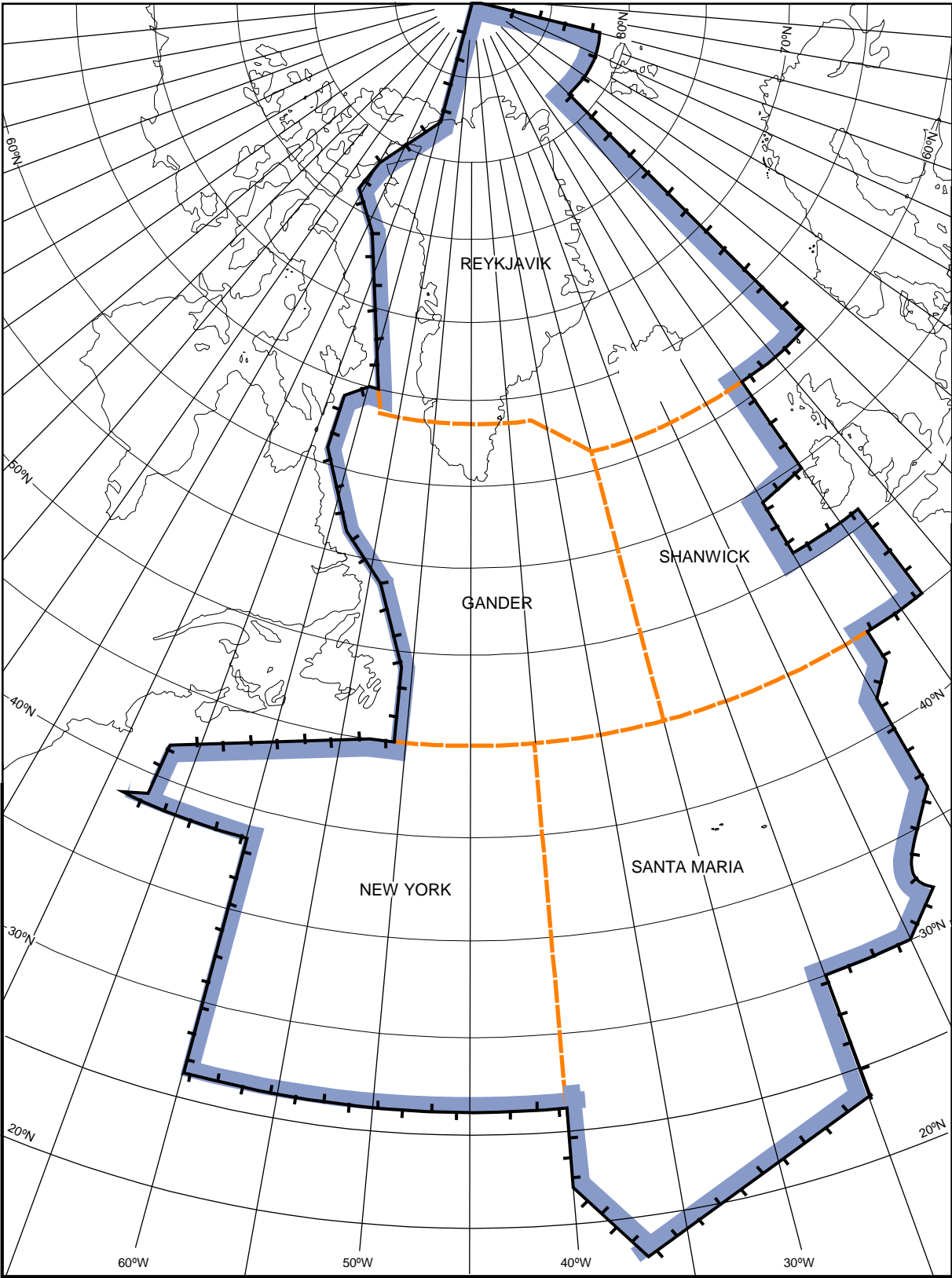


GUIDANCE CONCERNING AIR NAVIGATION IN AND ABOVE THE NORTH ATLANTIC MNPS AIRSPACE Edition 2010



*Published on behalf of the North Atlantic Systems Planning Group (NAT SPG)
by the European and North Atlantic Office of ICAO*

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This is the first publication of this document, being an update and consolidation of material previously contained in the “North Atlantic MNPS Airspace Operations Manual - Edition 2009” and the “ICAO Guidance Material concerning Air Navigation in the North Atlantic Region (NAT Doc 001)”

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FOREWORD

This Document is for guidance only. Regulatory material relating to North Atlantic aircraft operations is contained in relevant ICAO Annexes, PANS/ATM (Doc.4444), Regional Supplementary Procedures (Doc.7030), State AIPs and current NOTAMs, which should be read in conjunction with the material contained in this Document.

This Document is primarily for the information of Aircraft Operating Agencies, Pilots and Dispatchers planning and conducting operations in or above the North Atlantic (NAT) Minimum Navigation Performance Specifications (MNPS) Airspace. It is also expected to be useful to the State Regulators responsible for the approval/certification/or licensing of such aircraft operators, pilots or dispatchers. It forms a replacement for and augmentation of relevant guidance material previously contained in the “North Atlantic MNPS Airspace Operations Manual” and the ICAO “Guidance Material for Air Navigation in the North Atlantic Region (NAT Doc 001)”.

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This Manual has been produced with the approval and on behalf of the North Atlantic Systems Planning Group (NAT SPG); 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 operational procedures; specifying the necessary services and facilities and; defining the aircraft and operator approval standards employed in the NAT Region. Further information on the functions and working methods of the NAT SPG, together with the NAT Regional Safety Policy Statement, are contained in the NAT SPG Handbook which is available from the ICAO European and North Atlantic Office website <http://www.paris.icao.int/>.

This Document can be accessed/downloaded from the ICAO European and North Atlantic Office website: <http://www.paris.icao.int/>. This website will also include, any noted post publication errata (changes) or addenda (additions) to the current edition. The Document will be reissued on a yearly basis in September. Details of additional Internet access will be promulgated through the Aeronautical Information Service (AIS) of NAT ATS Provider States.

Material, intended for the information of States of Registry and Aircraft Operating Agencies, dealing primarily with planning and management aspects of NAT MNPS operations, previously (prior to 2010) contained in ICAO ‘Consolidated Guidance and Information Material concerning Air Navigation in the North Atlantic Region’ (NAT Doc 001), has been incorporated into this Document. To assist with the editing of this Manual and to ensure the currency and accuracy of future editions it would be appreciated if readers would submit their comments/suggestions for possible amendments/additions, to the ICAO EUR/NAT Office at the above Email address.

The NATSPG has also commissioned the UK National Air Traffic Services to produce an interactive DVD ROM, “On the Right Track”, which contains general information on Air Traffic Control in the

North Atlantic Region and which highlights many of the common operational errors and discusses their causes. This DVD ROM, like this Manual, is aimed at pilots, dispatchers and others concerned in operations in the North Atlantic. It is available at no charge to *bona fide* operators on application to: customerhelp@nats.co.uk.

As part of the continuing development within the operating environment of NAT MNPS Airspace, various trials take place in the NAT from time to time. Some of these trials require the assistance of operators and pilots. For a listing of current trials (if any) and participation details etc., reference should be made to the AIS documentation of NAT ATS Provider States. Details may also be found on the above-mentioned ICAO Paris website.

NORTH ATLANTIC MINIMUM NAVIGATION PERFORMANCE SPECIFICATIONS AIRSPACE

The vertical dimension of MNPS Airspace is between FL285 and FL420 (i.e. in terms of normally used cruising levels, from FL290 to FL410 inclusive).

The lateral dimensions include the following Control Areas (CTAs):

REYKJAVIK, SHANWICK, GANDER and SANTA MARIA OCEANIC plus
the portion of NEW YORK OCEANIC which is North of 27°N but excluding the area
which is west of 60°W & south of 38°30'N

Some idea of these dimensions can be obtained from the maps on the cover of this document and those in Chapters 2 and 3. However, for specific dimensions, reference should be made to *ICAO Regional Supplementary Procedures (Doc.7030) - NAT/RAC (available at <http://www.paris.icao.int/>)*.

Pilots **MUST NOT** fly across the North Atlantic within MNPS Airspace, nor at flight levels 290 to 410 inclusive anywhere within the NAT Region, unless they are in possession of the appropriate Approval(s) issued by the State of Registry or the State of the Operator.

The North Atlantic is the busiest oceanic airspace in the world. In 2008 approximately 425,000 flights crossed the North Atlantic. For the most part in the North Atlantic, Direct Controller Pilot Communications (DCPC) and ATS Surveillance are unavailable. Aircraft separation assurance and hence safety are nevertheless ensured by demanding the highest standards of horizontal and vertical navigation performance/accuracy and of operating discipline. Within NAT MNPS Airspace a formal Approval Process by the State of Registry of the aircraft or the State of the Operator ensures that aircraft meet defined MNPS Standards and that appropriate crew procedures and training have been adopted.

DEVELOPMENT OF CONTENT

This is the first publication of this Document. It incorporates updated elements from Edition 2009 of the “North Atlantic MNPS Airspace Operations Manual” and relevant elements from the 7th Edition (2002) of the NAT Doc 001 - “Guidance and Information Material Concerning Air Navigation in the North Atlantic Region”. The Document’s format is based upon that of Edition 2009 of the Operations Manual. However, it includes the following content modifications and additions, most of the latter arising from the 7th Edition of Doc 001. Additionally, since Edition 2009 of the NAT MNPS Airspace Operations Manual was published, various other guidance material documents in the NAT Library have been designated as “NAT OPS Bulletins”. Mostly they provide detail in respect of specific elements of NAT operations. Some are copies or paraphrases of NAT ATS Provider State AIS. Since individual States must retain the prerogative to revise their AIS, as and when dictated by infrastructure developments, experience or changes to regulations, it has been determined that detailed information provided in these NAT OPS Bulletins should be omitted from this Document. The Document does, however, include references to these Bulletins where appropriate.

Content Modifications and Additions

The recommendations for Crew Training for NAT MNPS Airspace operations, as were contained in section 3.13 of Doc 001, are incorporated into Chapter 1 - “Operational Approval and Aircraft System Requirements for Flight in the NAT MNPS Airspace”.

Recommendations for the Presentation of Navigation Information contained in section 3.14 of Doc 001 are incorporated into Chapter 8 – “MNPS Flight Operation and Navigation Procedures”.

Elements of Part 4 of Doc 001 dealing with recommended procedures for the adoption by State Regulators in the granting of MNPS Approvals are incorporated into Chapter 1 – “Operational Approval and Aircraft System Requirements for Flight in the NAT MNPS Airspace”.

The contents of Parts 6 and 7 of Doc 001, dealing with Temporary Airspace Reservations, Formation Flying and Missile Activity in the NAT Region are of direct interest only to State or Military Aircraft Operating Agencies and to NAT ATS Providers. Consequently they are referenced only in passing in Chapter 1 of this Document. The future repository of the detail will be determined by the appropriate competent authorities.

Part 8 of Doc 001 dealt with “Manned Balloon Flights in the NAT Region”. Such flights are specifically excluded from operating in NAT MNPS Airspace and each such flight must be meticulously co-ordinated far in advance with the relevant ATS Providers. Consequently only passing reference is made in Chapter 1.

Appendix A5 from Doc 001 - “VHF Air/Ground Communications Coverage Existing in the NAT Region at FL 300” is incorporated as Attachment 5 to this document.

This Document includes a separate Chapter 10 – “Monitoring of aircraft systems and crew performance”. This Chapter incorporates the contents of Sections 8.7 & 9.3 and Attachment 1 of Edition 2009 of the MNPS Airspace Operations Manual, together with further information on the Monitoring Methods employed and the Collision Risk Models used (including information from Appendix B and Appendix C19 of Doc 001).

Canada is currently conducting ADS-B trials in the NAT Region and in immediately adjacent domestic airspace. Further trials are also planned by Iceland. Reference to these operations is included into Chapter 6 - “Communications and Position Reporting Procedures”. It is planned that up-to-date details of the Canadian trials will be provided via NAT OPS Bulletins; current information is fully described in the appropriate Canadian aeronautical information publications.

The sample “Oceanic Check List Proposals” and the “Expanded Oceanic Check List” included in Section 12.3 of the 2009 Edition of the MNPSA Operations Manual are now published in full as NAT OPS Bulletins. Their details have consequently been omitted from this Document.

GLOSSARY OF TERMS

ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ADC	Air Data Computer
ADF	Automatic Direction Finding
ADS	Automatic Dependant Surveillance
ADS-B	Automatic Dependant Surveillance - Broadcast
ADS-C	Automatic Dependant Surveillance - Contract
AFTN	Aeronautical Fixed Telecommunication Network
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Service
ARINC	ARINC - formerly Aeronautical Radio Incorporated
ASR	Aviation Safety Report
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
AWPR	Automatic Waypoint Position Reporting
BOTA	Brest Oceanic Transition Area
BRNAV	Basic Area Navigation
CAR	Caribbean
CDL	Configuration Deviation List
CDR	ConDitional Route
CDU	Control Display Unit
CMA	Central Monitoring Agency
Conflict	A situation that occurs when it is predicted that the spacing between aircraft, an aircraft and a defined airspace, or an aircraft and terrain, may or will reduce below the prescribed minimum.
CPDLC	Controller Pilot Data Link Communications
CTA	Control Area
DCPC	Direct Controller/Pilot Communications
DME	Distance Measuring Equipment
DR	Dead Reckoning
DVD ROM	Digital Video Disk Read-Only Memory
ELT	Emergency Locator Transmitter

ETA	Estimated Time of Arrival
ETOPS	Extended Range Twin-engine Aircraft Operations
EUR	Europe
FAA	Federal Aviation Administration
FANS 1/A	Future Air Navigation System 1 or A. (Respectively, Boeing and Airbus Proprietary Air-Ground ATC Data Link Communications Systems)
FDE	Fault Detection and Exclusion
FIR	Flight Information Region
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FMC	Flight Management Computer
FMS	Flight Management System
GLONASS	Global Orbiting Navigation Satellite System
GMU	GPS (Height) Monitoring Unit
GNE	Gross Navigation Error
GNSS	Global Navigation Satellite System
GP	General Purpose
GPS	Global Positioning System
HF	High Frequency
HMU	Height Monitoring Unit
HSI	Horizontal Situation Indicator
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
INS	Inertial Navigation System
IRS	Inertial Reference System
JAA	Joint Aviation Authorities
kHz	Kilohertz
LAT	Latitude
LONG	Longitude
LRNS	Long Range Navigation System
MASPS	Minimum Aircraft System Performance Specification
MEL	Minimum Equipment List
MET	Meteorological
MHz	Megahertz
MMEL	Master Minimum Equipment List
MNPS	Minimum Navigation Performance Specifications
MTT	Minimum Time Track
NAM	North America
NAR	North American Route

NAT	North Atlantic
NAT SPG	North Atlantic Systems Planning Group
NDB	Non Directional Beacon
NERS	North Atlantic European Routing Scheme
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOTA	Northern Oceanic Transition Area
NOTAM	Notice to Airmen
OAC	Oceanic Area Control Centre
OCA	Oceanic Control Area
Oceanic Entry Point	That point on the FIR boundary where the aircraft enters the first oceanic control area
Oceanic Exit Point	That point on the FIR boundary where the aircraft leaves the last oceanic control area
OESB	Oceanic Errors Safety Bulletin
OTS	Organized Track System
PRM	Preferred Route Message
Procedural Control	Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service. (PANS-ATM)
RA	Resolution Advisory (per ACAS/TCAS)
RAIM	Receiver Autonomous Integrity Monitoring
RMI	Radio Magnetic Indicator
RNP	Required Navigation Performance
R/T	Radio Telephony
RVSM	Reduced Vertical Separation Minimum
SAM	South America
SELCAL	Selective Calling
SID	Standard Instrument Departure
SLOP	Strategic Lateral Offset Procedures
SMS	Safety Management System
SOTA	Shannon Oceanic Transition Area
SSB	Single Sideband
SSR	Secondary Surveillance Radar
Strategic Control	As used in this manual, control techniques employed in an environment where the level of surveillance and intervention capability requires that each oceanic clearance be planned and issued prior to the flight's entry into oceanic airspace, in order to provide safe separation between known traffic from oceanic entry to oceanic exit.
TA	Traffic Advisory (per ACAS/TCAS)

Tactical Control	As used in this manual, control techniques employed in an environment where the surveillance and intervention capabilities allow conflicts between flights to be resolved nearer the time they would occur, rather than prior to the oceanic clearance being issued.
TAS	True Airspeed
TCAS	Traffic (Alert and) Collision Avoidance System
TLS	Target Level of Safety
TMI	Track Message Identification
UTC	Co-ordinated Universal Time
VHF	Very High Frequency
VOR	VHF Omni-directional Range
WAH	When Able Higher
WATRS	West Atlantic Route System
WPR	Waypoint Position Report

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CHAPTER 1: OPERATIONAL APPROVAL AND AIRCRAFT SYSTEM REQUIREMENTS FOR FLIGHT IN THE NAT MNPS AIRSPACE

Pilots may fly across the North Atlantic within MNPS Airspace only if they are in possession of the appropriate MNPS and RVSM Approvals issued by the State of Registry of the aircraft or by the State of the Operator.

1.1 GENERAL

1.1.1 It is implicit in the concept of MNPS that all flights within the airspace achieve the highest standards of horizontal and vertical navigation performance and accuracy. Formal monitoring programmes are undertaken to quantify the achieved performances and to compare them with standards required to ensure that established Target Levels of Safety (TLS) are met.

Note : Collision Risk Modelling is used to estimate risk in each of the three dimensions (i.e. lateral, longitudinal and vertical). Target maxima set for these estimates are expressed in terms of potential collisions per flight hour and are known as “Target Levels of Safety(TLSs)”.

1.1.2 Aircraft operating within MNPS Airspace are required to meet Minimum Navigation Performance Specifications (MNPS) in the horizontal plane through the mandatory carriage and proper use of a specified level of navigation equipment that has been approved by the State of Registry or State of the Operator for the purpose. Such approvals encompass all aspects affecting the expected navigation performance of the aircraft, including the designation of appropriate cockpit/flight deck operating procedures.

1.1.3 Since January 2002 when the final phase implementation of RVSM at all levels in NAT MNPS Airspace took place, all aircraft intending to operate within NAT MNPS Airspace have had to be equipped with altimetry and height-keeping systems which meet RVSM Minimum Aircraft System Performance Specifications (MASPS). RVSM MASPS are contained in ICAO Doc 9574 and detailed in designated FAA document, AC91-85, and in Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL No.6), Revision 1. These documents can be downloaded from:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/rvsm/documentation
and <http://www.ecacnav.com/downloads/TGL6rev1.pdf>, respectively.

1.1.4 This Document, together with the RVSM MASPS documents, are provided to assist States of Registry, operators, owners and planning staff who are responsible for issuing or obtaining MNPS/RVSM approvals for aircraft. However, the ultimate responsibility for checking that a NAT MNPS/RVSM flight has the necessary approval(s) rests with the pilot in command. In the case of most regular scheduled flights this check is a matter of simple routine but pilots of special charter flights, private flights, ferry and delivery flights are advised to pay particular attention to this matter. Routine monitoring of NAT traffic regularly reveals examples of pilots of non-approved flights, from within these user groups, flight planning or requesting clearance within MNPS Airspace. All such instances are prejudicial to safety and are referred to relevant State Authorities for further action.

1.1.5 While not a specific element of NAT MNPS approval, pilots and operators are reminded that for flights over the NAT, ICAO SARPS Annex 6, Part 1, Chapter 6, requires carriage of Emergency Locator Transmitters (ELTs). It should be further noted that new specifications for these beacons to operate exclusively on frequency 406 MHz (but with a 121.5 MHz search and rescue homing capability) have been in effect since January 2005. New aircraft have been required to be so equipped since 2005.

Exceptions - Special Operations

1.1.6 NAT ATS Providers may approve moving or stationary temporary airspace reservations within MNPS Airspace, for the benefit of State or Military Aircraft Operating Agencies to accommodate Military Exercises, Formation Flights, Missile Firing or UAV Activities. Procedures are established in respect of the requests for and management of such reservations. Whenever such reservations might impinge upon other flights in the NAT Region, relevant AIS is published, including, if appropriate, annotations on the NAT Track Message.

1.1.7 Manned Balloon flights can be operated in or through the NAT Region. They are, however, required to avoid MNPS Airspace and must be meticulously co-ordinated with affected ATS Authorities many months in advance.

1.2 APPROVAL

1.2.1 **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 system performance specification (MASPS) and hold an issued approval.** Approval for MNPS operations will require the checking by the State of Registry or State of the Operator, of various aspects affecting navigation performance. These aspects include: the navigation equipment used, together with its installation and maintenance procedures; plus the crew navigation procedures employed and the crew training requirements.

