-RVSM COMPLIANT
RESERVATION APPROVAL**

<i>PRIORITY</i> FF	<i>ADDRESSEE</i> EGGAYFYG
<i>FILING TIME</i>	<i>ORIGINATOR</i>
ATTENTION NAT CMA	
REPORT OF NON-RVSM COMPLIANT RESERVATION APPROVAL	
REPORTING AGENCY	
DATE / TIME	
AIRCRAFT IDENTIFICATION/OPERATOR	
ROUTE	
IMPACT ON RVSM TRAFFIC	
CREW JUSTIFICATION	
CREW COMMENTS WHEN NOTIFIED OF THE REQUIREMENT TO CONTACT NAT CMA TO JUSTIFY RESERVATION.	<u>CMA CONTACT</u> NAT CMA, T8G7, One Kemble Street London WC2B 4AP, UK ☎: (44) 020 7832 5732 FAX: (44) 020 7832 5562 Email: Jim.Benson@nats.co.uk
..... WATCH MANAGER	SIGNATURE
PLEASE ACKNOWLEDGE RECEIPT	<i>ITALICS NOT FOR TRANSMISSION</i>

**REPORT TO THE CMA ON THE TACTICAL MONITORING
OF MNPS/RVSM APPROVAL STATUS**

1. REPORT ON THE TACTICAL MONITORING OF MNPS/RVSM¹ APPROVAL
2. DATE/TIME
3. FLIGHT IDENT. AND OPERATOR
4. AIRCRAFT TYPE
5. PLANNED/REQUESTED LEVEL
6. CLEARED LEVEL
7. DEPARTURE AIRFIELD
8. DESTINATION AIRFIELD
9. LETTER 'X' FILED IN ITEM 10
10. LETTERS 'X' & 'W' FILED IN ITEM 10
11. CREW COMMENTS
12. REMARKS

¹ While RVSM approval for operations in the NAT encompasses the requirements for operations in MNPS Airspace, FL 290 and FL 410 will remain available for use by MNPS aircraft until circa January 2002.

When complete fax or send this form to:

North Atlantic Central Monitoring Agency
National Air Traffic Services Limited
One Kemble Street
London WC2B 4AP
United Kingdom

Fax: +44 (0)20 7832 5562
AFTN: EGGAYFYG

LETTERS USED BY THE CMA IN COMMUNICATIONS WITH STATES

Dear Mr/Ms,

MONITORING OF NORTH ATLANTIC (NAT) - APPROVALS FOR OPERATING IN MINIMUM NAVIGATION PERFORMANCE SPECIFICATIONS AIRSPACE

At its 25th meeting, the ICAO North Atlantic Systems Planning Group (NAT SPG) concluded that NAT Provider States should introduce, where possible, procedures designed to monitor the approval status of Operators in NAT MNPS Airspace, in order to assist in reducing the number of non-approved users. The procedure adopted by Oceanic Area Control Centre is that when a pilot requests a NAT oceanic clearance that includes MNPS levels the pilot may be asked to confirm the MNPS approval status.

In the situation where a pilot is unable to give this confirmation the details are passed to this office, which acts as the Central Monitoring Agency (CMA) for NAT SPG, in order that the State of Registry or the State of the Operator involved may be notified.

It was noted that the pilot/s of the following flight/s/list of flights, which took place on, and for which we believe you to be the State of Registry/the Operator, was/were unable to give assurance that he/they, possessed NAT MNPS approval. We would be grateful if you would investigate the circumstances, and advise whether or not this/these flight/s was/were in possession of a formal State Approval for NAT MNPS Operations. If the flight/s was/were not so approved we would be grateful if you would further notify this office of your proposed course of action.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

Dear Mr,Ms,

MONITORING OF NORTH ATLANTIC (NAT) - APPROVALS FOR OPERATING IN MINIMUM NAVIGATION PERFORMANCE SPECIFICATION AIRSPACE (MNPSA) AT RVSM LEVELS

At its 25th meeting, the ICAO North Atlantic Systems Planning Group (NAT SPG) concluded that NAT Provider States should introduce, where possible, procedures designed to monitor the approval status of Operators in NAT MNPS Airspace, in order to assist in reducing the number of non-approved users. At its 32nd meeting, the NAT SPG extended these procedures to include the monitoring of Operator approvals to operate at RVSM levels within the aforementioned airspace.

It was noted that the pilot of flight....., a type....., registration....., which flew from (departure airfield) to (destination airfield) on (date), and for which we believe you to be the State of Registry, gave assurance that he/she possessed the required approval. We have no record of this approval on the RVSM Approvals database and would be grateful if you would investigate the circumstances, and advise whether or not this flight was in possession of formal State Approval for NAT MNPS operations at RVSM levels. If the flight was not so approved we would be grateful if you would further notify this office of your proposed course of action.

Yours faithfully,

(Signature)
NAT CMA
for ICAO

Dear Mr/Ms,

NORTH ATLANTIC - HEIGHT DEVIATION REPORT

At its 27th meeting, the North Atlantic Systems Planning Group (NAT SPG) agreed that it was necessary to improve the effectiveness of the monitoring of height-keeping performance in the North Atlantic (NAT) Region. In order to achieve this objective, NAT SPG tasked NAT Provider States with improving, where necessary, the effectiveness of reporting of height deviations to the Central Monitoring Agency (CMA). In turn, the CMA is required to initiate an investigation into the causes of reported height deviations.

Please find attached details of a report of a height deviation in the NAT Region attributed to an aircraft registered in your State. I would be grateful if you would arrange for the circumstances of this incident to be investigated and advise this office of the causes of the reported deviation from the aircraft's cleared flight level, together with any remedial action you will be taking.

Yours faithfully,

NAT CMA
for ICAO

CMA QUARTERLY REPORT
CLASSIFICATION OF ERRORS AND WEIGHTING FACTORS USED

1. Classification of errors (NAT SPG/27, paragraph 1.2.4, revised NAT SPG/33)

CLASS	CAUSE
A	Aircraft not certified for operation in MNPS Airspace
B	ATC system loop error
C1	Equipment control error encompassing incorrect operation of fully functional FMS or navigation system
C2	Incorrect transcription of ATC clearance or re-clearance into the FMS
C3	Wrong information faithfully transcribed into the FMS e.g. flight plan followed rather than ATC clearance or original clearance followed instead of re-clearance
D	Other navigation errors, including equipment failure notified to ATC in time for action
E	Other navigation errors, including equipment failure notified to ATC too late for action
F	Other navigation errors, including equipment failure of which notification was not received by ATC

2. Weighting factors used in revised Model 2 (NAT SPG/27, paragraph 1.2.2.4)

		ERROR WEIGHTINGS		
		Type of Error		
Deviation NM		Waypoint insertion* or ATC System Loop	Equipment failure	Non-approved user (short range nav)
1°	(50-70)	0.33	0.40	0.40
2°	(71-130)	0.58	0.55	0.58
3°	(131-190)	0.84	0.70	0.84
4°	(191-250)	1.09	0.85	1.09
5°	(251-310)	1.34	1.00	1.34
6°	(311-370)	1.59	1.15	1.59

Waypoint insertion errors of 1°, which, because of the track geometry, result in a cross track error of less than 50 NM, will also be afforded the appropriate weighting.

Waypoint insertion errors will be afforded weightings appropriate to the 'equivalent' magnitude of the error (equivalent magnitude is the magnitude which scrutiny establishes that the error would have reached, had not the presence of radar enabled the error to be truncated).

NOTES TO AID COMPLETION OF CMA FORMS F1, F2 AND F3

Please read these notes before attempting to complete forms CMA F1, CMA F2 & CMA F3.