1.2.2 Since MNPS Airspace is now designated as RVSM airspace at all levels (i.e. FL290-410 inclusive) **specific State RVSM Approval is also required to operate within MNPS Airspace.** RVSM Approvals prescribe both airworthiness requirements to ensure aircraft height-keeping performance in accordance with the RVSM MASPS, and also crew operating procedures. In general RVSM Approvals granted by most States are not regionally specific but are valid for world-wide operations. However, some crew operating procedures, particularly those to be followed in contingency situations, are specific to the airspace environment. Such procedures for use in MNPS airspace vary from those adopted in a domestic airspace environment in which radar surveillance and DCPC are available (see Chapter 9 & Chapter 12). States provide approval of these procedures specific to MNPS or Oceanic airspace operations in different ways. It may be explicitly addressed in the general RVSM Approval. It may be included as an element of the MNPS Approval or it may be a stated item of the Operations Specifications. Nevertheless, however provided, all NAT crews/operators must be State approved specifically for NAT RVSM operations and each aircraft intended to be flown in MNPS airspace must have State RVSM Airworthiness Approval.

1.2.3 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.

1.2.4 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. States must also provide data on RVSM approved airframes to the North Atlantic Regional Monitoring Agency (RMA), which is maintained by the North Atlantic Central Monitoring Agency (NAT CMA). The CMA database facilitates the tactical monitoring of aircraft approval status and the exclusion of non-approved users.

1.2.5 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) State aviation authorities should consider limiting the validity period of approvals; and
- c) State aviation authorities should maintain detailed records of all NAT MNPS and RVSM approvals.

1.3 HORIZONTAL NAVIGATION REQUIREMENTS FOR UNRESTRICTED MNPS AIRSPACE OPERATIONS

Longitudinal Navigation

1.3.1 Longitudinal separations between subsequent aircraft following the same track (in-trail) and between aircraft on intersecting tracks in the NAT MNPS Airspace are assessed in terms of differences in ATAs/ETAs at common waypoints. The longitudinal separation minima currently used in the NAT MNPS Airspace are thus expressed in clock minutes. The maintenance of in-trail separations is aided by the application of the Mach Number Technique (See Chapter 7 – “Application of Mach Number Technique”). However, aircraft clock errors resulting in waypoint ATA errors in position reports can lead to an erosion of actual longitudinal separations between aircraft. It is thus vitally important that the time-keeping device intended to be used to indicate waypoint passing times is accurate, and is synchronised to an acceptable UTC time signal before commencing flight in MNPS Airspace. In many modern aircraft, the Master Clock can only be reset while the aircraft is on the ground. Thus **the pre-flight procedures** for any NAT MNPS operation **must include** a UTC time check and resynchronisation of the aircraft Master Clock (typically the FMS). Lists of acceptable time sources for this purpose have been promulgated by NAT ATS Provider States. A non-exhaustive list is shown in Chapter 8 of this Document.

Lateral Navigation

Equipment

1.3.2 There are two navigational equipment requirements for aircraft planning to operate in MNPS Airspace. One refers to the navigation performance that should be achieved, in terms of accuracy. The second refers to the need to carry standby equipment with comparable performance characteristics (*ICAO Annex 6, Parts I and II, Chapter 7* refer).

1.3.3 In terms of accuracy, 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 (56 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 (93 and 130 km) off the cleared track shall be less than 13×10^{-5} .

1.3.4 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. However, 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. Currently, it has been demonstrated that the requisite accuracies may be achieved using Long Range Navigation Systems, namely INS, IRS or GNSS. Consequently, State approval of unrestricted operation in the MNPS Airspace may presently be granted to an aircraft equipped as follows:

- a) **with at least two** fully serviceable Long Range Navigation Systems (LRNSs). A LRNS may be one of the following:
- one Inertial Navigation System (INS);
 - one Global Navigation Satellite System (GNSS); or
 - one navigation system using the inputs from one or more Inertial Reference System (IRS) or any other sensor system complying with the MNPS requirement.

Note 1: Currently the only GNSS system fully operational and for which approval material is available, is GPS.

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 Advisory Circular AC-20-138A Appendix 1 and their operation approved in accordance with FAA HBAAT 95-09. AC-20-138A (previously FAA Notice 8110.60) requires that GPS systems used in Oceanic airspace must have a FDE function. Equipment which previously demonstrated compliance with N8110.60 need not be re-evaluated. States other than the USA may set their own standards for operational approval of GPS to provide Primary Means of Navigation in Oceanic and remote areas but in all cases these approvals will include the requirement to carry out Pre-Departure Satellite Navigation Prediction Programmes (See Chapter 8 - GNSS (GPS) Systems for further details). If, however, GPS serves as only one of the two required LRNSs, then it must be approved in accordance with FAA TSO-C129 or later standard as Class A1, A2, B1, B2, C1 or C2, or with equivalent EASA documentation ETSO-C129a. In this instance individual States vary in their insistence upon the need for the conduct of pre-departure satellite navigation prediction programmes (viz. FDE RAIM).

Note 3: Currently equivalent approval material for GLONASS is not under development but it will need to be available prior to approval of any GLONASS equipped aircraft for MNPS operations.

- b) each LRNS must be capable of providing to the flight crew a continuous indication of the aircraft position relative to desired track.
- c) it is also highly desirable that the navigation system employed for the provision of steering guidance is capable of being coupled to the autopilot.

Note: Some aircraft may carry two independent LRNS 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 one LRNS; and an FMCS with inputs from one or more IRS/ISS is also considered to be a single LRNS.

Data Presentation

1.3.5 It is important that navigation data provided to crews in the form of charts, flight plans, master documents, track messages, etc. are presented in a format suitable for error-free use in the cockpit environment. A significant proportion of navigation errors result from the use of incorrect or misinterpreted

data. To minimize the problem, source data must be clearly legible under the worst cockpit lighting conditions. More detailed recommendations are included in Chapter 8 of this Document.

Crew Training

1.3.6 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 Chapter 8 of this Document.

1.3.7 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.

1.3.8 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).

1.3.9 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.

1.3.10 Finally, crew training should be extended to include instruction on what action should be considered in the event of systems failures. Chapter 11 of this Document provides assistance in establishing such action.

1.4 ROUTES FOR USE BY AIRCRAFT NOT EQUIPPED WITH TWO LRNSs

Routes for Aircraft with Only One LRNS

1.4.1 A number of special routes have been developed for aircraft equipped with only one LRNS and carrying normal short-range navigation equipment (VOR, DME, ADF), which require to cross the North Atlantic between Europe and North America (or vice versa). It should be recognised that these routes are within MNPS Airspace, and that State approval must be obtained prior to flying along them. These routes are also available for interim use by aircraft normally approved for unrestricted MNPS operations that have suffered a partial loss of navigation capability and have only a single remaining functional LRNS. Detailed descriptions of the special routes known as 'Blue Spruce Routes' are included in Chapter 11, paragraph 11.2.2 of this Document. Other routes also exist within MNPS Airspace that may be flown by aircraft equipped with only a single functioning LRNS. These include routings between the Azores and the Portuguese mainland and/or the Madeira Archipelago and also routes between Northern Europe and Spain/Canaries/Lisbon FIR to the east of longitude 009° 01' W (viz.T9). Other routes available for single LRNS use are also established in MNPS airspace, including a routing between Iceland and the east coast of Greenland and two routings between Kook Islands on the west coast of Greenland and Canada.

Note: if this single LRNS is a GPS it must be approved in accordance with FAA TSO-C129 or later standard as Class A1, A2, B1, B2, C1 or C2, or with equivalent EASA documentation ETSO-C129a. Some States may have additional requirements regarding the carriage and use of GPS (e.g. a requirement for FDE RAIM) and pilots should check with their own State of Registry to ascertain what, if any, they are. These above mentioned documents can be found at :

http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgWebcomponents.nsf/HomeFrame?OpenFrameSet and http://www.easa.europa.eu/ws_prod/g/doc/Agency_Mesures/Certification%20Spec/CS-ETSO.pdf

Routes for Aircraft with Short-Range Navigation Equipment Only

1.4.2 Aircraft that are equipped only with short-range navigation equipment (VOR, DME, ADF) may operate through MNPS Airspace but only along routes G3 or G11. However, once again formal State Approval must be obtained. (See Chapter 11, paragraph 11.2.2 for details of these routes.)

1.4.3 The filed ATS Flight Plan does not convey information to the controller on any such MNPS certification limitation. Hence, **it is the responsibility of those pilots with less than unrestricted (i.e. limited) certification to reject any ATC clearances that would otherwise divert them from officially permitted routes.**

1.5 SPECIAL ARRANGEMENTS FOR THE PENETRATION OF MNPS AIRSPACE BY NON-MNPS APPROVED AIRCRAFT

1.5.1 Aircraft not approved for operation in MNPS Airspace may be cleared by the responsible ATC unit to climb or descend through MNPS Airspace provided:

- MNPS approved aircraft operating in that part of the MNPS Airspace affected by such climbs or descents are not penalised.

1.5.2 Details of other required provisions will be found in the AIS publications of the appropriate ATS Provider State.

1.6 SPECIAL ARRANGEMENTS FOR NON-RVSM APPROVED AIRCRAFT

To Climb/Descend Through RVSM Levels

1.6.1 MNPS approved aircraft that are not approved for RVSM operation will be permitted, subject to traffic, to climb/descend through RVSM levels in order to attain cruising levels above or below RVSM airspace. Flights should climb/descend continuously through the RVSM levels without stopping at any intermediate level and should “Report leaving” current level and “Report reaching” cleared level (N.B. this provision contrasts with the regulations applicable for RVSM airspace operations in Europe, where aircraft not approved for RVSM operations are not permitted to effect such climbs or descents through RVSM levels.). Such aircraft are also permitted to flight plan and operate at FL430 either Eastbound or Westbound above NAT MNPS Airspace.

To Operate at RVSM Levels

1.6.2 ATC may provide special approval for an MNPS approved aircraft that is not approved for RVSM operation to fly in MNPS Airspace provided that the aircraft:

- a) is on a delivery flight; or
- b) was RVSM approved but has suffered an equipment failure and is being returned to its base for repair and/or re-approval; or
- c) is on a mercy or humanitarian flight.

1.6.3 Operators requiring such special approval should request prior approval by contacting the initial Oceanic Area Control Centre (OAC), normally not more than 12 hours and not less than 4 hours prior to the intended departure time, giving as much detail as possible regarding acceptable flight levels and routings. Operators should be aware, due to the requirements to provide non-RVSM separation, that requested levels and/or routes may not always be available (especially when infringing active OTS systems). The special approval, if and when received, should be clearly indicated in Item 18 of the ICAO flight plan. Operators must appreciate that the granting of any such approval does not constitute an oceanic clearance, which must be obtained from ATC, by the pilot, in the normal manner. **The service will not be provided to aircraft that are not approved for MNPS operations.**

1.6.4 It must be noted that the provision of this service is intended exclusively for the purposes listed above and is not the means for an operator or pilot to circumvent the RVSM approval process. Operators or pilots are required to provide written justification for the request, upon completion of the flight plan, to the NAT Central Monitoring Agency (CMA). Any suspected misuse of the exceptions rule above, regarding RVSM operation, will be reported and will therefore be subject to follow-up action by the State of Registry or State of the Operator as applicable.

Note: Some flight planning systems cannot generate a flight plan through RVSM airspace unless the “W” designator is inserted in item 10 (equipment). For a flight which has received this special approval, it is of utmost importance that the “W” is removed prior to transmitting the ICAO Flight Plan to ATC. ATC will use the equipment block information to apply either 1000 ft or 2000ft separation. Additionally, Pilots of any such non-RVSM flights operating in RVSM airspace should include the phraseology “Negative RVSM” in all initial calls on ATC frequencies, requests for flight level changes, read-backs of flight level clearances within RVSM airspace and read-back of climb or descent clearances through RVSM airspace

1.7 PERFORMANCE MONITORING

1.7.1 The horizontal (i.e. latitudinal and longitudinal) and vertical navigation performance of operators within NAT MNPS Airspace is monitored on a continual basis. If a deviation is identified, follow-up action after flight is taken, both with the operator and the State of Registry of the aircraft involved, to establish the cause of the deviation and to confirm the approval of the flight to operate in NAT MNPS and/or RVSM Airspace. The overall navigation performance of all aircraft in the MNPS Airspace is compared to the standards established for the Region, to ensure that the relevant TLSs are being maintained. (See Chapter 10)

CHAPTER 2: THE ORGANISED TRACK SYSTEM (OTS)

2.1 GENERAL

2.1.1 As a result of passenger demand, time zone differences and airport noise restrictions, much of the North Atlantic (NAT) air traffic contributes to two major alternating 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 crossing the 30W longitude between 1130 UTC and 1900 UTC and peak eastbound traffic crossing the 30W longitude between 0100 UTC and 0800 UTC.

2.1.2 Due to the constraints of large horizontal separation criteria and a limited economical height band (FL310–400) the airspace is congested at peak hours. In order to provide the best service to the bulk of the traffic, a system of organised tracks is constructed to accommodate as many flights as possible within the major flows on or close to their minimum time tracks and altitude profiles. Due to the energetic nature of the NAT weather patterns, including the presence of jet streams, consecutive eastbound and westbound minimum time tracks are seldom identical. The creation of a different organised track system is therefore necessary for each of the major flows. Separate organised track structures are published each day for eastbound and westbound flows. These track structures are referred to as the Organised Track System or OTS.

2.1.3 It should be appreciated, however, that use of OTS tracks is not mandatory. Currently about half of NAT flights utilise the OTS. Aircraft may fly on random routes which remain clear of the OTS or may fly on any route that joins or leaves an outer track of the OTS. There is also nothing to prevent an operator from planning a route which crosses the OTS. However, in this case, operators must be aware that whilst ATC will make every effort to clear random traffic across the OTS at published levels, re-routes or significant changes in flight level from those planned are very likely to be necessary during most of the OTS traffic periods.

2.1.4 Over the high seas, the NAT Region is primarily Class A airspace (at and above FL55) (See ICAO Doc. 7030 - NAT Regional Supplementary Procedures), in which Instrument Flight Rules (IFR) apply at all times. Throughout the NAT Region, below FL410, 1000 feet vertical separation is applied. However, airspace utilisation is under continual review, and within the MNPS portion of NAT airspace, in addition to the strategic and tactical use of 'opposite direction' flight levels during peak flow periods the Mach Number Technique is applied.

2.2 CONSTRUCTION OF THE ORGANISED TRACK SYSTEM (OTS)

General processes

2.2.1 The appropriate OAC constructs the OTS after determination of basic minimum time tracks; with due consideration of airlines' preferred routes and taking into account airspace restrictions such as danger areas and military airspace reservations. The night-time OTS is produced by Gander OAC and the day-time OTS by Shanwick OAC (Prestwick), each incorporating any requirement for tracks within the New York, Reykjavik, Bodø and Santa Maria Oceanic Control Areas (OCAs). OAC planners co-ordinate with adjacent OACs and domestic ATC agencies to ensure that the proposed system is viable. They also take into account the 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 system is finalised.

2.2.2 When the expected volume of traffic justifies it, tracks may be established to accommodate the EUR/CAR traffic axis or traffic between the Iberian Peninsular and North America. Extra care is required when planning these routes as they differ slightly from the 'core tracks' in that they may cross each other (using vertical separations via different flight level allocations), and in some cases may not extend from coast-out to coast-in (necessitating random routing to join or leave). Similarly, some westbound tracks may commence at 30°W, North of 61°N, to accommodate NAT traffic routing via the Reykjavik OCA and Northern Canada.

Collaborative Decision Making Process

2.2.3 Operators proposing to execute NAT crossings during the upcoming OTS period are encouraged to contribute to the OTS planning process. A comprehensive set of Collaborative Decision Making (CDM) procedures for NAT track design is now employed.

2.2.4 This CDM process commences with the Preferred Route Message (PRM) system, which has been used in the NAT Region for many years. To enable oceanic planners to take into consideration operators' preferred routes in the construction of the OTS, all NAT operators (both scheduled and non-scheduled) are urged to provide information by AFTN message to the appropriate OACs regarding the optimum tracks of any/all of their flights which are intended to operate during the upcoming peak traffic periods. Such information should be provided, in the correct format, as far in advance as possible, but not later than 1900 UTC for the following day-time OTS and 1000 UTC for the following night-time OTS. Addresses and formats for providing PRMs are published in the Canadian and UK AIPs/NOTAMs.

2.2.5 Subsequently, following the initial construction of the NAT tracks by the publishing agencies (Gander OAC for Eastbound tracks and Shanwick OAC for Westbound tracks), the proposed tracks are published on an internet site for interested parties to view and discuss. One hour is allocated for each of the proposals during which any comments will be considered by the publishing agency and any changes which are agreed are then incorporated into the final track design. This internet site is currently operated by NAV CANADA. Access to this site is by password which any bona fide NAT operator may obtain on application to NAV CANADA - see Canada AIP for details.

2.3 THE NAT TRACK MESSAGE

2.3.1 The agreed OTS is promulgated by means of the NAT Track Message via the AFTN to all interested addressees. A typical time of publication of the day-time OTS is 2200 UTC and of the night-time OTS is 1400 UTC.

2.3.2 This message gives full details of the co-ordinates of the organised tracks as well as the flight levels that are expected to be in use on each track. In most cases there are also details of domestic entry and exit routings associated with individual tracks (e.g. 'NERS...' or 'NAR'). In the westbound (day-time) system the track most northerly, at its point of origin, is designated Track 'A' (Alpha) and the next most northerly track is designated Track 'B' (Bravo) etc. In the eastbound (night-time) system the most southerly track, at its point of origin, is designated Track 'Z' (Zulu) and the next most southerly track is designated Track 'Y' (Yankee), etc.. Examples of both eastbound and westbound systems and Track Messages are shown below in this Chapter.

2.3.3 The originating OAC identifies each NAT Track Message, within the Remarks section appended to the end of the NAT Track message, by means of a 3-digit Track Message Identification (TMI) number equivalent to the Julian calendar date on which that OTS is effective. For example, the OTS

effective on February 1st will be identified by TMI 032. (The Julian calendar date is a simple progression of numbered days without reference to months, with numbering starting from the first day of the year.) If any subsequent NAT Track amendments affecting the entry/exit points, route of flight (co-ordinates) or flight level allocation are made, the whole NAT Track Message will be re-issued. The reason for this amendment will be shown in the Notes and a successive alphabetic character, i.e. 'A', then 'B', etc., will be added to the end of the TMI number (e.g. TMI 032A).

2.3.4 The remarks section is an important element of the Track Message. The Remarks may vary significantly from day to day. They include essential information that Shanwick or Gander need to bring to the attention of operators. These Remarks sometimes include details of special flight planning restrictions that may be in force and in the case of the Night-time Eastbound OTS Message, they include information on clearance delivery frequency assignments. The hours of validity of the two Organised Track Systems (OTS) are normally as follows:

Day-time OTS	1130 UTC to 1900 UTC at 30°W
Night-time OTS	0100 UTC to 0800 UTC at 30°W

2.3.5 Changes to these times can be negotiated between Gander and Shanwick OACs and the specific hours of validity for each OTS are indicated in the NAT Track Message. For flight planning, operators should take account of the times as specified in the relevant NAT Track Message(s). Tactical extensions to OTS validity times can also be agreed between OACs when required, but these should normally be transparent to operators.

2.3.6 Correct interpretation of the track message by airline dispatchers and aircrews is essential for both economy of operation and in minimising the possibility of misunderstanding leading to the use of incorrect track co-ordinates. Oceanic airspace outside the published OTS is available, subject to application of the appropriate separation criteria and NOTAM restrictions. It is possible to flight plan to join or leave an outer track of the OTS. If an operator wishes to file partly or wholly outside the OTS, knowledge of separation criteria, the forecast upper wind situation and correct interpretation of the NAT Track Message will assist in judging the feasibility of the planned route. When the anticipated volume of traffic does not warrant publication of all available flight levels on a particular track, ATC will publish only those levels required to meet traffic demand. However, the fact that a specific flight level is not published for a particular track does not necessarily mean that it cannot be made available if requested.

2.4 OTS CHANGEOVER PERIODS

2.4.1 To ensure a smooth transition from night-time to day-time OTSs and vice-versa, a period of several hours is interposed between the termination of one system and the commencement of the next. These periods are from 0801 UTC to 1129 UTC: and from 1901 UTC to 0059 UTC.

2.4.2 During the changeover periods some restrictions to flight planned routes and levels are imposed. Eastbound and westbound aircraft operating during these periods should file flight level requests in accordance with the Flight Level Allocation Scheme (FLAS) as published in the *UK and Canada AIPs* and shown at Attachment 6.