It is important for the Central Monitoring Agency (CMA) to have an accurate record of a point of contact for any queries that might arise from on-going height monitoring. **Recipients within the authority/administration of the State of Registry/State of Operator** are therefore requested to include a completed CMA F1 with their **first** reply to the CMA. Thereafter, there is no further requirement unless there has been a change to the details requested on the form.

Recipients with large databases of approvals information are requested to send the information at the appropriate time intervals to the CMA on a 3.5" floppy disk. **The data should be extracted from the database into a comma separated text file.**

Those recipients without electronic databases must complete a hard copy of CMA F2 for **each aircraft** granted the appropriate airworthiness and/or RVSM approval. The numbers below refer to the superscript numbers on the blank forms CMA F2 and F3.

1. Enter the 2-letter ICAO identifier as laid down in ICAO Doc 7910. In the event of there being more than one identifier for the same State, the one that appears first in the list should be used.
2. Enter the operator's 3-letter ICAO identifier as laid down in ICAO Doc 8585. If military, write 'MIL' and put the name of the aircraft's unit in the 'Remarks' field. If IGA, write 'IGA' and put the name of the operator/owner in the 'Remarks' field.
3. Enter the ICAO designator as laid down in ICAO Doc 8643, e.g. B767-200 = B762.
4. Enter Mark or Series of aircraft type e.g. 200.
5. Enter Aircraft Mode S address code in hexadecimal format.
e.g. 0001 0010 0011 0100 1101 1111 is equivalent to 1234DF in hexadecimal.
6. Enter Yes or No.
7. Example: For 26 June 1997 write 26:06:97.
8. Use a separate sheet of paper if insufficient space available.

The above numbers also refer to those superscript numbers used in CMA F3 - 'Withdrawal of Approval to Operate in North Atlantic RVSM Airspace'. ***If required, a CMA F3 must be completed and forwarded to the CMA by the most expeditious means available no later than the next business day after any withdrawal of RVSM approval.***

CMA F1

**POINT OF CONTACT DETAILS/CHANGE OF POINT OF CONTACT DETAILS
FOR MATTERS RELATING TO RVSM APPROVALS**

This form should be completed and returned to the address below on the first reply to the CMA or when there is a change to any of the details requested on the form. (PLEASE USE BLOCK CAPITALS).

STATE OF REGISTRY

STATE OF REGISTRY 2-LETTER ICAO IDENTIFIER

ADDRESS

NAME OF CONTACT PERSON

Title Surname Initials

Post/Position

Telephone Number

Fax Number

Initial Reply*/Change of Details*

**Delete as appropriate*

When complete, please return to the following address:

NAT CMA
Room T8G7
One Kemble Street
London WC2B 4AP
United Kingdom

Telex: 883092 EGGA

AFTN: EGGAYFYG

Fax: + 44 (0)20 7832 5562

CMA F2

RECORD OF AIRWORTHINESS APPROVAL AND RVSM APPROVAL

1. When a State of Registry/State of Operator approves or amends either the airworthiness approval or RVSM approval of an operator/aircraft for operations within North Atlantic (NAT) RVSM airspace, details of that approval must be recorded and sent to the NAT Central Monitoring Agency (CMA) as soon as practicable but no later than the 10th day of the month following the month that the approval was issued.

2. *Before providing the information as requested below, reference should be made to the accompanying notes. (PLEASE USE BLOCK CAPITALS).*

State of Registry¹:

Name of Operator²:

State of Operator¹:

Aircraft Type³:

Aircraft Mark/Series⁴:

Manufacturers Serial/Construction N^o:

Registration:

Aircraft Mode S Address Code⁵:

Airworthiness Approval⁶:

Date Airworthiness Approval Issued⁷:

RVSM Approval⁴:

Date RVSM Approval Issued⁷:

Date of Expiry of RVSM Approval (if any)⁷:

Remarks⁸:

When complete, please return to the following address by the most expeditious means.