2.4.3 It should also be recognised that during these times there is often a need for clearances to be individually co-ordinated between OACs and cleared flight levels may not be in accordance with those flight planned. If, for any reason, a flight is expected to be level critical, operators are recommended to contact the initial OAC prior to filing of the flight plan to ascertain the likely availability of required flight levels.

2.5 Examples of Day-time Westbound and Night-time Eastbound Track Messages and Associated Track Systems

Example 1- EXAMPLE OF WESTBOUND NAT TRACK MESSAGE

(NAT-1/3 TRACKS FLS 310/390 INCLUSIVE
 APR 01/1130Z TO APR 01/1900Z
 PART ONE OF THREE PARTS-
 A ATSEX 62/20 63/30 64/40 64/50 62/60 GRIBS JELCO
 EAST LVLS NIL
 WEST LVLS 310 320 330 350 360 370
 EUR RTS WEST AKIVO
 NAR N512C N514C N516H N518C N522C-
 B BALIX 61/20 62/30 63/40 63/50 61/60 MIBNO RODBO
 EAST LVLS NIL
 WEST LVLS 310 320 330 350 360 370
 EUR RTS WEST NINEX
 NAR N484C N486C N494C N496C N498C-
 C PIKIL 56/20 56/30 55/40 53/50 HECKK YAY
 EAST LVLS NIL
 WEST LVLS 310 320 330 340 350 360 370 380 390
 EUR RTS WEST NIL
 NAR N184B N188B-
 END OF PART ONE OF THREE PARTS)

(NAT-2/3 TRACKS FLS 310/390 INCLUSIVE
 APR 01/1130Z TO APR 01/1900Z
 PART TWO OF THREE PARTS-
 D RENSO 55/20 55/30 54/40 52/50 CRONO DOTTY
 EAST LVLS NIL
 WEST LVLS 310 320 330 340 350 360 370 380 390
 EUR RTS WEST NIL
 NAR N162B N168B-
 E DOGAL 54/20 54/30 53/40 51/50 DENDU CYMON
 EAST LVLS NIL
 WEST LVLS 310 320 330 340 350 360 370 380 390
 EUR RTS WEST NIL
 NAR N142B N148B-

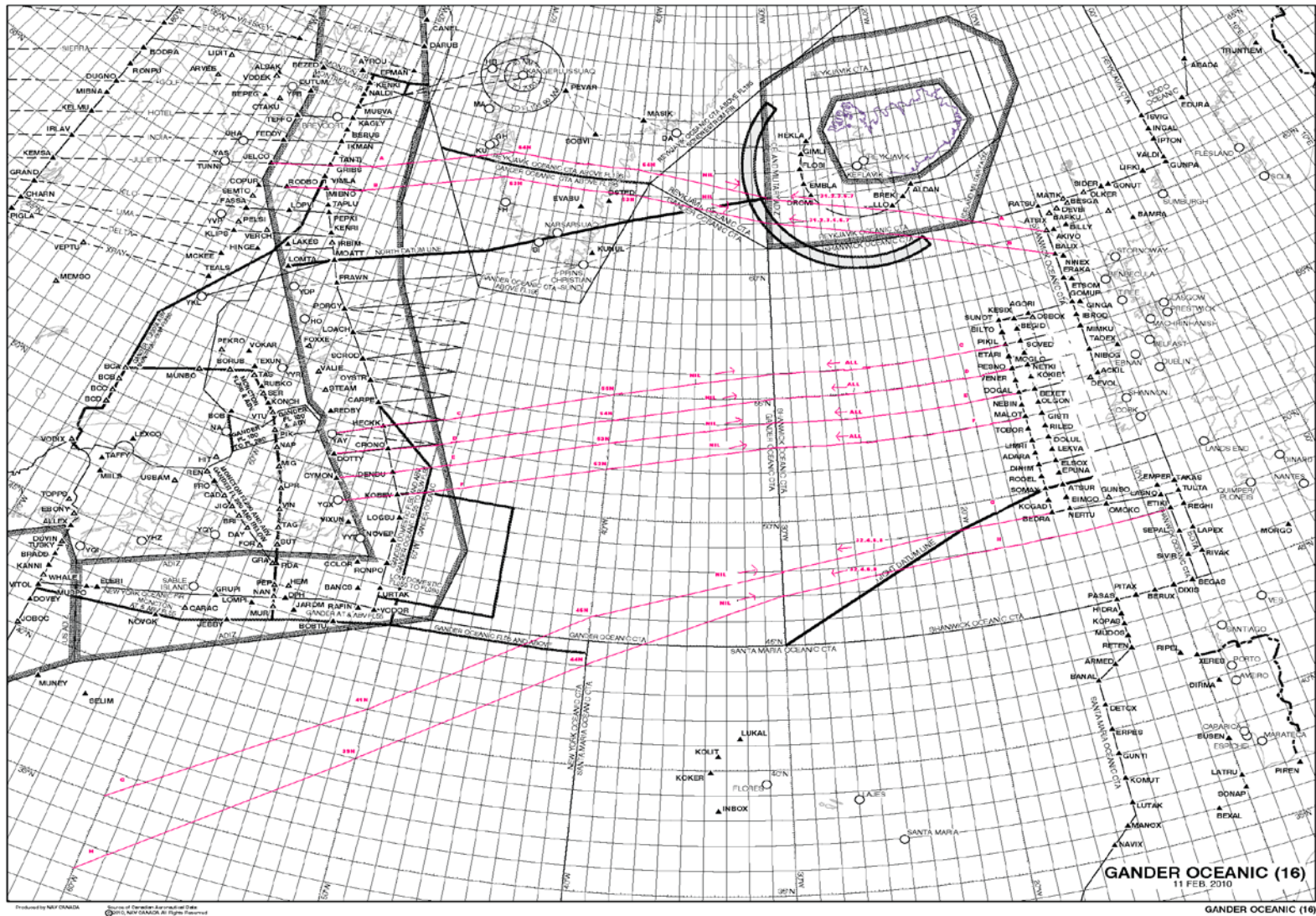
F MALOT 53/20 53/30 52/40 50/50 KOBEV YQX
 EAST LVLS NIL
 WEST LVLS 310 320 330 340 350 360 370 380 390
 EUR RTS WEST NIL

NAR N126B N130C-
 END OF PART TWO OF THREE PARTS)

(NAT-3/3 TRACKS FLS 310/390 INCLUSIVE
 APR 01/1130Z TO APR 01/1900Z
 PART THREE OF THREE PARTS-
 G BEDRA 49/20 48/30 46/40 41/50 35/60 BALOO
 EAST LVLS NIL
 WEST LVLS 320 340 360 380
 EUR RTS WEST NIL
 NAR NIL-
 H ETIKI 48/15 48/20 47/30 44/40 39/50 33/60 NUMBR
 EAST LVLS NIL
 WEST LVLS 320 340 360 380
 EUR RTS WEST REGHI
 NAR NIL-
 REMARKS.

1. TRACK MESSAGE IDENTIFICATION NUMBER IS 092 AND OPERATORS AREREMINDED TO INCLUDE THE TMI NUMBER AS PART OF THE OCEANIC CLEARANCE READ BACK.
 2. FOR STRATEGIC LATERAL OFFSET AND CONTINGENCY PROCEDURES RELATED TO OPS IN NAT FLOW PLEASE REFER TO THE ICAO EUR/NAT WEB SITE AT <http://www.paris.icao.int>
 3. EIGHTY PERCENT OF GROSS NAVIGATION ERRORS RESULT FROM POOR COCKPIT PROCEDURES. ALWAYS CARRY OUT PROPER WAY POINT CHECKS
 4. FLIGHTS REQUESTING WESTBOUND OCEANIC CLEARANCE VIA ORCA DATALINK SHALL INCLUDE IN THE RMK/FIELD THE HIGHEST ACCEPTABLE FLIGHT LEVEL WHICH CAN BE MAINTAINED AT THE OCA ENTRY POINT-
- END OF PART THREE OF THREE PARTS)

Figure 1 - Example of Day-time Westbound Organised Track System



Example 2 - EXAMPLE OF EASTBOUND NAT TRACK MESSAGE

(NAT- TRACKS FLS 320/400 INCLUSIVE
 FEB 23/0100Z TO FEB 23/0800Z
 U CYMON DENDU 51/50 52/40 54/30 55/20 RESNO NETKI
 EAST LVLS 320 330 340 350 360 370 380 390 400
 WEST LVLS NIL
 EUR RTS EAST NIL
 NAR N95B N97B N99A-
 V YQX KOBEV 50/50 51/40 53/30 54/20 DOGAL BEXET
 EAST LVLS 320 330 340 350 360 370 380 390 400
 WEST LVLS NIL
 EUR RTS EAST LFPG E349A
 NAT N79B N83B N85A-
 W VIXUN LOGSU 49/50 50/40 52/30 53/20 MALOT GISTI
 EAST LVLS 320 330 340 350 360 370 380 390 400
 WEST LVLS NIL
 EUR RTS EAST LFPG E391A
 NAR N63B N67B-
 X YYT NOVEP 48/50 49/40 51/30 52/20 LIMRI DULUL
 EAST LVLS 320 330 340 350 360 370 380 390 400
 WEST LVLS NIL
 EUR RTS EAST NIL
 NAR N53B N59A-
 Y COLOR RONPO 47/50 48/40 50/30 51/20 DINIM ELSOX
 EAST LVLS 320 330 340 350 360 370 380 390 400
 WEST LVLS NIL
 EUR RTS EAST NIL
 NAR N43A N49A-
 Z DANER 40/60 43/50 47/40 49/30 50/20 SOMAX ASTUR
 EAST LVLS 320 340 360 380
 WEST LVLS NIL
 EUR RTS EAST NIL
 NAR NIL-

REMARKS:

1. TMI NUMBER IS 054 AND OPERATORS ARE REMINDED TO INCLUDE THE TRACK MESSAGE IDENTIFICATION NUMBER. AS PART OF THE OCEANIC CLEARANCE READ BACK
2. CLEARANCE DELIVERY FREQUENCY ASSIGNMENTS FOR AIRCRAFT OPERATING FROM KENKI TO BOBTU INCLUSIVE:
 KENKI TO VIMLA 132.02
 MIBNO TO LAKES/KENRI 134.2
 MOATT TO SCROD 128.7
 OYSTR TO YAY 135.45
 DOTTY TO YQX 135.05
 VIXUN TO COLOR 128.45
 BANCS TO BOBTU 119.42
3. 80 PERCENT OF NAVIGATIONAL ERRORS RESULT FROM POOR COCKPIT PROCEDURES. ALWAYS CARRY OUT PROPER WAYPOINT CHECKS.
4. NAT EASTBOUND FLIGHT PLANNING RESTRICTIONS IN FORCE REFER TO EGGX G0344/04.)
5. CREWS ARE REMINDED THAT, WITHIN THE NAT REGION, THE STRATEGIC LATERAL OFFSET PROCEDURES, SLOP, SHOULD BE USED AS A STANDARD OPERATING PROCEDURE TO REDUCE THE RISK OF COLLISION AND NOT SOLELY FOR TURBULENCE/WEATHER

Figure 2 - - Example of Night-time Eastbound Organised Track System



CHAPTER 3: OTHER ROUTES AND ROUTE STRUCTURES WITHIN OR ADJACENT TO NAT MNPS AIRSPACE

3.1 GENERAL

3.1.1 The Organised Track System is the most significant route structure within NAT MNPS Airspace. Other route structures within and adjacent to MNPS Airspace are detailed below.

3.2 OTHER ROUTES WITHIN NAT MNPS AIRSPACE

3.2.1 Other routes within NAT MNPS Airspace (illustrated in Fig 3) are as follows:

- (1)* 'Blue Spruce' Routes, established as special routes for aircraft equipped with only one serviceable LRNS. (Chapter 1 refers.) **State approval for MNPS operations is required in order to fly along these routes.** (See Chapter 11 for full route definitions);
- (2) routes between Northern Europe and Spain/Canaries/Lisbon FIR. (T9* and T16);
- (3)* routings between the Azores and the Portuguese mainland and between the Azores and the Madeira Archipelago;
- (4)* routings between Iceland and Constable Pynt on the east coast of Greenland and between Kook Islands on the west coast of Greenland and Canada
- (5) special routes of short stage lengths where aircraft equipped with normal short-range navigation equipment can meet the MNPS track-keeping criteria (G3 and G11). **State approval for MNPS operations is required in order to fly along these routes.**

**Note: routes identified with an asterisk in sub paragraphs (1), (2), (3) and (4) above may be flight planned and flown by approved aircraft equipped with normal short-range navigation equipment (VOR, DME, ADF) and at least one approved fully operational LRNS.*

3.3 ROUTE STRUCTURES ADJACENT TO NAT MNPS AIRSPACE

North American Routes (NARs)

3.3.1 The North American Routes (NARs) consist of a numbered series of predetermined routes which provide an interface between NAT oceanic and North American domestic airspace. The NAR System is designed to accommodate major airports in North America.

3.3.2 Full details of all NAR routings (eastbound and westbound) together with associated procedures are published in two saleable documents :

- the United States Airport Facility Directory - Northeast
http://www.naco.faa.gov/index.asp?xml=naco/catalog/charts/supplementary/af_directory and
- and the Canada Flight Supplement
<http://www.navcanada.ca/NavCanada.asp?Language=en&Content=ContentDefinitionFiles%5CPublications%5CAeronauticalInfoProducts%5CPublications%5Cdefault.xml>.

It should be noted that these routes are subject to occasional changes and are re-published/updated on a regular AIRAC 56-day cycle

US East Coast Transitions

3.3.3 Aircraft Operators are encouraged to refer to FAA Air Traffic Control System Command Center Advisory Database (www.fly.faa.gov) for NAT Advisory Message, published daily, for specified transitions from select U.S. airports to the NAT Entry Points. Additionally, route advisories are published, as necessary, to address special route requirements eastbound and westbound through the New York Oceanic FIR/CTA.

Canadian Domestic Track Systems

3.3.4 Within Canada there are three track systems: the Northern Control Area tracks (NCAs), the Southern Control Area tracks (SCAs) and the Northern Organised Track System (NOROTS); these provide links for NAT traffic operating between Europe and North America to central and western North American airports. Track procedures and details are published in Transport Canada's Aeronautical Information Manual (TC AIM). The co-ordinates of the NOROTS are published daily via NOTAM.

Routes between North America and the Caribbean area

3.3.5 An extensive network of routes linking points in the United States and Canada with Bermuda, the Bahamas and the Caribbean area are defined in the New York OCA to the west of 60°W. This network has been known as the West Atlantic Route System (WATRS). Since 5 June 2008 the original WATRS airspace together with portions of the Miami Oceanic airspace and the San Juan FIR have been designated as "WATRS Plus Airspace". 50NM lateral separation standards are employed here on the basis of RNP approval status. Details of these routes and associated procedures are contained in the United States AIP. See the following web page for information on WATRS.

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/ .

Irish/UK Domestic Route Structures

3.3.6 The UK AIP and AIP Ireland both specify the domestic routes to be used for westbound NAT traffic, based upon entry points into oceanic airspace.

North Atlantic European Routing Scheme (NERS)

3.3.7 The NERS exists to provide an interface between NAT oceanic and European domestic airspace. The scheme is similar in concept to the NARS which has been in use in North America by NAT traffic for many years. It consists of a numbered series of predetermined routes, designed to accommodate eastbound traffic exiting the NAT en route to a number of major European airports.

3.3.8 The NERS valid for a particular day will be published in the NAT Track Message but will only be used when the traffic density warrants their use. They are not expected to be published every day. Full details of all NER routings together with associated procedures are published in *CFMU Route Availability Document Annex NAT*:

http://www.cfmueurocontrol.int/cfmu/opsd/public/standard_page/operational_services_rad.html

Shannon Oceanic Transition Area (SOTA) and Northern Oceanic Transition Area (NOTA)

3.3.9 Parts of the Shanwick OCA are designated as the Shannon Oceanic Transition Area (SOTA) and the Northern Oceanic Transition Area (NOTA). MNPS Airspace requirements are still applicable from FL285 to FL420 in both areas.

3.3.10 SOTA has the same vertical extent as the Shanwick OCA, and is bounded by lines joining successively the following points:

N5100 W01500 – N5100 W00800 – N4830 W00800 – N4900 W01500 – N5100 W01500

3.3.11 NOTA has the same vertical extent as the Shanwick OCA and is bounded by the lines joining successively the following points.

N5400 W01500 - N5700 W01500 - N5700 W01000W - N5434 W01000 - N5400 W01500.

3.3.12 Air Traffic Services are provided by Shannon ACC using the call sign SHANNON CONTROL. Full details of the service provided and the procedures used are contained in AIP Ireland.

Brest Oceanic Transition Area (BOTA)

3.3.13 Part of the Shanwick OCA is designated as the Brest Oceanic Transition Area (BOTA). MNPS Airspace requirements are still applicable from FL285 to FL420. BOTA has the same vertical extent as the Shanwick OCA, and is bounded by lines joining successively the following points:

N4834 W00845 – N4830 W00800 – N4500 W00800 – N4500 W00845 – N4834 W00845

3.3.14 Air Traffic service is provided by the Brest ACC, call sign BREST CONTROL.

CHAPTER 4: FLIGHT PLANNING

4.1 FLIGHT PLAN REQUIREMENTS

General

4.1.1 It is essential that care is taken when entering track information into a computer and the information should be cross-checked before it is given to the operating crew. Crews of all NAT flights at or above FL290, even those that will transit the NAT above the MNPSA (i.e. above FL420) or through the MNPSA but are not planned to use the OTS, must be given both the organised track message and relevant amendments to it. Copies must be available on-board the aircraft. *(N.B. In the event of a contingency or diversion, knowledge of the location of the OTS tracks will be useful to the crew of any NAT high level flight)*. Should more than one version of the daily Track Message have been issued, then crews should be issued the entire revised version together with an appropriate explanation to relate differences between versions. Each successive version will be identified by the TMI and an alphabetic suffix. e.g. 243A, 243B etc.

4.1.2 All flights which generally route in an eastbound or westbound direction should normally be flight planned so that specified ten degrees of longitude (20°W, 30°W, 40°W etc.) are crossed at whole degrees of latitude; and all generally northbound or southbound flights should normally be flight planned so that specified parallels of latitude spaced at five degree intervals (65°N, 60°N, 55°N etc.) are crossed at whole degrees of longitude. *(N.B. For those flights that generally route in an eastbound or westbound direction, it is important that the latitude crossings of ALL oceanic ten-degree meridians be included as waypoints in the flight plan submitted to ATC. Even where "named" significant points are close to these "prime" meridians of longitude it is not appropriate to omit the ten-degree crossings from the ATC Flight Plan.)*

4.1.3 All flights should plan to operate on great circle tracks joining successive significant waypoints.

Routings

4.1.4 During the hours of validity of the OTS, operators are encouraged to flight plan as follows:

- in accordance with the OTS; or
- along a route to join or leave an outer track of the OTS; or
- on a random route to remain clear of the OTS, either laterally or vertically.

4.1.5 Nothing in the paragraph above prevents operators from flight planning through/across the OTS. However they should be aware that whilst ATC will make every effort to clear random traffic across the OTS at published levels, re-routes or significant changes in flight level are likely to be necessary during most of the OTS traffic periods.

4.1.6 Outside of the OTS periods operators may flight plan any random routing, except that during a period of one hour prior to each OTS period the following restrictions apply:

Eastbound flights that cross 30°W less than one hour prior to the incoming/pending Westbound OTS (i.e. after 1029 UTC), or Westbound flights that cross 30°W less than one hour prior to the incoming/pending

Eastbound OTS (i.e. after 2359 UTC), should plan to remain clear of the incoming/pending OTS structure.

Flight Levels

4.1.7 Within RVSM Airspace greater opportunity exists for step climbs. Operators may include step climbs in the flight plan, although each change of level during flight must be requested from ATC by the pilot. The chance of approval of such requests will, of course, be entirely dependent upon potential traffic conflicts. Outside the OTS there is a good likelihood of achieving the requested profiles. However, within the prime OTS levels at peak times, ATC may not always be able to accommodate requested flight level changes and prudent pre-flight fuel planning should take this into consideration.

4.1.8 During the OTS Periods (eastbound 0100-0800 UTC, westbound 1130-1900 UTC) aircraft intending to follow an OTS Track for its entire length may plan at any of the levels as published for that track on the current daily OTS Message. Flights which are planned to remain entirely clear of the OTS or which join or leave an OTS Track (i.e. follow an OTS track for only part of its published length), are all referred to as Random Flights. Pilots intending to fly on a random route or outside the OTS time periods, should normally plan flight level(s) appropriate to the direction of flight.