NAT CMA
Room T8G7
One Kemble Street
London
WC2B 6T4AP
United Kingdom

Telex: 883092 EGGA
AFTN: EGGAYFYG
Fax: + 44 (0)20 7832 556

CMA F3**WITHDRAWAL OF APPROVAL TO OPERATE IN NORTH ATLANTIC RVSM AIRSPACE**

1. Immediately a State of Registry/State of Operator has cause to withdraw the RVSM approval of an operator/aircraft for operations within the North Atlantic (NAT) MNPS/RVSM airspace, details as requested below, must be submitted to the NAT Central Monitoring Agency (CMA) by the most expedient method.
2. *Before providing the information as requested below, reference should be made to the accompanying notes. (PLEASE USE BLOCK CAPITALS).*

State of Registry¹:**Name of Operator²:****State of Operator¹:****Aircraft Type³:****Aircraft Mark/Series⁴:****Manufacturers Serial/Construction N^o:****Registration:****Aircraft Mode S Address Code⁵:****Date of Withdrawal of RVSM Approval⁷:****Reason for Withdrawal of RVSM Approval⁸:****Remarks⁸:**

When complete, please return to the following address by the most expeditious means.

NAT CMA
Room T8G7
One Kemble
London WC2B 4AP
United Kingdom

Telex: 883092 EGGA
AFTN: EGGAYFYG
Fax: + 44 (0)20 7832 5562

APPENDIX D
DOCUMENTATION RELEVANT TO NAT OPERATIONS ISSUED BY STATES

STATE	PUBLICATION	AVAILABLE FROM
CANADA	<p>Aeronautical Information Publication (AIP Canada) Air Navigation Orders and Air Regulations Canada Flight Supplement (Canada and North Atlantic)</p> <p>NOTAM</p> <p>Canada Air Pilot Instrument Approach Procedures (East and West)</p> <p>En-route Terminal charts</p>	<p>Canadian Government Publishing Centre Supply and Services Canada OTTAWA, Ontario Canada KIA OS9</p> <p>Canada Map Office Department of Energy, Mines and Resources 615 Booth Street OTTAWA, Ontario Canada KIA OE9</p>
FRANCE	<p>Publication d'Information Aéronautique - Nord Atlantique</p> <p>NOTAM Bureau NOTAM International</p>	<p>Service de l'Information Aéronautique 8, Avenue Roland Garros BP 245 33698 Mérignac Cedex Tel : +33 557925555 (AIP) Fax : +33 557925510 (AIP)</p> <p>Tel : +33 557925792 Fax : +33557925799</p>
GREENLAND	<p>Aeronautical Information Publication (AIP Greenland and Faro Island)</p> <p>NOTAM</p> <p>Aeronautical Information Circulars</p>	<p>Civil Aviation Administration AIS Box 744 DK 2450 Copenhagen SV Denmark</p>
ICELAND	<p>Aeronautical Information Publication (AIP)</p> <p>NOTAM</p>	<p>Icelandic Civil Aviation Administration Aeronautical Information Service Reykjavik Airport IS-101 REYKJAVIK Iceland Tel (AIP): +354 569 4109 Fax (AIP): +354 569 4286 Tel (NOTAM): +354 569 4294 Fax (NOTAM): +354 569 4200</p>

IRELAND	Aeronautical Information Publication (AIP Ireland) NOTAM	Aeronautical Information Service Irish Aviation Authority Aviation House Hawkins Street DUBLIN, 2
NORWAY	Aeronautical Information Publication Aeronautical Information Circulars (AIC) NOTAM	Civil Aviation Administration P.O. Box 8124, Dep. N-0032 OSLO 1
PORTUGAL	Aeronautical Information Publication (AIP Portugal) Aeronautical Information Circulars NOTAM	Serviço Informação Aeronautica ANA EP Rua C, Edificio 118 - Aeroporto Apartado 8131 1802 LISBOA CODEX
UNITED KINGDOM	Air Navigation Order and General Regulations United Kingdom Aeronautical Information Publication NOTAM Aeronautical Information Circulars	Westward Digital Limited 37 Windsor Street Cheltenham Glos. GL52 2DG International NOTAM Office First Floor, Control Tower Building London Heathrow Airport Hounslow, Middlesex TW6 1JJ
UNITED STATES OF AMERICA	United States Aeronautical Information Manual (AIM) United States International Flight Information Manual (IFIM) Website http://www.faa.gov/ats/aat/ifim/ Alaska, Caribbean and South American Supplements En-route Charts NOTAMS NAT IGA Operations Manual	Superintendent of Documents Government Printing Offices Washington D.C. 20402 National Ocean Survey (NOS) Distribution Division C44 Riverdale, Maryland 20840 Federal Aviation Administration