Note: “Appropriate Direction Levels” within the NAT MNPSA are specified by the Semi-circular Rule Per ICAO Annex 2, Appendix 3, Table a.

4.1.9 Planners should note however that the AIPs specify some exceptions to use of “Appropriate Direction Levels” both during the OTS time periods and outside them. At specified times, appropriate direction levels are reserved for use by (opposite direction) traffic flows that then predominate. These exceptions may be modified in future to accommodate changes in traffic flows. The current usage allocation of flight levels in the NAT MNPSA is published in the UK and Canadian AIPs and shown at Attachment 6 as the NAT Flight Level Allocation Scheme (FLAS). Hence, pilots and planners should always consult the current AIPs and any supporting NOTAMs when flight planning random routes through NAT MNPS Airspace.

4.1.10 If a flight is expected to be level critical, operators should contact the initial OAC prior to filing of the flight plan to determine the likely availability of specific flight levels.

ATC Flight Plans

4.1.11 Correct completion and addressing of the flight plan is extremely important as errors can lead to delays in data processing and to the subsequent issuing of clearances to the flights concerned. Despite the growing use of automated flight planning systems, a significant proportion of ATC Flight Plans submitted in respect of flights through the North Atlantic Region continue to contain errors. In some instances these errors are such that the Flight Plan is rejected and the Operator is required to re-submit a corrected version. Full and detailed explanations of how to complete an ATS Flight Plan in respect of the NAT portion of a flight are contained in Chapter 16 and Attachment 4 of this Manual. The Attachment also highlights the more common completion errors that are made. UK AIC 55/2003 provides similar NAT Region specific guidance and includes example completed ICAO Flight Plans. A copy of this AIC may be downloaded from http://www.nats-uk.ead-it.com/aip/current/aic/yellow/EG_Circ_2003_Y_055_en.pdf. New and/or infrequent North Atlantic operators are earnestly recommended to make diligent reference to these documents.

4.1.12 In order to signify that a flight is approved to operate in NAT MNPS Airspace, the letter ‘X’ shall be inserted, in addition to the letter ‘S’, within Item 10 of the flight plan. A ‘W’ must also be included in Item 10 to indicate that the flight is approved for RVSM operations.

Note: Since 5 June 2008 the former West Atlantic Route System (WATRS) together with the Atlantic portion of Miami Oceanic Airspace and the San Juan FIR has been designated "WATRS Plus Airspace". RNP-10 or RNP-4 Approval is required in order to benefit from the 50 NM minimum lateral separation employed here. Any MNPSA Aircraft intending to also fly in this WATRS Plus airspace should ensure that its RNP Approval status is included in the Flight Plan. Specifically such operators should:

- i) *annotate ICAO Flight Plan Item 10 (Equipment) with the letters "R" and "Z", and*
- ii) *annotate Item 18 (Other Information) with, as appropriate, "NAV/RNP10" or "NAV/RNP4" (no spaces).*

Full details can be found at :

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/WATRS_Plus/

4.1.13 For turbojet aircraft the Speeds/Mach Number planned to be used for each portion of the flight in the NAT Region should be specified in Item 15 of the flight plan.

4.1.14 For turbojet aircraft, Item 15 of the flight plan should reflect the proposed speeds in the following sequence:

- a) cruising True Airspeed (TAS) prior to oceanic entry;
- b) oceanic entry point and cruising Mach Number;
- c) TAS subsequent to oceanic exit .

4.1.15 For non-turbojet aircraft TAS should be specified in Item 15 of the flight plan.

4.2 FLIGHT PLANNING REQUIREMENTS ON SPECIFIC ROUTES

Flights Planning on the Organised Track System

4.2.1 **If (and only if) the flight is planned to operate along the entire length of one of the organised tracks**, from oceanic entry point to oceanic exit point, as detailed in the NAT Track Message, should the intended organised track be defined in Item 15 of the flight plan using the abbreviation 'NAT' followed by the code letter assigned to the track.

4.2.2 Flights wishing to join or leave an organised track at some intermediate point are considered to be random route aircraft and full route details must be specified in the flight plan. **The track letter must not be used to abbreviate any portion of the route in these circumstances.**

4.2.3 The planned Mach Number and flight level for the organised track should be specified at either the last domestic reporting point prior to oceanic airspace entry or the organised track commencement point.

4.2.4 Each point at which a change of Mach Number or flight level is planned must be specified by geographical co-ordinates in latitude and longitude or as a named waypoint.

4.2.5 For flights operating along the whole length of one of the organised tracks, estimates are only required for the commencement point of the track.

Flights Planning on Random Route Segments in a Generally Eastbound or Westbound Direction at/or South of 70°N

4.2.6 The requested Mach Number and flight level should be specified at either the last domestic reporting point prior to oceanic airspace entry or the OCA boundary.

4.2.7 The route of flight should be specified in terms of the following significant points, with estimates included in Item 18 of the flight plan:

- a) the last domestic reporting point prior to the oceanic entry point;
- b) the OCA boundary entry point (only required by the Gander, Shanwick, New York and Santa Maria OACs);
- c) significant points formed by the intersection of half or whole degrees of latitude, with meridians spaced at intervals of ten degrees of longitude from the Zero degree E/W (Greenwich) Meridian to longitude 70°W;
- d) the OCA boundary exit point (only required by the Gander, Shanwick, New York and Santa Maria OACs); and
- e) the first domestic reporting point after ocean exit.

4.2.8 Each point at which a change of Mach Number or flight level is requested must be specified and followed in each case by the next significant point.

Flights Planning on a Generally Eastbound or Westbound Direction on Random Route Segments North of 70°N

4.2.9 Flight planning requirements for flights in this category are identical to those listed for flights on random route segments at/or south of 70°N except that a route should be specified in terms of significant points formed by the intersection of parallels of latitude expressed in degrees and minutes with meridians normally spaced at intervals of 20° from the Zero degree E/W (Greenwich) Meridian to longitude 60°W, using the longitudes 000W, 020W, 040W and 060W.

Flights Planning on Random Routes in a Generally Northbound or Southbound Direction

Note : The ICAO Regional Supplementary Procedures for the NAT Region (Doc.7030) state that flights operating between North America and Europe shall generally be considered as operating in a predominantly east-west direction. However, flights planned between these two continents via the North Pole shall be considered as operating in a predominantly north-south direction.

4.2.10 Flight planning requirements for flights in this category are identical to those listed for flights operating on random route segments at/or south of 70°N except that the route should be specified in terms of significant points formed by the intersection of whole degrees of longitude with specified parallels of latitude which are spaced at 5° intervals from 20°N to 90°N.

Flights Planning to Enter or Leave the NAT Region via the European or North American Regions

4.2.11 To provide for the safe and efficient management of flights to/from the NAT Region, transition route systems/schemes are established in the NAM and EUR Regions (NARs and NERs, respectively). These schemes detail particular domestic routings associated with each oceanic entry or landfall point. Flights in this category must be planned in accordance with these schemes and, in particular, OTS flights should comply with the daily published NAR/NER restrictions as specified in the relevant OTS message. Canadian Domestic route schemes and the US East Coast Link Routes are also published. Flights

entering the NAM Region north of 65N must be planned in accordance with the NCA and/or NOROTS as appropriate. All of these linking structures are referenced in Chapter 3 of this Manual and account must be taken of any such routing restrictions when planning flights in this category.

Flights Planning to Operate Without Using HF Communications

4.2.12 The carriage of functioning HF communications is mandatory for flight in the Shanwick OCA, even if the pilot intends using alternative media for regular ATS air-ground contacts. Aircraft with only functioning VHF communications equipment should plan their route outside the Shanwick OCA and ensure that they remain within VHF coverage of appropriate ground stations throughout the flight. Theoretical VHF coverage charts are shown in Attachment 5. Such strict routing restriction may not apply in all NAT Oceanic Control Areas. Some may permit the use of SATCOM Voice to substitute for or supplement HF communications. Details of communication requirements by individual NAT ATS Providers are published in State AIPs. However, it must also be recognised that the Safety Regulator of the operator may impose its own operational limitations on SATCOM Voice usage. Any operator intending to fly through NAT MNPS Airspace without fully functional HF communications or wishing to use an alternative medium should ensure that it will meet the requirements of its State of Registry and those of all the relevant ATS Providers throughout the proposed route.

CHAPTER 5: OCEANIC ATC CLEARANCES

5.1 GENERAL

5.1.1 Oceanic Clearances are required for all flights within NAT controlled Airspace (at or above FL55). Pilots should request Oceanic Clearances from the ATC unit responsible for the first OCA within which they wish to operate, following the procedures and the time-frame laid down in appropriate AIPs. Such clearances, although in most cases obtained some time before reaching the Oceanic entry point, are applicable only from that entry point. It is recommended that pilots should request their Oceanic Clearance at least 40 minutes prior to the Oceanic entry point ETA except when entering the Reykjavik area from the Scottish or Stavanger areas, then the clearance should be requested 20 minutes before the Oceanic entry point ETA.

5.1.2 To assist the OAC in pre-planning optimum airspace utilisation, when requesting an oceanic clearance the pilot should notify the OAC of the maximum acceptable flight level possible at the boundary, taking into account that a climb to the assigned oceanic flight level must be achieved prior to entering oceanic airspace and normally whilst the aircraft is within radar coverage. The pilot should also notify the OAC of any required change to the oceanic flight planned level, track or Mach Number as early as practicable after departure. If requesting an OTS track, the clearance request should include the next preferred alternative track.

5.1.3 Specific information on how to obtain oceanic clearance from each NAT OAC is published in State AIPs. Various methods of obtaining Oceanic Clearances include:

- a) use of published VHF clearance delivery frequencies;
- b) by HF communications to the OAC through the appropriate aeradio station (in accordance with the timeframes detailed in paragraph 5.1.1 above);
- c) a request via domestic or other ATC agencies;
- d) by data link, when arrangements have been made with designated airlines to request and receive clearances using on-board equipment (ACARS). Detailed procedures for its operation may vary. Gander, Shanwick, Santa Maria and Reykjavik OACs provide such a facility and the relevant operational procedures are published in national AIS and also as NAT OPS Bulletins which are available for download from the ICAO Paris website (see <http://www.paris.icao.int/>). New York OAC uses the FANS 1/A CPDLC function to uplink oceanic clearances to all aircraft utilising CPDLC.

5.1.4 At some airports **situated close to oceanic boundaries or within the NAT Region**, it may be necessary to obtain the Oceanic Clearance before departure. These procedures are detailed in relevant State AIPs, which should be consulted prior to departure. On the east side of the NAT, this will apply to departures from all Irish airfields, all UK airfields west of 2° 30'W and all French Airfields west of zero degree longitude. Oceanic Clearances for controlled flights leaving airports **within the region** are issued by the relevant ATS unit prior to departure.

5.1.5 If an aircraft, which would normally be RVSM and/or MNPS approved, encounters, whilst en route to the NAT Oceanic Airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the MEL requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting Oceanic Clearance.

5.1.6 After obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by **3 minutes or more**, the pilot must pass a revised estimate to ATC. As planned longitudinal spacing by these OACs is based solely on the estimated times over the oceanic entry fix or boundary, failure to adhere to this ETA amendment procedure may jeopardise planned separation between aircraft, thus resulting in a subsequent re-clearance to a less economical track/flight level for the complete crossing. Any such failure may also penalise following aircraft.

5.1.7 If any of the route, flight level or Mach Number in the clearance differs from that flight planned, requested or previously cleared, attention may be drawn to such changes when the clearance is delivered (whether by voice or by datalink). Pilots should pay particular attention when the issued clearance differs from the Flight Plan. (*N.B. a significant proportion of navigation errors investigated in the NAT involve an aircraft which has followed its Flight Plan rather than its differing clearance*).

5.1.8 Furthermore it must be recognised that if the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, **the pilot is responsible for requesting and obtaining the necessary domestic re-clearance** to ensure that the flight is in compliance with its Oceanic Clearance when entering oceanic airspace.

5.1.9 There are three elements to an Oceanic Clearance: route, Mach Number and flight level. These elements serve to provide for the three basic elements of separation: lateral, longitudinal and vertical.

5.1.10 The Oceanic Clearance issued to each aircraft is at a specific flight level and cruise Mach Number. Flight level or Mach Number changes should not normally be made without prior ATC clearance. (See Chapter 7 for Application of Mach Number Technique.)

5.1.11 If pilots have not received their Oceanic Clearance prior to reaching the Shanwick OCA boundary, they must contact Domestic ATC and request instructions to enable them to remain clear of Oceanic Airspace whilst awaiting such Clearance. This is not the case for other NAT OCAs into any of which flights may enter whilst pilots are awaiting receipt of a delayed Oceanic Clearance. Pilots should always endeavour to obtain Oceanic Clearance prior to entering these other NAT OCAs; however if any difficulty is encountered the pilot should not hold while awaiting Clearance unless so directed by ATC. In such circumstances, pending receipt of the Oceanic Clearance, the aircraft should continue to maintain the flight level cleared by the current control authority.

5.1.12 An example of a pilot voice request for Oceanic Clearance is as follows:

“ACA 865 request Oceanic Clearance. Estimating PIKIL at 1131. Request Mach decimal eight zero, Flight Level three five zero, able Flight Level three six zero, second choice Track Charlie”.

5.1.13 If the request also includes a change to the original flight plan, affecting the OCA, then it should be according to the following example:

“BAW 123 request Oceanic Clearance. Estimating RESNO at 1147. Request Mach decimal eight zero, Flight Level three four zero. Now requesting Track Charlie, able Flight Level three six zero, second choice Track Delta”.

5.2 CONTENTS OF CLEARANCES

5.2.1 An abbreviated clearance is issued by Air Traffic Services when clearing an aircraft to fly along the whole length of an Organised Track. When an abbreviated clearance is issued it includes:

- a) clearance Limit, which will normally be destination airfield;

- b) cleared track specified as “Track” plus code letter;
- c) cleared flight level(s);
- d) cleared Mach Number; and

A typical example of such a clearance is as follows:

“ACA865 is cleared to Toronto via Track Bravo, from PIKIL maintain Flight Level three five zero, Mach decimal eight zero”.

5.2.2 Procedures exist for an abbreviated read back of an Oceanic Clearance. The flight crew will confirm that they are in possession of the current NAT Track message by using the TMI number (including any appropriate alpha suffix) in the read-back of the Oceanic Clearance, as follows:

“ACA865 is cleared to Toronto via Track Bravo 283A, from PIKIL maintain Flight Level three five zero, Mach decimal eight zero”.

5.2.3 If the TMI number is included in the read-back there is no requirement for the pilot to read back the NAT Track co-ordinates even if the cleared NAT Track is not the one which was originally requested. If any doubt exists as to the TMI (see fuller explanation of this term Chapter 2, paragraph 2.3.3) or the NAT Track co-ordinates, the pilot should request the complete track co-ordinates from the OAC. Similarly, if the pilot cannot correctly state the TMI, the OAC will read the cleared NAT Track co-ordinates in full and request a full read back of those co-ordinates.

5.2.4 For aircraft cleared by Shanwick OAC on random routings in the NAT Region the present procedure of reading the full track co-ordinates as part of the Oceanic Clearance and requesting from the pilot a full read back of the co-ordinates is expected to continue. Gander and Reykjavik OACs may, however, issue clearances for random routings which specify “via flight plan route”. Nevertheless, in all circumstances regarding random route clearances, pilots are required to read back **the full track co-ordinates** of the flight plan route, from the oceanic entry point to the exit point.

5.3 OCEANIC CLEARANCES FOR WESTBOUND FLIGHTS ROUTING VIA 61°N 010°W

5.3.1 The provision of air traffic service at RATSU (61°N 010°W) has been delegated by Shanwick to Reykjavik. Flights intending to enter NAT Oceanic airspace via RATSU (61°N 010°W) should not call Shanwick for an Oceanic Clearance. The required Oceanic Clearance will be issued by Reykjavik Control. There are three points established at the boundary of delegated airspace from Scottish to Reykjavik, BESGA, DEVBI and BARKU on routes to RATSU. Reykjavik will issue Oceanic Clearances from those points. Aircraft that have not received their oceanic clearance prior to those points shall enter Reykjavik airspace at the domestic cleared flight level while awaiting such oceanic clearance.

5.4 OCEANIC CLEARANCES FOR FLIGHTS INTENDING TO OPERATE WITHIN THE NAT REGION AND SUBSEQUENTLY ENTER THE EUR OR NAM REGIONS

5.4.1 As indicated in Chapters 3 and 4 of this Manual, to provide for the safe and efficient management of flights to/from the NAT Region, transition route systems/schemes are established in the NAM and EUR Regions. These schemes detail particular domestic routings associated with each landfall point. Flights in this category must be planned in accordance with these schemes. Should a pilot of a flight

in this category receive a clearance on a route other than originally flight planned, special caution should be exercised to ensure that the co-ordinates of the assigned route and of the associated landfall **and** subsequent domestic routings are fully understood and correctly inserted into the automated navigation systems. Appropriate cross checks should be carried out. In all cases when an en route re-clearance is requested, the pilot should ensure that the revised ATC clearance includes the new routing from the oceanic exit point to the first landfall point or coastal fix. If at the time of being given a clearance or re-clearance, the pilot has any doubt concerning the subsequent domestic routing, details should be checked with the ATC unit issuing the clearance/re-clearance.

5.5 OCEANIC CLEARANCES FOR RANDOM FLIGHTS INTENDING TO OPERATE WITHIN THE NAT REGION AND SUBSEQUENTLY ENTER REGIONS OTHER THAN NAM OR EUR

5.5.1 Oceanic Clearances issued to flights in this category are similar to domestic ATC clearances in that clearances are to destination on the assumption that co-ordination will be effected ahead of the aircraft's passage. In this case, if necessary, the flight profile may be changed en route, prior to hand-over from one centre to another, subject to traffic conditions in the adjacent area.

5.6 OCEANIC FLIGHTS ORIGINATING FROM THE CAR OR SAM REGIONS AND ENTERING NAT MNPS AIRSPACE VIA THE NEW YORK OCA

5.6.1 If a pilot has received the three clearance elements, i.e. a complete route, altitude, and Mach Number, even if these elements are not issued at the same time, then the pilot has been provided with an Oceanic Clearance and no request for one is necessary. For example: on a flight from Santo Domingo to Europe, Santo Domingo ACC issues a Clearance with a complete route and altitude; later, San Juan CERAP issues the aircraft a clearance to maintain Mach 0.84. At this point, all three required elements (route, Mach Number and flight level) have been received and the flight has an Oceanic Clearance. Subsequent changes to any single element of the Oceanic Clearance does not alter the others.

5.6.2 If the pilot has not received all three elements of an Oceanic Clearance, then a full Oceanic Clearance should be obtained prior to entering MNPS Airspace. If any difficulty is encountered obtaining the elements of the Oceanic Clearance, the pilot should not hold while awaiting a Clearance unless so instructed by ATC. The pilot should proceed on the cleared route into MNPS Airspace and continue to request the Clearance elements needed.

5.7 ERRORS ASSOCIATED WITH OCEANIC CLEARANCES

5.7.1 Navigation errors associated with Oceanic Clearances fall into several categories of which the most significant are ATC System Loop errors and Waypoint Insertion errors.

ATC System Loop Errors

5.7.2 An ATC system loop error is any error caused by a misunderstanding between the pilot and the controller regarding the assigned flight level, Mach Number or route to be followed. Such errors can arise from: incorrect interpretation of the NAT Track Message by dispatchers; errors in co-ordination between OACs; or misinterpretation by pilots of Oceanic Clearances or re-clearances. Errors of this nature, which are detected by ATC from pilot position reports will normally be corrected. However, timely ATC intervention cannot always be guaranteed, especially as it may depend on the use of third-party relayed HF, GP/VHF or SATCOM Voice communications.

Waypoint Insertion Errors

5.7.3 Experience has shown that many of the track-keeping errors in the NAT MNPS Airspace occur as a result of crews programming the navigation system(s) with incorrect waypoint data. These are referred to as Waypoint Insertion Errors. They frequently originate from:

- a) failure to observe the principles of checking waypoints to be inserted in the navigation systems, against the ATC cleared route;
- b) failure to load waypoint information carefully; or
- c) failure to cross-check on-board navigation systems.

5.7.4 More detailed guidance on this subject is contained in Chapter 8, Chapter 14 and Chapter 15 of this Document.

5.7.5 Many of the navigation error occurrences are the product of one or both of the foregoing causes. It is therefore extremely important that pilots double check each element of the Oceanic Clearance on receipt, and at each waypoint, since failure to do so may result in inadvertent deviation from cleared route and/or flight level.