APPENDIX E
LIST OF ADDRESSES OF AGENCIES IN THOSE STATES
CONCERNED WITH THE CO-ORDINATION AND CONDUCT OF
ROCKET/MISSILE FIRING ACTIVITIES
IN THE NAT REGION

<p>CANADA Altitude Reservation EAST (ARE) Gander Area Control Centre 35, Memorial Drive East P.O. Box 328 Gander, Newfoundland A1V 1W7</p> <p>Tel : +1 709 651 5243 Fax : +1 709 651 5288 AFTN : CZQXZGZA</p>	<p>ICELAND Icelandic Civil Aviation Administration Shift Manager Reykjavik OACC Reykjavik Airport IS – 101 REYKJAVIK</p> <p>Tel : +354 569 4141 Fax : +354 569 4200 AFTN : BIRDZQZX</p> <p>(*Short-time notices to be addressed to Reykjavik OAC as well as AFTN BIRDZQZX)</p>
<p>DENMARK (GREENLAND) Civil Aviation Administration Luftfartshuset Box 744 DK-2450 COPENHAGEN SV</p> <p>Tel : +45 3618 6000 Fax : +45 1-440303 AFTN : EKCA YALL</p>	<p>IRELAND General Manager Irish Aviation Authority Tower Building Shannon Airport CO CLARE</p> <p>Tel : +353 61 471233 Fax : +353 61 472955 AFTN : EISNZQZX</p>
<p>FRANCE Direction de la Navigation Aérienne DGAC DNA 50, rue Henry Farman 75720 PARIS Cedex 15</p> <p>Tel : +33 1-58094321 Fax : +33 1-58093840 AFTN : LFPSYADN attn DNA/1</p>	<p>NORWAY Civil Aviation Administration Postboks 8124, Dep. N-0032 OSLO 1</p> <p>Tel : +47 2-942000 Fax : +47 2 942390 AFTN : ENCA YAYX</p>

<p>PORTUGAL Direcção de Operações do Atlantico Aeroporto de Santa Maria P.O. Box 47 9580-909 Vila do Porto - Portugal</p> <p>Tel : +351 296 886 501 Fax : +351 296 886 116 AFTN : LPAZYJYN</p> <p>(*Short-time notices also to be addressed to LPPOZOZX, attn Supervisor, Tel : +351 296 886 299 Fax : +351 296 820 422</p>	<p>RUSSIAN FEDERATION Central Air Traffic Control of Civil Aviation 37, Leningradsky Prospekt MOSCOW A-167</p> <p>Tel : +7 095/228 54 82, 227 67 21 Fax : AFTN : UUUUZG</p>
<p>UNITED KINGDOM Manager ATC (Oceanic) National Air Traffic Services Limited Atlantic House Sherwood Road PRESTWICK Ayrshire KA9 2NR</p> <p>Tel : +44 1292 692684 Fax : +44 1292 692522 AFTN : EGGXYTYO</p> <p>(*Short-time notices also to be addressed to: EGGXZOZX or Fax: : +44 1292 671048 (Attention Watch Manager)</p>	<p>UNITED STATES OF AMERICA Federal Aviation Administration Central Altitude Reservation Function (CARF) 13600 EDS Drive Herndon VA 20175</p> <p>Tel : +1 703 9044525 Fax : +1 703 9044459 AFTN : KARFYG ARINC: HDQOZYA</p>

– END –