CHAPTER 6: COMMUNICATIONS AND POSITION REPORTING PROCEDURES

6.1 ATS COMMUNICATIONS

6.1.1 It is important that pilots appreciate that routine air/ground ATS Voice communications in the NAT Region are conducted via aeradio stations staffed by communicators **who have no executive ATC authority**. Messages are relayed by the ground station to/from the air traffic controllers in the relevant OAC.

6.1.2 In the North Atlantic Region there are six aeronautical radio stations, one associated with each of the Oceanic Control Areas. They are: Bodo Radio (Norway, Bodo ACC), Gander Radio (Canada, Gander OACC), Iceland Radio (Iceland, Reykjavik ACC), New York Radio (USA, New York OACC), Santa Maria Radio (Portugal, Santa Maria OACC) and Shanwick Radio (Ireland, Shanwick OACC). However, the aeradio stations and OACs are not necessarily co-located. For example, in the case of Shanwick operations, the OAC is located at Prestwick in Scotland whilst the associated aeradio station is at Ballygirreen in the Republic of Ireland. In addition to those six aeronautical stations, there are two other stations that operate NAT frequencies. They are Canarias Radio which serves Canarias ACC and Arctic Radio serving Edmonton, Winnipeg and Montreal ACC's.

HF Voice Communications

6.1.3 The majority of NAT air/ground voice communications are conducted on SSB HF frequencies. To support air/ground ATC communications in the North Atlantic Region, twenty-four HF frequencies have been allocated, in bands ranging from 2.8 to 18 MHz.

6.1.4 There are a number of factors which affect the optimum frequency for communications over a specific path. The most significant is the diurnal variation in intensity of the ionisation of the refractive layers of the ionosphere. Hence frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during day-time. Generally in the North Atlantic frequencies of less than 7 MHz are utilised at night and frequencies of greater than 8 MHz during the day.

6.1.5 The 24 NAT frequencies are organized into six groups known as Families. The families are identified as NAT Family A, B, C, D, E and F. Each Family contains a range of frequencies from each of the HF frequency bands. A number of stations share families of frequencies and co-operate as a network to provide the required geographical and time of day coverage.. A full listing of the frequency hours of operation of each NAT aeradio station is contained in the "*HF Management Guidance Material for the NAT Region*" – ICAO NAT Doc 003 (Appendices C- 1 thru 6), available via the ICAO EUR/NAT website at www.paris.icao.int/ . Each Family is designated for use by aircraft of specific States of Registry and according to the route to be flown. NAT ATS provider State *AIPs* list the families of frequencies to be used.

6.1.6 Each individual aircraft is normally allocated a primary and a secondary HF frequency, either when it receives its clearance or by domestic controllers shortly before the oceanic boundary.

6.1.7 When initiating contact with an aeradio station the pilot should state the HF frequency in use. HF Radio operators usually maintain a listening watch on more than one single frequency. Identification by the calling pilot of the particular frequency being used is helpful to the radio operator.

SELCAL

6.1.8 When using HF communications **and even when using ADS and/or CPDLC**, pilots should maintain a listening watch on the assigned frequency, unless SELCAL is fitted, in which case they should ensure the following sequence of actions:

- a) provide the SELCAL code in the flight plan; (any subsequent change of aircraft for a flight will require passing the new SELCAL information to the OAC);
- b) check the operation of the SELCAL equipment, at or prior to entry into Oceanic airspace, with the appropriate aeradio station. (This SELCAL check must be completed prior to commencing SELCAL watch); and
- c) maintain thereafter a SELCAL watch.

6.1.9 **It is important to note that it is equally essential to comply with the foregoing SELCAL provisions even if SATCOM Voice or ADS/CPDLC are being used for routine air/ground ATS communications. This will ensure that ATC has a timely means of contacting the aircraft.**

6.1.10 Flight management staffs and crews of aircraft equipped with 12-tone SELCAL equipment should be made aware that SELCAL code assignment is predicated on the usual geographical area of operation of that aircraft. If the aircraft is later flown in geographical areas other than as originally specified by the aircraft operator, the aircraft may encounter a duplicate SELCAL code situation. Whenever an aircraft is to be flown routinely beyond the area of normal operations or is changed to a new geographic operating area, the aircraft operator should contact the SELCAL Registrar and request a SELCAL code appropriate for use in the new area.

6.1.11 When acquiring a previously owned aircraft equipped with SELCAL, many aircraft operators mistakenly assume that the SELCAL code automatically transfers to the purchaser or lessee. This is not true. As soon as practical, it is the responsibility of the purchaser or lessee to obtain a SELCAL code from the Registrar, or, if allocated a block of codes for a fleet of aircraft, to assign a new code from within the block of allocated codes. In the latter instance, if 12-tone equipment is involved, the Registrar should be consulted when there is any question as to the likely geographical area of operation and the possibility of code duplication.

6.1.12 The registrar can be contacted via the AFTN address KDCAXAAG, and by including "ATTN. OPS DEPT. (forward to SELCAL Registrar)" as the first line of message text.

VHF Voice Communications

6.1.13 Aeradio stations are also responsible for the operation of General Purpose VHF (GP/VHF) outlets. North Atlantic flights may use these facilities for all regular and emergency communications with relevant OACs. Such facilities are especially valuable in the vicinity of Iceland, Faroes and Greenland since VHF is not as susceptible to sunspot activity as HF. Outlets are situated at Prins Christian Sund, which is remotely controlled from Gander Aeradio station, and at Qaqatoq, Kulusuk, several locations in Iceland and the Faroes, via Iceland Radio. Theoretical VHF coverage charts are shown at Attachment 5. When using GP/VHF frequencies in areas of fringe coverage however, care should be taken to maintain a SELCAL watch on HF thus ensuring that if VHF contact is lost the aeradio station is still able to contact the aircraft. It is important for the pilot to appreciate that when using GP/VHF, as with HF and SATCOM Voice, these communications are with an aeradio station and the pilot is not in direct contact with ATC. However Direct Controller/Pilot Communications (DCPC) can be arranged, if necessary, via patch-through on some GP/VHF frequencies.

6.1.14 Reykjavik centre operates several Direct Controller Pilot Communications (DCPC) VHF stations providing coverage to approximately 250 NM from the coast of Iceland and Faroes. Those stations are used to provide tactical procedural control and radar control within the South and East sectors of the Reykjavik area. The callsign of the Reykjavik centre is “*Reykjavik control*” or just “*Reykjavik*” and indicates that the pilot is communicating directly with an air traffic controller. The callsign of Iceland radio is “*Iceland radio*” or just “*Iceland*” and indicates that the pilot is communicating with a radio operator who is relaying messages between the pilot and the appropriate control facility.

6.1.15 Gander OAC operates a number of VHF remote outlets in Greenland and in the adjacent eastern seaboard of Canada, providing DCPC service for ADS-B operations in those parts of its airspace. For details of this ADS-B service, participation requirements and coverage charts, operators should consult Canadian AIS. A brief description of the service is provided in a NAT OPS Bulletin, which can be downloaded from www.paris.icao.int/.

6.1.16 The carriage of HF communications equipment is mandatory for flight in the Shanwick OCA. Aircraft with only functioning VHF communications equipment should plan their route outside the Shanwick OCA and ensure that they remain within VHF coverage of appropriate ground stations throughout the flight. Details of communication requirements are published in State AIPs and ICAO publications.

SATCOM Voice Communications

6.1.17 Following successful trials, Aeronautical Mobile Satellite (Route) Service (AMS(R)S), more commonly referred to as SATCOM Voice, may now be used for any routine, non-routine or emergency ATS air/ground communications throughout the NAT Region. State AIPs contain the necessary telephone numbers and/or short-codes for air-initiated call access to aeradio stations and/or direct to OACs. Since oceanic traffic typically communicate with ATC through aeradio facilities, routine SATCOM Voice calls should be made to such a facility rather than the ATC Centre. Only when the urgency of the communication dictates otherwise should SATCOM Voice calls be made to the ATC Centre. SATCOM voice communication initiated due to HF propagation difficulties does not constitute urgency and should be addressed to the air-ground radio facility. **CORRIGENDUM NAT DOC 007 2010/1: Paragraph 6.1.17 is not yet applicable in the ICAO NAT Region, subject to the expected approval of an amendment to the NAT SUPPs. NAT SUPPs paragraph 3.4.1 concerning use of SATCOM voice remains in effect until the amendment is approved, at which time this Corrigendum will be rescinded.**

6.1.18 Operators are, of course, also bound by their own State of Registry’s regulations regarding carriage and use of any and all long-range ATS communications equipment. In many instances MMEL remarks for HF systems now provide significant relief for SATCOM Voice equipped aircraft, thereby making the requirement for the carriage of fully serviceable/redundant HF communications equipment much less of an issue (Reference HF Communications Failure).

6.1.19 Pilots electing to use SATCOM Voice as an alternative to HF voice communications remain responsible for operating SELCAL or maintaining a listening watch on the assigned HF frequency.

Datalink Communications

6.1.20 Datalink communications are gradually being introduced into the NAT environment for position reporting (via FANS 1/A ADS-C & CPDLC and also via FMC WPR through ACARS) and for other air/ground ATS exchanges (using FANS 1/A CPDLC). NAT Region specific guidance may be published in NAT OPS Bulletins when deemed necessary by the NAT SPG and the operational procedures to be used are specified in the Global Operational Data Link Document (GOLD), both of which can be downloaded from <http://www.paris.icao.int/>. AIS publications of the NAT ATS Provider States should be consulted to determine the extent of current implementation in each of the North Atlantic OCAs

6.1.21 On first contact with the initial aeradio stations crews of participating aircraft should expect to receive the instruction “VOICE POSITION REPORTS NOT REQUIRED”.

6.2 INTER-PILOT AIR-TO-AIR VHF FACILITY 123.45 MHz and EMERGENCY FREQUENCY 121.5 MHz

6.2.1 The frequency 121.5 MHz should be continuously monitored by all aircraft operating in the NAT Region so as to be prepared to offer assistance to any other aircraft advising an emergency situation.

6.2.2 An air-to-air VHF frequency has been established for world-wide use when aircraft are out of range of VHF ground stations which utilise the same or adjacent frequencies. This frequency, 123.45 MHz, is intended for pilot-to-pilot exchanges of operationally significant information (*N.B. It is not to be used as a “chat” frequency*).

6.2.3 123.45 MHz may be used to relay position reports via another aircraft in the event of an air-ground communications failure.

6.2.4 This frequency (123.45 MHz) may also be used by pilots to contact other aircraft when needing to coordinate offsets required in the application of the Strategic Lateral Offset Procedures (SLOP).

6.2.5 If necessary initial contact for relays or offset coordination can be established on 121.5 MHz, although great care must be exercised should this be necessary, in case this frequency is being used by aircraft experiencing or assisting with an ongoing emergency.

6.2.6 Therefore in order to minimise unnecessary use of 121.5 MHz, it is recommended that aircraft additionally monitor 123.45 MHz when flying through NAT airspace.

6.3 POSITION REPORTING

Time and Place of Position Reports

6.3.1 Unless otherwise requested by Air Traffic Control, position reports from flights on routes which are not defined by designated reporting points should be made at the significant points listed in the flight plan.

6.3.2 Air Traffic Control may require any flight operating in a North/South direction to report its position at any intermediate parallel of latitude when deemed necessary.

6.3.3 In requiring aircraft to report their position at intermediate points, ATC is guided by the requirement to have positional information at approximately hourly intervals and also by the need to accommodate varying types of aircraft and varying traffic and MET conditions.

6.3.4 If the estimated time for the ‘next position’, as last reported to ATC, has changed by **three minutes or more**, a revised estimate must be transmitted to the ATS unit concerned as soon as possible.

6.3.5 Pilots must always report to ATC as soon as possible on reaching any new cruising level.

Contents of Position Reports

6.3.6 For flights outside domestic ATS route networks, position should be expressed in terms of latitude and longitude except when flying over named reporting points. For flights whose tracks are

predominantly east or west, latitude should be expressed in degrees and minutes, longitude in degrees only. For flights whose tracks are predominantly north or south, latitude should be expressed in degrees only, longitude in degrees and minutes. However, it should be noted that when such minutes are zero then the position report may refer solely to degrees (as per examples below).

6.3.7 All times should be expressed in four digits giving both the hour and the minutes UTC.

6.3.8 Radio operators may simultaneously monitor and operate more than one frequency. Therefore, when initiating an HF voice contact it is helpful if the pilot include advice on the frequency being used (see examples below).

Standard Message Types

6.3.9 Standard air/ground message types and formats are used within the NAT Region and are published in State AIPs and Atlantic Orientation charts. To enable ground stations to process messages in the shortest possible time, pilots should observe the following rules:

- a) use the correct type of message applicable to the data transmitted;
- b) state the message type in the contact call to the ground station or at the start of the message;
- c) adhere strictly to the sequence of information for the type of message;
- d) **all times** in any of the messages should be expressed in hours and minutes **UTC**.

6.3.10 The message types are shown below with examples:

POSITION

Example: *“Position, Swissair 100, on 8831, RESNO at 1235, Flight Level 330, Estimating 56 North 020 West at 1310, 56 North 030 West Next”*

REQUEST CLEARANCE

Example: *“Request Clearance, American 123, on 8831, 56 North 020 West at 1308, Flight Level 330, Estimating 56 North 030 West at 1340, 56 North 040 West Next. Request Flight Level 350”*

or if a position report is not required

“Request Clearance, Speedbird 212 on 3476, Request Flight Level 370”

REVISED ESTIMATE

Example: *“Revised Estimate, Speedbird 212 on 3476, 57 North 040 West at 0305”*

MISCELLANEOUS

Plain language – free format

Addressing of Position Reports

6.3.11 Position reports for aircraft operating on tracks through successive points on the mutual boundary of two OCAs (e.g. when routing along the 45°N parallel), should be made to both relevant OCAs. (In practice this only requires an addition to the address. (e.g. “Shanwick copy Santa Maria”).)

6.4 “WHEN ABLE HIGHER” (WAH) REPORTS

6.4.1 Prior advice to ATC of the time or position that a flight will be able to accept the next higher level can assist ATC in ensuring optimal usage of available altitudes. A WAH Report must be provided by all flights entering the MNPS Airspace portion of the New York OCA and entering the Santa Maria OCA. Due to the higher number of step climb requests on the generally longer NAT route segments that transit New York and Santa Maria OCAs and also because of the greater frequency of crossing traffic situations here, the strategy of issuing “coast-out to coast-in” conflict-free clearances is not always employed by these two oceanic control centres. Here, air traffic control of a more tactical nature is often exercised. The provision of WAH Reports in these circumstances allows the controllers to more effectively utilise their airspace and provide aircraft more fuel efficient profiles. Provision of WAH Reports on entering other NAT OCAs is optional or they may be requested by any OAC.

6.4.2 When required or when otherwise provided, upon entering an oceanic FIR, pilots should include in the initial position report the time or location that the flight will be able to accept the next higher altitude. The report may include more than one altitude if that information is available.

Example: *”Global Air 543, 40 North 040 West at 1010, Flight Level 350, Estimating 40 North 050 West at 1110, 40 North 060 West Next. Able Flight Level 360 at 1035, Able Flight Level 370 at 1145, Able Flight Level 390 at 1300”*

6.4.3 Information thus provided of the aircraft’s future altitude “ability” will not automatically be interpreted by ATC as an advance “request” for a step climb. It will be used as previously indicated to assist ATC in planning airspace utilisation. However, should the pilot wish to register a request for one or more future step climbs, this may be incorporated in the WAH report by appropriately substituting the word “Request” for the word “Able”.

Example: *”Global Air 543, 42 North 040 West at 1215, Flight Level 330, Estimating 40 North 050 West at 1310, 38 North 060 West Next. Request Flight Level 340 at 1235, Able Flight Level 350 at 1325, Request Flight Level 360 at 1415”*

6.4.4 Although optimal use of the WAH reports is in conjunction with a Position Report, a WAH report can be made or updated separately at any time.

Example: *”Global Air 543, Able Flight Level 360 at 1035, Request Flight Level 370 at 1145, Able Flight Level 390 at 1300”*

6.4.5 It should be noted that ATC acknowledgement of a WAH report (and any included requests) is NOT a clearance to change altitude.

6.5 METEOROLOGICAL REPORTS

6.5.1 In accordance with Amendment 75 to ICAO Annex 3, with effect from 18 November 2010 aircraft are no longer required to provide voice reports of MET observations of wind speed and direction nor outside air temperature. Nevertheless any turbulence or other significant meteorological conditions encountered should be reported to ATC. The format to be used for the reporting of such observations should, where appropriate, be by reference to geographical co-ordinates.

6.5.2 When a ground unit establishes an event contract with an aircraft to provide ADS position reports, it may also establish an additional periodic report contract (e.g. with a 30 mn interval). Such ADS-C

periodic reports, unlike event reports, contain wind and temperature data and thereby satisfy the MET authorities requirements for the provision of MET data. Similarly, “FMC Waypoint position reports” sent via datalink also include wind and temperature data and aircraft participating in such a datalink programme are deemed to meet the MET authorities requirements. However, it must be appreciated that any such automated MET Reports do not include information on any turbulence or any other unusual meteorological phenomena. Therefore any pilot providing position reports via datalink, who encounters turbulence, etc, should report this information via voice or, if appropriate, via a CPDLC free text downlink message.

6.6 HF COMMUNICATIONS FAILURE

6.6.1 Rules and procedures for the operation of an aircraft following a radio communications failure (RCF) are established to allow ATC to anticipate that aircraft’s subsequent actions and thus for ATC to be able to provide a service to all other flights within the same vicinity, so as to ensure the continued safe separation of all traffic. The general principles of such rules and procedures are set out in Annexes 2 and 10 to the ICAO Convention. States publish in their AIPs specific RCF rules and regulations to be followed within their particular sovereign airspace.

6.6.2 It must be recognised that there is in general an underlying premise in “normal” radio communications failure procedures that they are for use when a single aircraft suffers an on-board communications equipment failure. Within the NAT Region and some adjacent domestic airspace (e.g. Northern Canada), where HF Voice is primarily used for air-ground ATC communications, ionospheric disturbances resulting in poor radio propagation conditions can also interrupt these communications. While it is impossible to provide guidance for all situations associated with an HF communications failure, it is, however, extremely important to differentiate between two distinct circumstances: - firstly, an on-board communications equipment failure, resulting in an individual aircraft losing HF communications with ATC and; secondly, the occurrence of poor HF propagation conditions (commonly referred to as “HF Blackouts”), which can simultaneously interrupt HF air-ground communications for many aircraft over a wide area.

6.6.3 In the case of an on-board communications equipment failure, even though ATC loses contact with that aircraft, it can anticipate that aircraft’s actions and, if necessary, modify the profiles of other aircraft in the same vicinity in order to maintain safe separations.

6.6.4 However, the occurrence of poor HF propagation conditions can simultaneously interrupt HF air-ground communications for many aircraft over a wide area and ATC may then be unable to make any interventions to assure safe traffic separations. Notwithstanding the gradual introduction of Datalink and SATCOM Voice for regular air-ground ATS communications in the NAT Region, all pilots must recognise that, pending the mandatory carriage and use of such means, an HF blackout will impact the ability of ATC to ensure the safe separation of all traffic. **Hence, even if using other than HF for regular communications with ATC, pilots should still exercise appropriate caution when HF blackout conditions are encountered.**

6.6.5 The following procedures are intended to provide general guidance for aircraft which experience a communications failure while operating in, or proposing to operate in, the NAT Region,. These procedures are intended to complement and not supersede State procedures/regulations.

General Provisions

1. The pilot of an aircraft experiencing a two-way ATS communications failure should operate the SSR Transponder on identity Mode A Code 7600 and Mode C.
2. When so equipped, an aircraft should use Satellite Voice Communications to contact the responsible aeradio station via special telephone numbers/short codes published in State AIPs

(see also “HF Management Guidance Material for the NAT Region”). However, it must be appreciated that pending further system developments and facility implementations the capability for Ground(ATC)-initiated calls varies between different NAT OACs

3. If the aircraft is not equipped with SATCOM Voice then the pilot should attempt to use VHF to contact any (other) ATC facility or another aircraft, inform them of the difficulty, and request that they relay information to the ATC facility with which communications are intended.
4. The inter-pilot air-to-air VHF frequency, 123.45 MHz, may be used to relay position reports via another aircraft. *(N.B. The emergency frequency 121.5 MHz should not be used to relay regular communications, but since all NAT traffic is required to monitor the emergency frequency, it may be used, in these circumstances, to establish initial contact with another aircraft and then request transfer to the inter-pilot frequency for further contacts).*
5. In view of the traffic density in the NAT Region, pilots of aircraft experiencing a two-way ATS communications failure should broadcast regular position reports on the inter-pilot frequency (123.45 MHz) until such time as communications are re-established.

Communications Procedures for Use in the Event of an On-board HF Equipment Failure

6.6.6 Use SATCOM Voice communications, if so equipped. (See General Provisions 2. above).

6.6.7 If not SATCOM Voice equipped try VHF relay via another aircraft (See General Provisions 3. & 4. above).

Communications Procedures for Use during Poor HF Propagation Conditions

6.6.8 Poor HF propagation conditions are the result of ionospheric disturbances. These are usually caused by sun-spot or solar flare activity creating bursts of charged particles in the solar wind which can spiral down around the Earth’s magnetic lines of force and distort or disturb the ionised layers in the stratosphere which are utilised to refract HF radio waves. As with the Aurora Borealis, which is of similar origin, these ionospheric disturbances most commonly occur in regions adjacent to the Magnetic Poles. Since the Earth’s North Magnetic Pole is currently located at approximately 80N 110W, flights through the North Atlantic and Northern Canada regions can, on occasion, experience resulting HF communications difficulties.

6.6.9 SATCOM Voice communications are unaffected by most ionospheric disturbances. Therefore, when so equipped, an aircraft may use SATCOM Voice for ATC communications (See General Provisions 2 above).

6.6.10 If not SATCOM Voice equipped, in some circumstances it may be feasible to seek the assistance, via VHF, of a nearby SATCOM Voice equipped aircraft to relay communications with ATC (See General Provisions 3. & 4. above).

6.6.11 Whenever aircraft encounter poor HF propagation conditions that would appear to adversely affect air-ground communications generally, it is recommended that all pilots then broadcast their position reports on the air-to-air VHF frequency 123.45 MHz. Given the density of traffic in the NAT Region and the fact that in such poor propagation conditions ATC will be unable to maintain contact with all aircraft, it is important that even those aircraft that have been able to establish SATCOM Voice contact also broadcast their position reports.

6.6.12 If for whatever reason SATCOM Voice communications (direct or relayed) are not possible, then the following procedures may help to re-establish HF communications. Sometimes these ionospheric

disturbances are very wide-spread and HF air-ground communications at all frequencies can be severely disrupted throughout very large areas (e.g. simultaneously affecting the whole of the NAT Region and the Arctic.). However, at other times the disturbances may be more localised and/or may only affect a specific range of frequencies.

6.6.13 In this latter circumstance, HF air-ground communications with the intended aeradio station may sometimes continue to be possible but on a frequency other than either the primary or secondary frequencies previously allocated to an aircraft. Hence, in the event of encountering poor HF propagation conditions pilots should first try using alternative HF frequencies to contact the intended aeradio station.

6.6.14 However, while the ionospheric disturbances may be severe, they may nevertheless only be localized between the aircraft's position and the intended aeradio station, thus rendering communications with that station impossible on any HF frequency. But the aeradio stations providing air-ground services in the NAT Region do co-operate as a network and it may, even then, still be possible to communicate with another aeradio station in the NAT network on HF and request that they relay communications. Efforts should therefore be made to contact other NAT aeradio stations via appropriate HF frequencies.

6.6.15 Nevertheless, as previously indicated, there are occasions when the ionospheric disturbance is so severe and so widespread that HF air-ground communications with any aeradio station within the NAT Region network are rendered impossible.

Rationale for Lost Communications Operational Procedures

6.6.16 Because of the density of oceanic traffic in the NAT Region, unique operational procedures have been established here to be followed by pilots whenever communications are lost with ATC. These procedures and the rationale for their development follow.

Tactical ATC Environment

6.6.17 In a tactical ATC environment,, such as one in which Secondary Surveillance Radar and VHF voice communications are used, ATC has continuous real-time data on the position/progress of all relevant traffic and the intentions of any individual aircraft with which ATC may have lost communications can be inferred from that aircraft's filed flight plan. Hence, in such an environment, when voice communications with a single aircraft fail, the relevant published "lost comms procedures" normally require that aircraft to "land at a suitable aerodrome or continue the flight and adjust level and speed in accordance with the filed flight plan". Communications blackouts affecting multiple aircraft, are not a feature of this type of VHF environment and hence in these circumstances, if required, ATC will be able to re-clear other traffic to ensure safe separations are maintained.

Procedural ATC Environment

6.6.18 However, in a (largely) non-radar environment such as the North Atlantic, ATC must rely significantly upon the HF Voice Position Reports communicated by each aircraft for position, progress and intent data. Communications equipment failures and/or poor propagation conditions can interrupt the provision of this information. Therefore, to mitigate against such occurrences in the busy NAT MNPS airspace, outside of VHF coverage, ATC often employs strategic traffic planning and issues Oceanic Clearances which have been pre-co-ordinated with downstream OACs. Flights that continue to follow such a pre-coordinated strategic oceanic clearance are thereby guaranteed conflict-free progress to oceanic exit, even if no ATIS communications are subsequently possible with any one, or even with all, of those strategically planned aircraft.

6.6.19 Every effort is made by the initial NAT OAC to clear aircraft as per their filed flight plans. However, this is not always possible, particularly during peak traffic flow periods. Aircraft may receive

clearances at flight levels or speeds other than those flight planned or, less frequently, may be cleared on oceanic tracks via entry or exit points other than those contained in the filed flight plan. Also it must be recognized that while a filed NAT flight plan may contain one or more step climbs for execution within the NAT Region, the initially issued oceanic clearance, or even any subsequently updated clearance (i.e. re-clearance), has only been co-ordinated for a single (i.e. initial or current) flight level. It must therefore be appreciated that it is only the flight routing and profile contained in the current received oceanic clearance that has been guaranteed to provide conflict-free progress. Unless this oceanic clearance is precisely the same as the filed flight plan, in any lost communications situation in the NAT Region, if a pilot in receipt of an oceanic clearance unilaterally reverts to his/her filed flight plan (even by simply executing a later step climb), then a guarantee of conflict-free progress no longer exists. Consequently, if a NAT aircraft loses the possibility of communications with the relevant OAC at any time after receiving and acknowledging an oceanic clearance, and the pilot elects to continue the flight, then the aircraft must adhere strictly to the routing and profile of the current oceanic clearance until exiting the NAT Region. Pilots must not unilaterally revert to their filed flight plan.

Operational Procedures following Loss of HF Communications Prior to Entry into the NAT

On-Board HF Communications Equipment Failure

6.6.20 Due to the potential length of time in oceanic airspace, it is strongly recommended that a pilot, experiencing an HF communications equipment failure prior to entering the NAT, whilst still in domestic airspace and still in VHF contact with the domestic ATC Unit, does not enter NAT airspace but adopts the procedure specified in the appropriate domestic AIP and lands at a suitable airport. Should the pilot, nevertheless, elect to continue the flight then every effort must be made to obtain an oceanic clearance and the routing, initial level and speed contained in that clearance must be maintained throughout the entire oceanic segment. Any level or speed changes required to comply with the Oceanic Clearance must be completed within the vicinity of the oceanic entry point.

6.6.21 If, however, an oceanic clearance cannot be obtained, the individual aircraft suffering radio communications equipment failure should enter oceanic airspace at the first oceanic entry point, level and speed contained in the filed flight plan and proceed via the filed flight plan route to landfall. **The initial oceanic level and speed included in the filed flight plan must be maintained until landfall.** Any subsequent step-climbs included in the filed flight plan must not be executed.

HF Blackout

6.6.22 In the case of aircraft that lose ATC communications as a result of poor propagation conditions HF Blackouts when approaching NAT airspace through domestic airspace where ATC communications are also conducted via HF (e.g. entering the NAT through Northern Canadian airspace into the Reykjavik OCA), it is probably less advisable to execute unscheduled landings. These poor propagation conditions are very likely to affect many aircraft simultaneously and multiple diversions of “lost comms” aircraft might create further difficulties and risks.

6.6.23 As with the equipment failure situation, aircraft approaching the NAT and losing ATC communications as a result of poor HF radio propagation conditions should, if already in receipt of an oceanic clearance, follow the routing specified in that clearance and maintain the **initial** cleared level and speed throughout the oceanic segment i.e. through to landfall.

6.6.24 However, in these HF Blackout circumstances, if no oceanic clearance has been received, the aircraft must remain at the last cleared domestic flight level, not only to the ocean entry point but also throughout the whole subsequent oceanic segment (i.e. until final landfall). This is in stark contrast to the equipment failure case. In such HF Blackouts, pilots must not effect level changes to comply with filed

flight plans. Such aircraft should, however, enter oceanic airspace at the first oceanic entry point and speed contained in the filed flight plan and proceed via the filed flight plan route to landfall.

6.6.25 The rationale here must be appreciated. In such circumstances it is likely that ATC will have simultaneously lost HF communications with multiple aircraft in the same vicinity. Should pilots then wrongly apply the “normal” radio failure procedures and “fly the flight plan”, there is a possibility that two such aircraft may have filed conflicting flight paths/levels through the subsequent oceanic airspace, and without communications with either aircraft, ATC would then be unable to intervene to resolve the conflict. Since safe aircraft level separation assurance has already been incorporated into the current domestic clearances, **it is consequently imperative that under such (Domestic and Oceanic) HF-blackout circumstances, all aircraft electing to continue flight into NAT oceanic airspace without a received and acknowledged oceanic clearance, should adhere to the flight level in the last received domestic clearance. No level changes should be made to comply with a filed oceanic level that is different from that of the domestic clearance in effect at the time that ATC air-ground communications were lost.**

Operational Procedures following Loss of HF Communications after Entering the NAT

6.6.26 If the HF communications equipment failure occurs or HF Blackout conditions are encountered after entering the NAT then : -

The pilot must proceed in accordance with the last received and acknowledged Oceanic Clearance, including level and speed, to the last specified oceanic route point (normally landfall). After passing this point, the pilot should conform with the relevant AIP specified State procedures/regulations and if necessary rejoin the filed flight plan route by proceeding, via the published ATS route structure where possible, to the next significant point contained in the filed flight plan. *Note: the relevant State procedures/regulations to be followed by an aircraft in order to rejoin its filed Flight Plan route are specified in detail in the appropriate State AIP.*

6.6.27 Aircraft with a destination within the NAT Region should proceed to their clearance limit and follow the ICAO standard procedure to commence descent from the appropriate designated navigation aid serving the destination aerodrome at, or as close as possible to, the expected approach time. Detailed procedures are promulgated in relevant State AIPs.

Summary of Operational Procedures Required following Loss of Air/Ground ATS Communications in the NAT Region

6.6.28 The foregoing detailed operational procedures can be simply summarised as follows :

- Equipment Failure before receiving an Oceanic Clearance:-
Divert or fly the Flight Plan route, speed and initial planned oceanic level to landfall.
- Blackout encountered (in an HF comms Domestic ATC environment) before receiving an Oceanic Clearance:-
Continue at Domestic cleared level and follow flight planned route and speed to landfall.
- Equipment Failure or Blackout after receiving an Oceanic Clearance:-
Fly that clearance to landfall.

In all cases, after landfall rejoin, or continue on, the flight planned route, using appropriate State AIP specified procedures for the domestic airspace entered.

6.7 CONTINGENCY SITUATIONS AFFECTING ATM PROVISION IN THE NAT REGION

6.7.1 In the anticipation of situations arising which might result in the partial or total disruption of Air Traffic Services within the NAT Region, NAT ATS Providers have developed arrangements which would, in such events, be put in place to ensure, as far as possible, the continued safety of air navigation. Such arrangements include required actions by pilots and operators of affected flights. These arrangements are detailed in “The North Atlantic Air Traffic Management Operational Contingency Plan – Doc.006” which can be downloaded from the ICAO Paris website at <http://www.paris.icao.int/> . Operators and Pilots planning and conducting operations in North Atlantic region should ensure their familiarity with these arrangements and in particular with the actions expected of pilots in such contingency situations.

6.7.2 The plan is presented in two parts. The first deals with contingency arrangements necessary when only one NAT ATS unit is affected. While the second addresses events which are likely to affect more than one facility within the NAT region, for example the contamination of the airspace by volcanic ash. Where available, information is also provided outlining the steps taken by ANSPs to deal with any long term unavailability of an ATC facility.

6.8 OPERATION OF TRANSPONDERS

6.8.1 All aircraft operating as IFR flights in the NAT Region shall be equipped with a pressure-altitude reporting SSR transponder. Unless otherwise directed by ATC, pilots flying in the NAT FIRs will operate transponders continuously in Mode A/C Code 2000, except that the last assigned code will be retained for a period of 30 min after entry into NAT airspace. Pilots should note that it is important to change from the last assigned domestic code to the Mode A/C Code 2000 since the original domestic code may not be recognised by the subsequent Domestic Radar Service on exit from the oceanic airspace. It should be noted that this procedure does not affect the use of the special purpose codes (7500, 7600 and 7700) in cases of unlawful interference, radio failure or emergency. However, given the current heightened security environment crews must exercise CAUTION when selecting Codes not to inadvertently cycle through any of these special purpose codes and thereby possibly initiate the launching of an interception.

6.8.2 Reykjavik ACC provides a radar control service in the south-eastern part of its area and consequently transponder codes issued by Reykjavik ACC must be retained throughout the Reykjavik OCA until advised by ATC.

6.9 AIRBORNE COLLISION AVOIDANCE SYSTEMS (ACAS)

6.9.1 From 1 January 2005, all turbine-engined aeroplanes having a maximum certificated take-off mass exceeding 5,700 kg or authorized to carry more than 19 passengers have been required to carry and operate ACAS II in the NAT Region. TCAS Version 7.0 meets the technical specifications for ACAS II as contained in ICAO Annex 10 Volume IV. Pilots should report all ACAS/TCAS Resolution Advisories which occur in the NAT Region to the controlling authority for the airspace involved. (See further on this in Chapter 12.)

CHAPTER 7: APPLICATION OF MACH NUMBER TECHNIQUE

7.1 DESCRIPTION OF TERMS

7.1.1 The term 'Mach Number Technique' is used to describe a technique whereby subsonic turbojet aircraft operating successively along suitable routes are cleared by ATC to maintain appropriate Mach Numbers for a relevant portion of the en route phase of their flight.

7.2 OBJECTIVE

7.2.1 The principal objective of the use of Mach Number Technique is to achieve improved utilisation of the airspace on long route segments where ATC has no means, other than position reports, of ensuring that the longitudinal separation between successive aircraft is not reduced below the established minimum. Practical experience has shown that when two or more turbojet aircraft, operating along the same route at the same flight level, maintain the same Mach Number, they are more likely to maintain a constant time interval between each other than when using other methods. This is due to the fact that the aircraft concerned are normally subject to approximately the same wind and air temperature conditions, and minor variations in ground speed, which might increase and decrease the spacing between them, tend to be neutralised over long periods of flight.

7.2.2 For many aircraft types the cockpit instrument displays the True Mach being flown. However, for some types the AFM notes a correction that must be made to the Indicated Mach to provide the True Mach. It is important to recognise that the maintenance of longitudinal separations depends upon the assumption that the ATC assigned Mach numbers maintained by all aircraft are True Mach numbers. Pilots must therefore ensure that any required corrections to indicated Mach are taken into account when complying with the True Mach number specified in the ATC clearance.

7.3 PROCEDURES IN NAT OCEANIC AIRSPACE

7.3.1 The Oceanic Clearance includes the assigned (True) Mach Number which is to be maintained. It is therefore necessary that information on the desired Mach Number be included in the flight plan for turbojet aircraft intending to fly in NAT oceanic airspace. ATC uses Mach Number together with pilot position reports to calculate estimated times for significant points along track. These times provide the basis for longitudinal separation between aircraft and for co-ordination with adjacent ATC units.

7.3.2 ATC will try to accommodate pilot/dispatcher requested or flight planned Mach Numbers when issuing Oceanic Clearances. It is rare that ATC will assign a Mach Number more than 0.01 faster or 0.02 slower than that requested. The prescribed longitudinal separation between successive aircraft flying a particular track at the same flight level is established over the oceanic entry point. Successive aircraft following the same track may be assigned different Mach Numbers but these will be such as to ensure that prescribed minimum separations are assured throughout the oceanic crossing. Intervention by ATC thereafter should normally only be necessary if an aircraft is required to change its Mach Number due to conflicting traffic or to change its flight level.

7.3.3 It is, however, important to recognise that the establishment and subsequent monitoring of longitudinal separation is totally reliant upon aircraft providing accurate waypoint passing times in position reports. It is therefore essential that pilots conducting flights in MNPS Airspace utilise accurate clocks and synchronise these with a standard time signal, based on UTC, prior to entering MNPS Airspace. It should be

noted that some aircraft clocks can only be re-set while the aircraft is on the ground. (See further comments on time-keeping/longitudinal navigation in Chapter 1 and Chapter 8.)

7.3.4 In the application of Mach Number Technique, pilots must adhere strictly to their assigned True Mach Numbers unless a specific re-clearance is obtained from the appropriate ATC unit. However, as the aircraft weight reduces it may be more fuel efficient to adjust the Mach Number. Since the in-trail and crossing track separations between individual aircraft are established on the basis of ETAs passed to, or calculated by, ATC, it is essential that ATC approval is requested prior to effecting any change in cruise Mach Number. Such approval will be given if traffic conditions permit. **Pilots must recognise that adherence to the assigned Mach Number is essential. No tolerance is provided for. Pilots must not utilise Long Range Cruise or ECON FMC modes when transiting NAT MNPS airspace.** If an immediate temporary change in the Mach Number is essential, e.g. due to turbulence, ATC must be notified as soon as possible. Pilots with experience of flying in oceanic airspaces other than the North Atlantic, may be familiar with a procedure in those areas which permits pilots to unilaterally elect to change their cruising mach number by up to 0.02M, without prior ATC approval. **This is not the case in the North Atlantic MNPS airspace.**

7.3.5 Pilots should maintain their last assigned Mach Number during step-climbs in oceanic airspace. If due to aircraft performance this is not feasible ATC should be advised at the time of the request for the step climb.

7.4 PROCEDURE AFTER LEAVING OCEANIC AIRSPACE

7.4.1 After leaving oceanic airspace pilots must maintain their assigned Mach Number in domestic controlled airspace unless and until the appropriate ATC unit authorises a change.

CHAPTER 8: MNPS FLIGHT OPERATION & NAVIGATION PROCEDURES

8.1 INTRODUCTION

8.1.1 The aircraft navigation systems necessary for flying in NAT MNPS Airspace are capable of high-performance standards. However, it is essential that stringent cross-checking procedures are employed, both to ensure that these systems perform to their full capabilities and to minimise the consequences of equipment failures and possible human errors.

8.1.2 Navigation systems are continually evolving and early editions of the NAT MNPSA Operations Manual concentrated on offering specific guidance on the use of individual approved long range navigation systems. The current philosophy within ICAO is to specify the navigation system performance required for operations within a given airspace. This concept is referred to as “Performance Based Navigation” (PBN). Within this philosophy some navigation specifications, in addition to stating the accuracies to be achieved, also require on-board automatic integrity monitoring and alerting functions. Such specifications are referred to as RNP-X, where X represents an accuracy of 95% containment in X Nms. However, specifications requiring the same accuracies but not requiring on-board monitoring are referred to as RNAV-X.

8.1.3 MNPS has been in use in the NAT Region for more than thirty years. It does not require on-board automatic monitoring and alerting functions. Instead, pilots must remain vigilant and are required to employ rigorous routine manual monitoring procedures. In the 1990’s a navigation requirements system was introduced for use originally in the Pacific Region. Like the MNPS, it too does not include any requirement for on-board automatic monitoring. Its introduction was long before the PBN concept was developed and it was then annotated as “RNP-10”. Large numbers of aircraft worldwide are now in receipt of “RNP-10” approvals. To conform with the PBN standard terminology, as indicated above, this system should actually be designated as “RNAV-10”. However, it has been recognised that re-classifying such a widespread existing approval designation would create significant difficulties for both operators and State regulators. Consequently, it has been agreed that this designation of “RNP-10” will remain as such, even though the navigation specifications here are, in PBN terminology, effectively “RNAV-10”.

8.1.4 With current technology, on-board automatic performance monitoring can only be carried out using GPS. Hence GPS is mandatory for true RNP airspace (e.g. RNP-4) but is not required for RNAV airspace, including that historically and still designated as “RNP-10”.

8.1.5 MNPS was established primarily with the NAT OTS environment in mind. The defining waypoints of OTS tracks are specified by whole degrees of latitude and, using an effective 60 NM lateral separation standard, most adjacent tracks are separated by only one degree of latitude at each ten-degree meridian. The traffic density in the OTS is higher than in any other oceanic airspace. In such a densely populated flexible track system (one that changes twice every day), it is essential that crews avoid (whole degree) waypoint insertion errors. Such errors in the NAT MNPSA will inevitably result in a conflict with traffic on an adjacent track. For this reason Minimum Navigation Performance Specifications had to include not just the technical navigation accuracy of the Long-range Navigation Systems used on the aircraft but also the crew navigation procedures employed. The MNPS statement thus involves both cockpit/flight deck procedures and crew training requirements. In the early days of the RNP concept, it was these additional requirements that separated MNPS from RNP. However, RNP has come a long way since its inception and the development of the RNP-10 approvals for PAC operations brought it much closer to the original MNPS concept. The ICAO Air Navigation Plan for the North Atlantic Region states that the intention in the future is that navigational performance is expected to be tied to a level of RNP. This will probably require the

carriage of dual GPS to allow the required on-board performance monitoring and alerting which would be necessary for the closer track spacing then envisaged.

Note: For more detailed information on RNP see ICAO Document *Doc 9613 – ‘Performance Based Navigation Manual’*

8.1.6 Obviously, there are several combinations of airborne sensors, receivers, computers with navigation data bases and displays which are capable of producing like accuracies, and which with inputs to automatic flight control systems provide track guidance. However, regardless of how sophisticated or mature a system is, it is still essential that stringent navigation and cross checking procedures are maintained if Gross Navigation Errors (GNEs) are to be avoided. A GNE within NAT Airspace is defined as a deviation from cleared track of 25 NM or more. Some of these errors are detected by means of long range radars as aircraft leave oceanic airspace. Other such errors may also be identified through the scrutiny of routine position reports from aircraft.

8.1.7 All reported navigation errors in North Atlantic airspace are thoroughly investigated. Records show that navigation equipment or system technical failures are now fortunately rare. However, when they do occur they can be subtle or progressive, resulting in a gradual and perhaps not immediately discernible degradation of performance. Chapter 11 of this Manual provides guidance on detection and recovery when such problems are encountered.

8.1.8 Unfortunately, human failings produce the vast majority of navigation errors in the North Atlantic Region. As indicated above, while the flexible OTS structure and the employment of a 60 NM lateral separation standard, provide for highly efficient use of NAT airspace, they also bring with them a demand for strictly disciplined navigation procedures. About half of NAT flights route via an OTS track and a large portion of the remaining random flights follow routes that at some point approach within one or two degrees of the outermost OTS tracks. One consequence of this is that a single digit error in the latitude of one significant point of an aircraft's route definition will very likely lead to a conflict with another aircraft which is routing correctly via the resulting common significant point. Ironically, the risk of an actual collision between two aircraft routing via a common point, as is the case when such errors are made, is further exacerbated by the improved technical accuracy of the modern navigation equipment employed.

8.1.9 Today in North Atlantic operations the predominant source of aircraft positioning information is that of GPS. This includes aircraft that use stand-alone GPS equipment and aircraft where GPS positioning information is integrated into the system navigation solution (e.g. a GPS / IRS mix). The accuracy of GPS navigation is such that the actual flight paths of any two GPS equipped aircraft navigating to a common point will almost certainly pass that point within less than a wingspan of each other. Given that the North Atlantic is the most heavily used oceanic airspace anywhere in the world, it must therefore be appreciated that even a single digit error in just one waypoint can result in a significant conflict potential.

8.1.10 The importance of employing strict navigation system operating procedures designed to avoid the insertion of wrong waypoints or misunderstandings between pilots and ATC over cleared routes cannot be over-emphasised. The principles embodied in many of the procedures described in this Chapter are aimed squarely at the prevention of such problems.

8.1.11 Many of the procedures listed in this Chapter are not equipment specific and others may not be pertinent to every aircraft. For specific equipment, reference should be made to Manufacturers' and operators' handbooks and manuals.

8.1.12 There are various references in this material to two pilots; however when carried, a third crew member should be involved in all cross check procedures to the extent practicable.

8.1.13 Maintenance of a high standard of navigation performance is absolutely essential to the maintenance of safety in the NAT MNPS Airspace.

8.2 GENERAL PROCEDURES

Presentation of Navigation Information

8.2.1 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.

Importance of Accurate Time

8.2.2 It must be recognised that proper operation of a correctly functioning LRNS will ensure that the aircraft follows its cleared track. ATC applies standard separations between cleared tracks and thereby assures the safe **lateral** separation of aircraft. However, longitudinal separations between subsequent aircraft following the same track and between aircraft on intersecting tracks are assessed in terms of differences in ETAs/ATAs at common waypoints. Aircraft clock errors resulting in position report time errors can therefore lead to an erosion of actual longitudinal separations between aircraft. **It is thus vitally important that prior to entry into the NAT MNPS Airspace the time reference system to be used during the flight is accurately synchronised to UTC and that the calculation of waypoint ETAs and the reporting of waypoint ATAs are always referenced to this system.** Many modern aircraft master clocks (typically the FMS) can only be reset while the aircraft is on the ground. Thus the Pre-flight Procedures for any NAT MNPS flight **must include** a UTC time check and resynchronisation of the aircraft master clock. Lists of acceptable time sources for this purpose have been promulgated by NAT ATS Provider States.

8.2.3 The following are examples of acceptable time standards:

- GPS (Corrected to UTC) - Available at all times to those crews who can access time via approved on-board GPS (TSO-C129) equipment.
- WWV - National Institute of Standards (NIST - Fort Collins, Colorado). WWV operates continually H24 on 2500, 5000, 10,000, 15,000 and 20,000 kHz (AM/SSB) and provides UTC (voice) once every minute.

- CHU - National Research Council (NRC - Ottawa, Canada) - CHU operates continually H24 on 3330, 7335 and 14,670 kHz (SSB) and provides UTC (voice) once every minute (English even minutes, French odd minutes).
- BBC - British Broadcasting Corporation (United Kingdom). The BBC transmits on a number of domestic and world-wide frequencies and transmits the Greenwich time signal (referenced to UTC) once every hour on most frequencies, although there are some exceptions.

8.2.4 Further details of these and other acceptable time references can be found in AIS documentation of the NAT ATS Provider States. In general, the use of any other source of UTC, that can be shown to the State of the Operator or the State of Registry of the aircraft to be equivalent, may be allowed for this purpose.

The Use of a Master Document

8.2.5 Navigation procedures must include the establishment of some form of master working document to be used on the flight deck. This document may be based upon the flight plan, navigation log, or other suitable document which lists sequentially the waypoints defining the route, the track and distance between each waypoint, and other information relevant to navigation along the cleared track. When mentioned subsequently in this guidance material, this document will be referred to as the 'Master Document'.

8.2.6 Misuse of the Master Document can result in GNEs occurring and for this reason strict procedures regarding its use should be established. These procedures should include the following:

- a) Only one Master Document is to be used on the flight deck. However, this does not preclude other crew members maintaining a separate flight log.
- b) On INS equipped aircraft a waypoint numbering sequence should be established from the outset of the flight and entered on the Master Document. The identical numbering sequence should be used for storing waypoints in the navigation computers.
- c) For aircraft equipped with FMS data bases, FMS generated or inserted waypoints should be carefully compared to Master Document waypoints and cross checked by both pilots.
- d) An appropriate symbology should be adopted to indicate the status of each waypoint listed on the Master Document.

8.2.7 The following is a typical example of Master Document annotation. An individual operator's procedures may differ slightly but the same principles should be applied:

- a) The waypoint number is entered against the relevant waypoint co-ordinates to indicate that the waypoint has been inserted into the navigation computers.
- b) The waypoint number is circled, to signify that insertion of the correct co-ordinates in the navigation computers has been double-checked independently by another crew member.
- c) The circled waypoint number is ticked, to signify that the relevant track and distance information has been double-checked.
- d) The circled waypoint number is crossed out, to signify that the aircraft has overflown the waypoint concerned.

8.2.8 All navigational information appearing on the Master Document must be checked against the best available prime source data. When a re-route is necessary, some regulators recommended that a new Master Document is prepared for the changed portion of the flight. In cases where the original Master Document is to be used, the old waypoints must be clearly crossed out and the new ones carefully entered in their place. The checks listed in the previous paragraph must be carried out in respect of all new or revised waypoints.

8.2.9 When ATC clearances or re-clearances are being obtained, headsets should be worn. The inferior clarity of loud-speakers has, in the past, caused errors during receipt. Two qualified crew members should monitor such clearances; one of them recording the clearance on the Master Document as it is received, the other cross-checking the receipt and read-back. All waypoint co-ordinates should be read back in detail, adhering strictly to standard ICAO phraseology, except where approved local procedures make this unnecessary. Detailed procedures pertaining to abbreviated clearances/read-backs are contained in the appropriate AIPs, and in this Manual at Chapter 5 - Oceanic ATC Clearances.

Position Plotting

8.2.10 A simple plotting chart provides a visual presentation of the intended route which, is defined otherwise only in terms of navigational co-ordinates. Plotting the intended route on such a chart may reveal errors and discrepancies in the navigational co-ordinates which can then be corrected immediately, before they reveal themselves in terms of a deviation from the ATC cleared route. As the flight progresses, plotting the aircraft's present position on this chart will also serve the purpose of a navigation cross check, provided that the scale and graticule are suitable.

8.2.11 As the flight progresses in oceanic airspace, plotting the aircraft's position on this chart will help to confirm (when it falls precisely on track) that the flight is proceeding in accordance with its clearance. However, if the plotted position is laterally offset, the flight may be deviating unintentionally, and this possibility should be investigated at once.

8.2.12 It is recommended that a chart with an appropriate scale be used for plotting. Many company Progress Charts are of the wrong scale or too small. It has been noted that the use of plotting charts that are small can lead to oceanic errors. EAG Chart AT (H) 1; No 1 AIDU (MOD) Charts AT(H)1, 2, 3 & 4 and the Jeppesen North/Mid Atlantic Plotting Charts are all useful compromises between scale and overall chart size; while the *NOAA/FAA North Atlantic Route Chart* has the advantage, for plotting purposes, of a 1° latitude/longitude graticule.

Provision of Step-Climbs

8.2.13 Tactical ATS Surveillance control and tactical procedural control are exercised in some areas of the NAT MNPS Airspace. However, oceanic clearances for most NAT flights are of a strategic nature, whereby flights are allocated a conflict-free route and profile from coast-out to landfall. Although such strategic clearances normally specify a single flight level for the entire crossing, there is often scope for en route step-climb re-clearances as fuel burn-off makes higher levels more optimal. Controllers will accommodate requests for step-climbs whenever possible. When so re-cleared, pilots should initiate the climb without delay (unless their discretion was invited or unless a conditional clearance was issued) and **always** report to ATC immediately upon **leaving** the old and on **reaching** the new cruising levels.

Relief Crew Members

8.2.14 Very long range operations may include the use of relief crew. In such cases it is necessary to ensure that procedures are such that the continuity of the operation is not interrupted, particularly in respect of the handling and treatment of the navigational information.

8.3 PRE-FLIGHT PROCEDURES

Inertial Navigation Systems

Insertion of Initial Latitude and Longitude

8.3.1 Two fundamental principles concerning the operation of an IRS are: that it needs to be accurately aligned before flight; and that the actual position of the aircraft, at alignment, is set into the system. If either of these principles is violated, systematic errors will be introduced. These errors can be corrected whilst the aircraft is on the ground but it is not possible to adequately recover from them whilst the aircraft is in flight, despite any indications to the contrary. Correct insertion of the initial position must therefore be checked before inertial systems are aligned and the position should be recorded in the flight log and/or Master Document. It is recommended that subsequent 'silent' checks of the present position and of the inertial velocity outputs (e.g. ground speed registering zero) be carried out independently by both pilots during (an early stage of) the pre-flight checks and again just before the aircraft is moved. Any discrepancies should be investigated.

8.3.2 With regard to the insertion of the initial co-ordinates whilst on the ramp, the following points should be taken into account:

- in some inertial systems, insertion errors exceeding about one degree of latitude will illuminate a malfunction light. It should be noted that very few systems provide protection against longitude insertion errors.
- at all times, but particularly in the vicinity of the Zero Degree E/W (Greenwich) Meridian or near to the Equator, care should be taken to ensure that the co-ordinates inserted are correct. (i.e. E/W or N/S).

System Alignment

8.3.3 The alignment of inertial systems must be completed and the equipment put into navigation mode prior to releasing the parking brake at the ramp. Some systems will align in about 10 minutes, others can take 15 minutes or more; expect alignment to take longer in extreme cold or at higher latitudes or when the aircraft (and hence the inertial platform) is buffeted by winds or rocked during cargo loading. A rapid realignment feature is sometimes provided but should only be used if, during an intermediate stop, it becomes necessary to increase the system accuracy. The aircraft must be stationary during rapid realignment which typically will take about one minute.

8.3.4 To ensure that there is adequate time for the initial alignment, the first crew member on the flight deck should normally put the inertial system(s) into the align mode as soon as practicable.

GNSS (GPS) Systems

8.3.5 As with all LRNS operations, GPS LRNS operations must be approved by the State of the Operator (or the State of Registry for International General Aviation operations) as part of the MNPS operational approval. When both the LRNSs required for unrestricted MNPS operations are GPSs the approval of their operation will include the requirement to carry out Pre-Departure Satellite Navigation Prediction Programmes (as shown below). When only one of the two LRNSs required is a GPS, State Authorities vary as to whether they require their operators to conduct such pre-departure programmes.

Satellite Availability

- 8.3.6 Given suitable geometry:
- Four satellites are required to determine 3-D position;

- 8.3.7 For Receiver Autonomous Integrity Monitoring (RAIM) purposes:
- Five satellites are required to detect the presence of a single faulty satellite;
- 8.3.8 For Fault Detection and Exclusion (FDE) purposes:
- Six satellites are required to identify a faulty satellite and exclude it from participating in further navigation solution calculations. (Note that an FDE algorithm is normally associated with a RAIM algorithm).

Note: the above numbers of satellites (for RAIM and FDE purposes only) may in each case be reduced by one if barometric aiding is used.

Satellite Navigation Prediction

8.3.9 When so required, operators intending to conduct GPS navigation in MNPS Airspace must utilise a Satellite Navigation Availability Prediction Programme specifically designated for the GPS equipment installed. This prediction programme must be capable of predicting, prior to departure for flight on a "specified route"*, the following:

- a) Any loss of navigation coverage (meaning that less than 3 satellites will be in view to the receiver);
- and
- b) Any loss of the RAIM function and its duration.

***Note:** "specified route" is defined by a series of waypoints (to perhaps include the route to any required alternate), with the time between waypoints based on planned speeds. Since flight planned ground speeds and/or departure times may not be met, the pre-departure prediction must be performed for a range of expected ground speeds.

8.3.10 This prediction programme must use appropriate parameters from the RAIM algorithm employed by the installed GPS equipment. In order to perform the predictions this programme must provide the capability to manually designate satellites that are scheduled to be unavailable. Such information is not included in the GPS almanac or ephemeris data in the navigation message (i.e. the GPS receiver does not receive this information). Information on GPS satellite outages is promulgated via the U.S. NOTAM Office. The KNMH transmitting station (US Coast Guard Station, Washington D.C.) is responsible for release (in NOTAM format) of information relating to the operating condition of the GPS constellation satellites. These NOTAMs can be obtained through direct query to the USA data bank, via the AFTN, using the following service message format : SVC RQ INT LOC = KNMH addressed to KDZZNAXX. Such information can also be found on the US Coastguard Web site at <http://www.navcen.uscg.gov> ."

8.3.11 When GPS is being used as a supplementary navigation means or when GPS is only one of the two LRNSs required for MNPS approval (e.g. when the second LRNS is an IRS/INS installation) then some States of Registry may not require the operator to conduct pre-flight RAIM prediction checks.

Operational Control Restrictions

The Capability to determine a GPS position

8.3.12 Prior to departure, the operator must use the prediction programme to first demonstrate that forecast satellite outages will not result in a loss of navigation coverage (i.e. the capability to determine position) on any part of the specified route of flight. If such outages are detected by the programme, the flight will need to be re-routed, delayed or cancelled.

Determination of the Availability of RAIM

8.3.13 Once the position determination function is assured (i.e. no loss in navigation coverage for the route has been predicted), the operator must run the RAIM outage prediction programme. Any

continuous outage of RAIM capability of greater than 51 minutes in MNPS airspace means again that the flight should be re-routed, delayed or cancelled. It is understood that some prediction programmes carry out both these checks together.

Note - Derivation of the 51 minute limit – At the instant the RAIM capability is lost, it is assumed that the GPS navigation solution proceeds to direct the aircraft away from track at a speed of 35 knots. With the current MNPS track spacing of 60 nautical miles, it is further assumed that aircraft on adjacent tracks have a lateral “safety buffer” of 30 nautical miles. At 35 knots it will take an aircraft 51 minutes to exit this “safety buffer”. It should be noted that this is a very conservative methodology and it is thought unlikely that a RAIM outage alone could cause such errant navigation behaviour.

Loading of Initial Waypoints

8.3.14 The manual entry of waypoint data into the navigation systems must be a co-ordinated operation by two persons, working **in sequence and independently**: one should key in and insert the data, and subsequently the other should recall it and confirm it against source information. **It is not sufficient for one crew member just to observe or assist another crew member inserting the data.**

8.3.15 The ramp position of the aircraft, plus at least two additional waypoints, or, if the onboard equipment allows, all the waypoints relevant to the flight, should be loaded while the aircraft is at the ramp. However, it is more important initially to ensure that the first en route waypoint is inserted accurately.

Note - The vast majority of commercial air transport aircraft operating in MNPS airspace have an IRS/INS as part of their Long Range navigation fit. An increasing number of those with IRS/INS also have GPS and whilst GPS may then be considered the primary LRNS, these aircraft are still required to input the ramp position. This should then be compared with the GPS solution. For those few aircraft with GPS as the only LRNS, whilst there may be no need to actually load the ramp position, it is good airmanship and recommended operational practice to compare the published ramp position with the GPS-derived position. Without selective availability GPS should give a position within 30 metres of the published ramp position. If the GPS position is more than 100 metres from the published ground position, then the cause should be investigated. If sufficient satellites are in view the most likely causes are GPS receiver error, atmospheric interference, or, incorrect ramp co-ordinates.

8.3.16 During flight, at least two current waypoints beyond the leg being navigated should be maintained in the Control Display Units (CDUs) until the destination ramp co-ordinates are loaded. Two pilots should be responsible for loading, recalling and checking the accuracy of the inserted waypoints; one loading and the other subsequently recalling and checking them independently. However, this process should not be permitted to engage the attention of both pilots simultaneously during the flight. Where remote loading of the units is possible, this permits one pilot to cross-check that the data inserted automatically is indeed accurate.

8.3.17 An alternative and acceptable procedure is for the two pilots silently and independently to load their own initial waypoints and then cross-check them. The pilot responsible for carrying out the verification should work from the CDU display to the Master Document rather than in the opposite direction. This may lessen the risk of the pilot 'seeing what is expected to be seen' rather than what is actually displayed.

Flight Plan Check

8.3.18 The purpose of this check is to ensure complete compatibility between the data in the Master Document and the calculated output from the navigation systems. Typical actions could include:

- a) checking the distance from the ramp position to the first waypoint. Some systems will account for the track distance involved in an ATC SID; in others, an appropriate allowance for a SID may have to be made to the great circle distance indicated in order to match that in the Master Document. If there is significant disagreement, rechecking initial position and waypoint co-ordinates may be necessary.
- b) selecting track waypoint 1 to waypoint 2 and doing the following:
 - checking accuracy of the indicated distance against that in the Master Document;
 - checking, when data available, that the track displayed is as listed in the Master Document. (This check will show up any errors made in lat/long designators (i.e. N/S or E/W).)
- c) similar checks should be carried out for subsequent pairs of waypoints and any discrepancies between the Master Document and displayed data checked for possible waypoint insertion errors. These checks can be co-ordinated between the two pilots checking against the information in the Master Document.
- d) when each leg of the flight has been checked in this manner it should be annotated on the Master Document by means of a suitable symbology as previously suggested (See "The Use of a Master Document" above).
- e) some systems have integral navigation databases and it is essential that the recency of the database being used is known. It must be recognised that even the co-ordinates of waypoint positions contained in a data base have been keyed in at some point by another human. The possibility of input errors is always present. **Do not assume the infallibility of navigation databases and always maintain the same thorough principles which are applied in the checking of your own manual inputs.**

Leaving the Ramp

8.3.19 The aircraft must not be moved prior to the navigation mode being initiated, otherwise inertial navigation systems must be realigned. Prior to leaving the ramp Zero Ground Speed indications from the LRNS should be confirmed. Any excessive Ground Speeds noted while on chocks should be resolved by checking fault codes, the currency of data bases and RAIM (if GPS is employed).

8.3.20 After leaving the ramp, inertial groundspeeds should be checked (a significantly erroneous reading may indicate a faulty or less reliable inertial unit). A check should be made on any malfunction codes whilst the aircraft is stopped but after it has taxied at least part of the way to the take-off position; any significant ground-speed indications whilst stationary may indicate a faulty inertial unit such as a tilted platform. Prior to take-off, operators with an avionic fit which employs an electronic map display should confirm that the derived position indicates that the aircraft is at the start of the runway.

8.3.21 Many modern aircraft are equipped with FMS navigation systems (i.e. Flight Management Computers fed by multiple navigation sensors.). Once the FMS is put into 'Nav' mode, the system decides on the most appropriate (i.e. accurate) navigation sensors to use for position determination. If GPS is part of the solution, then the position is normally predominantly based on GPS inputs with the IRS/INS in a supporting role. It may therefore be difficult to know exactly what component of the navigation solution (IRS, GPS, DME etc) is being used to derive position at any one time. With an FMS-based system, or a GPS stand-alone system, the "Leaving the Ramp" checks should be designed to provide assurance that the navigation information presented is indeed 'sensible'.

8.4 IN FLIGHT PROCEDURES

Initial flight

8.4.1 It is recommended that during the initial part of the flight, ground nav aids should be used to verify the performance of the LRNSs. Large or unusual 'map shifts' in FMS output, or other discrepancies in navigation data, could be due to inertial platform misalignment or initialisation errors. Position updates to the FMS will not correct these errors despite possible indications to the contrary. If such a situation is encountered when INS/IRS are the primary LRNSs then it would be unwise to continue into NAT MNPS Airspace. Pilots should consider landing in order to investigate the cause and then perhaps be in a position to correct the problem.

8.4.2 It is recommended that a compass heading check be presented and the results recorded. This check is particularly helpful when using inertial systems. The check can also aid in determining the most accurate compass if a problem develops later in the crossing.

ATC Oceanic Clearance and subsequent Re-clearances

8.4.3 Where practicable, two flight crew members should listen to and record every ATC clearance and both agree that the recording is correct. Any doubt should be resolved by requesting clarification from ATC. In the event that a re-clearance is received when temporarily only one pilot is on the flight deck. Any flight profile, mach number or routing changes should not be executed, nor should the Navigation or Flight Management Systems be updated, until the second pilot has returned to the Flight Deck and a proper cross-checking and verification process can be undertaken.

8.4.4 If the ATC oceanic cleared route is identical to the flight planned track, it should be drawn on the plotting chart and verified by the other pilot.

8.4.5 If the aircraft is cleared by ATC on a different track from that flight planned, some regulators strongly recommend that a new Master Document be prepared showing the details of the cleared track. Overwriting of the existing flight plan can cause difficulties in reading the waypoint numbers and the new co-ordinates. For this purpose, it is helpful if a blank pro-forma Master Document (flight plan) is carried with the flight documents. One flight crew member should transcribe track and distance data from the appropriate reference source onto the new Master Document pro-forma and this should be checked by another crew member. If necessary, a new plotting chart may be used on which to draw the new track. The new document(s) should be used for the oceanic crossing. If the subsequent domestic portion of the flight corresponds to that contained in the original flight plan, it should be possible to revert to the original Master Document at the appropriate point.

8.4.6 Experience has clearly shown that when ATC issues an initial oceanic clearance that differs from the flight plan, or subsequently during the flight issues a re-clearance involving re-routing and new waypoints, there is a consequential increase in the risk of errors being made. Indeed errors associated with re-clearances continue to be the most frequent cause of Gross Navigation Errors in the North Atlantic MNPS Airspace. Therefore, in both of these circumstances the situation should be treated virtually as the start of a new flight and the procedures employed with respect to the following, should all be identical to those procedures employed at the beginning of a flight (see paragraph 8.3.18 above):

- a) copying the ATC re-clearance;
- b) amending the Master Document;
- c) loading and checking waypoints;
- d) extracting and verifying flight plan information, tracks and distances, etc.; and

- e) preparing a new plotting chart.

8.4.7 When reviewing the causes of navigation errors the NAT CMA has noted that numerous operator reports make reference to crew breaks in their explanation of the circumstances of the error. In all dimensions, errors are more likely to occur where a clearance or re-route, speed or level change has been communicated to a crew and either not been actioned completely, or has been incorrectly or incompletely processed before a relief crew member has started duty. Operators' SOPs are generally consistent in regard to the importance of properly handing over, and taking control, and if adopted with due diligence, would forestall the development of an error. However, human factors often confound the best laid SOPs, and distraction or human failings can contribute to the omission of all, or a part of, the process handed over by the departed crew member for subsequent action. Flights requiring crew augmentation, particularly, ultra-long-haul flights present specific issues as regards to crew relief. With the requirement to have the aircraft commander and the designated co-pilot on duty for critical stages of the flight i.e.: take off and landing, sometimes crew changes then occur during times when critical information is being received such as oceanic clearances or conditional clearances and/or company communications such as re-dispatch etc. It is imperative that during these crew changes, a thorough turnover briefing takes place so that the incoming crew is aware of all clearances and requirements for the segment of the flight, especially those involving conditional re-clearances such as a change of level at specific points or times.

8.4.8 Strict adherence to all the above procedures should minimise the risk of error. However, flight deck management should be such that one pilot is designated to be responsible for flying the aircraft whilst the other pilot carries out any required amendments to documentation and reprogramming of the navigation systems - appropriately monitored by the pilot flying the aircraft, as and when necessary.

Approaching the Ocean

8.4.9 Prior to entering MNPS Airspace, the accuracy of the LRNSs should be thoroughly checked, if necessary by using independent navigation aids. For example, INS position can be checked by reference to en route or proximate VOR/DMEs, etc. However, with a modern FMS, the system decides which LRNS is to be used, and indeed, the FMS may be taking information from DMEs (and possibly VORs) as well as the LRNS carried. Nevertheless, in spite of all this modern technology and even if the FMS is using GPS, it is still worthwhile to carry out a 'reasonableness' check of the FMS/GPS position, using (for example) DME/VOR distance and bearing.

8.4.10 When appropriate and possible, the navigation system which, in the opinion of the pilot, has performed most accurately since departure should be selected for automatic navigation steering.

8.4.11 In view of the importance of following the correct track in oceanic airspace, it is advisable at this stage of flight that, if carried, a third pilot or equivalent crew member should check the clearance waypoints which have been inserted into the navigation system, using source information such as the track message or data link clearance if applicable.

Entering the MNPS Airspace and Reaching an Oceanic Waypoint

8.4.12 When passing waypoints, the following checks should be carried out:

- a) just prior to the waypoint, check the present position co-ordinates of each navigation system against the cleared route in the Master Document, and
- b) check the next two waypoints in each navigation system against the Master Document.
- c) at the waypoint, check the distance to the next waypoint, confirm that the aircraft turns in the correct direction and takes up a new heading and track appropriate to the leg to the next waypoint.

- d) before transmitting the position report to ATC, verify the waypoint co-ordinates against the Master Document and those in the steering navigation system. When feasible the position report “next” and “next plus 1” waypoint co-ordinates should be read from the CDU of the navigation system coupled to the autopilot.

8.4.13 Even if automatic waypoint position reporting via data link (e.g. ADS-C, CPDLC or FMC WPR) is being used to provide position reports to ATC the above checks should still be performed.

8.4.14 The crew should be prepared for possible ATC follow-up to the position report.

8.4.15 Crews should also be aware that trials are underway in the NAT Region of ADS-C conformance monitoring. ATC may establish event contracts that will result in automatic alerts whenever the aircraft diverges from its cleared profile. Unless previously advised by the pilot of the need for such a divergence, crews should expect ATC to query the situation. Standardised CPDLC alert messages have been developed for use here.

Routine Monitoring

8.4.16 It is important to remember that there are a number of ways in which the autopilot may unobtrusively become disconnected from the steering mode. Therefore, regular checks of correct engagement with the navigation system should be made.

8.4.17 It is recommended that where possible the navigation system coupled to the autopilot should display the present position co-ordinates throughout the flight. If these are then plotted as suggested above, they will provide confirmation that the aircraft is tracking in accordance with its ATC clearance. Distance to go information should be available on the instrument panel, whilst a waypoint alert light, where fitted, provides a reminder of the aircraft’s imminent arrival over the next waypoint.

8.4.18 A position check should be made at each waypoint and the present position plotted 10 minutes after passing each waypoint. For a generally east-west flight, this 10 minute point will be approximately 2 degrees of longitude beyond the oceanic waypoint. It may therefore in fact be simpler to plot a present position 2 degrees of longitude after each 10 degree waypoint. There may be circumstances, (e.g. when, due to equipment failure, only one LRNS remains serviceable) in which additional plots midway between each waypoint may be justified.

8.4.19 It is good practice to cross check winds midway between oceanic waypoints by comparing the flight plan, LRNS and upper millibar wind charts data. Such a cross check will also aid crews in case there is a subsequent need for a contingency requiring the use of Dead Reckoning.

8.4.20 The navigation system not being used to steer the aircraft should display cross-track distance and track angle error. Both of these should be monitored, with cross-track distance being displayed on the HSI where feasible.

Approaching Landfall

8.4.21 When the aircraft is within range of land based nav aids, and the crew is confident that these nav aids are providing reliable navigation information, consideration should be given to updating the LRNSs. Automatic updating of the LRNSs from other nav aids should be closely monitored, and before entry into airspace where different navigation requirements have been specified (e.g. RNP5 in European BRNAV airspace), crews should use all aids (including VORs and DMEs) to confirm that the in-use navigation system is operating to the required accuracy. If there is any doubt regarding system accuracy, the appropriate ATC unit should be informed.

8.5 SPECIAL IN-FLIGHT PROCEDURES

Strategic Lateral Offset Procedures (SLOP)

8.5.1 ATC clearances are designed to ensure that separation standards are continually maintained for all traffic. However, the chain of clearance definition, delivery and execution involves a series of technical system processes and human actions. Errors are very rare but they do occur. Neither pilots nor controllers are infallible. Gross Navigation Errors (usually involving whole latitude degree mistakes in route waypoints) are made, and aircraft are sometimes flown at flight levels other than those expected by the controller. When such errors are made, ironically, the extreme accuracies of modern navigation and height keeping systems themselves increase the risk of an actual collision. Within an SSR environment the controller is alerted to such errors and can, using VHF voice communications, intervene in a timely fashion. This is not the case in Oceanic airspace, such as the North Atlantic, where the controller's awareness of the disposition of a significant proportion of the traffic is reliant largely upon pilot position reports through communication links utilising HF or SATCOM Voice via third party radio operators. And furthermore, even among that proportion of traffic utilising datalink for automated position reporting, and perhaps ATS communications, navigation errors continue to occur. Consequently, it has been determined that allowing aircraft conducting oceanic flight to fly self-selected lateral offsets will provide an additional safety margin and mitigate the risk of traffic conflict when non-normal events such as aircraft navigation errors, height deviation errors and turbulence induced altitude-keeping errors do occur. Collision risk is significantly reduced by application of these offsets. These procedures are known as "Strategic Lateral Offset Procedures (SLOP)".

8.5.2 This procedure provides for offsets within the following guidelines:

- a) along a route or track there will be three positions that an aircraft may fly: centreline or one or two miles right;
- b) offsets will not exceed 2 NM right of centreline; and
- c) offsets **left** of centreline **must not be made**.

8.5.3 Distributing aircraft laterally and equally across the three available positions adds an additional safety margin and reduces collision risk. This is now a **standard operating procedure** for the entire NAT Region and pilots **are required** to adopt this procedure as is appropriate. In this connection, it should be noted that:

- a) Aircraft without automatic offset programming capability must fly the centreline.
- b) It is recommended that pilots of aircraft capable of programming automatic offsets elect to fly an offset one or two nautical miles to the right of the centre line in order to obtain lateral spacing from nearby aircraft (ie those immediately above and/or below). Pilots should use whatever means are available (e.g. TCAS, communications, visual acquisition, GPWS) to determine the best flight path to fly.
- c) An aircraft overtaking another aircraft should offset within the confines of this procedure, if capable, so as to create the least amount of wake turbulence for the aircraft being overtaken.
- d) For wake turbulence purposes, pilots should fly one of the three positions shown above. Pilots should not offset to the left of centreline nor offset more than 2 NM right of centreline. Pilots may contact other aircraft on the air-to-air channel, 123.45 MHz, as necessary; to co-ordinate the best wake turbulence mutual offset option. (*Note. It is recognised that the pilot will use his/her judgement to determine the action most appropriate to any given situation and that the pilot has the final authority and responsibility for the safe operations of the*

aeroplane. See also Chapter 12, paragraph 12.5.) As indicated below, contact with ATC is not required.

- e) Pilots may apply an offset outbound at the oceanic entry point and must return to centreline prior to the oceanic exit point.
- f) Aircraft transiting ATS Surveillance-controlled airspace mid-ocean should remain on their already established offset positions.
- g) There is no ATC clearance required for this procedure and it is not necessary that ATC be advised.
- h) Voice Position reports should be based on the waypoints of the current ATC clearance and not the offset positions.

8.5.4 SLOP has been implemented as a standard operating procedure in the NAT Region since 2004. An indication of the proportion of pilots adopting a SLOP offset here is obtained through study of ADS-C position reports. Such study has shown that during 2009 most aircraft flying an offset in the NAT Region selected the 1NM Right option. Only a few chose the 2NM Right option. As indicated above, system safety would be further enhanced if offsetting aircraft were more evenly distributed between the centre-line, 1 and 2 NM Right options. As proposed in Paragraph 8.5.3 b) above, Pilots should attempt to determine the offsets (if any) being flown by aircraft immediately ahead on the same track one flight level above and one flight level below. And then select an offset which differs from those. If this is not possible or practical, then pilots should randomly choose one of the three flight path options.

8.5.5 The previously mentioned study of ADS-C position reports has also shown that some aircraft continue to adopt an offset LEFT of cleared track centre-line. The standard SLOP procedures are designed to provide safety enhancements for both uni-directional and bi-directional flows. On bi-directional routes a LEFT offset will INCREASE collision risk rather than decrease it. There are areas in the NAT Region where bi-directional traffic flows are routinely used. And there are times when opposite direction traffic may be encountered in any part of the Region. Pilots must therefore recognise that **LEFT offsets from the cleared track centre-line must not be adopted**. After the introduction of RVSM and before the adoption of SLOP, a NAT offsetting procedure was promulgated for wake-turbulence avoidance. This procedure allowed both right and left offsets to be flown. The procedure was developed primarily with a view to the unique traffic flows of the NAT OTS, where uni-directional traffic occupied every flight level from FL310 to FL390. That procedure is no longer in place. The avoidance of wake turbulence (even in the OTS) can be accomplished effectively within the confines of the SLOP procedures, as specified in paragraph 8.5.3 d) above. Pilots should communicate with the other aircraft involved to co-ordinate a pair of mutual offsets from within the allowed three options, in order to mitigate any wake-turbulence issue.

Monitoring during Distractions from Routine

8.5.6 Training and drills should ensure that minor emergencies or interruptions to normal routine are not allowed to distract the crew to the extent that the navigation system is mishandled.

8.5.7 If during flight the autopilot is disconnected (e.g. because of turbulence), care must be taken when the navigation steering is re-engaged to ensure that the correct procedure is followed. If the system in use sets specific limits on automatic capture, the across-track indications should be monitored to ensure proper recapture of the programmed flight path/profile.

8.5.8 Where crews have set low angles of bank, perhaps 10° or less, say for passenger comfort considerations, it is essential to be particularly alert to possible imperceptible departures from cleared track.

Avoiding Confusion between Magnetic and True Track Reference

8.5.9 To cover all navigation requirements, some operators produce flight plans giving both magnetic and true tracks. However, especially if crews are changing to a new system, there is a risk that at some stage (e.g. during partial system failure, re-clearances, etc.), confusion may arise in selecting the correct values. Operators should therefore devise procedures which will reduce this risk, as well as ensuring that the subject is covered during training.

8.5.10 Crews who decide to check or update their LRNSs by reference to VORs should remember that in the Canadian Northern Domestic Airspace these may be oriented with reference to true north, rather than magnetic north.

Navigation in the Area of Compass Unreliability

8.5.11 As aircraft move towards the Earth's North magnetic pole the horizontal field strength reduces and the ability of the compass to accurately sense magnetic North is reduced. It is generally recognised that when the horizontal magnetic field strength falls below 6000 nanotesla, the magnetic compass can no longer be considered to be reliable. Moreover, when the horizontal magnetic field strength falls below 3000 nanotesla, the magnetic compass is considered to be unuseable. Within MNPS airspace the North West of Greenland is an area of Compass Unreliability and adjoining areas of Canadian airspace include areas where the magnetic Compass is unuseable. En route charts for the North Atlantic and North Polar areas show the areas where the compass is either unreliable or unuseable.

8.5.12 In areas where the compass is unreliable or unuseable, basic inertial navigation requires no special procedures. Different manufacturers may offer their own solutions to the special problems existing in such areas. However, such solutions should not involve the use of charts and manual measurement of direction.

8.5.13 Furthermore, Operators/Pilots are reminded that before operating in an area of Compass Unreliability they are responsible for checking with their State Authorities whether specific regulatory approval or training is required.

Deliberate Deviation from Track

8.5.14 Deliberate temporary deviations from track are sometimes necessary, usually to avoid severe weather; whenever possible, prior ATC approval should be obtained (See paragraph 12.4). Such deviations have often been the source of gross errors as a consequence of failing to re-engage the autopilot with the navigation system. It should also be noted that selection of the 'turbulence' mode of the autopilot on some aircraft may have the effect of disengaging it from the aircraft navigation system. After use of the turbulence mode, extra care should be taken to ensure that the desired track is recaptured by the steering navigation system.

8.6 POST-FLIGHT PROCEDURES

Inertial Navigation System Accuracy Check

8.6.1 At the end of each flight, an evaluation of accuracy of the aircraft's navigation systems should be carried out. Equipment operating manuals specify maxima for radial errors before a system is considered to be unserviceable. For early gimbaled-platform inertial systems these are in the order of 2 NM per hour. One method used to determine radial error is to input the shutdown ramp position; in other systems error messages are output giving differences between raw inertial reference positions and computed radio

navigation updated positions. Whatever method is used, a record should be kept of the performance of each INS.

8.7 HORIZONTAL NAVIGATION PERFORMANCE MONITORING

8.7.1 The navigation performance of operators within NAT MNPS Airspace is monitored on a continual basis. The navigation accuracy achieved by NAT MNPS aircraft is periodically measured and additionally all identified instances of significant deviation from cleared track are subject to thorough investigation by the NAT Central Monitoring Agency (CMA), currently operated on behalf of ICAO by the UK National Air Traffic Services Limited.

8.7.2 Pilots and operators are encouraged to cooperate as fully as possible with the CMA in its investigations of any deviations, since the objective here is to support regional safety management function. These investigations are not conducted for regulatory/punitive purposes.

8.7.3 The CMA also maintains a data base of all NAT MNPS Approvals. The CMA runs a continuous monitoring process to compare this Approvals list with the records of all aircraft flying in the NAT MNPS Airspace. The Approval status of any aircraft involved in a track deviation is specifically checked against the data base and in any cases of doubt the State of the operator or the State of Registry is contacted. Chapter 10 provides full details of the monitoring processes.

CHAPTER 9: RVSM FLIGHT IN MNPS AIRSPACE

9.1 GENERAL

9.1.1 The aircraft altimetry and height keeping systems necessary for flying in RVSM airspace are capable of high-performance standards. However it is essential that stringent operating procedures are employed, both to ensure that these systems perform to their full capabilities and also to minimise the consequences of equipment failures and possible human errors.

9.1.2 As is the case with lateral navigation systems, technical failures of altimetry and/or height keeping systems are extremely rare within the NAT MNPSA. However, less rare in the NAT MNPSA are situations in which an aircraft is flown at a level other than that cleared by ATC. ATC Loop Errors, when there is a misunderstanding or miscommunication between ATC and the pilot over the actual cleared level, unfortunately do occur. In an SSR environment ATC are alerted immediately when aircraft departs from the cleared level. Furthermore with Direct Controller Pilot Communications (DCPC) the controller can instantly intervene to resolve the situation and/or to provide potential conflict warnings to other traffic. In the NAT MNPSA SSR coverage is very limited and regular air/ground ATC Voice communications are usually conducted via a third party radio operator.

9.1.3 Severe turbulence in the NAT MNPSA is uncommon but mountain waves in the vicinity of Greenland and clear air turbulence associated with jet streams are not unknown. Aircraft encountering such conditions can inadvertently depart from their cleared levels or the pilot may elect to change level to avoid the effects of the turbulence. Other circumstances also occur in which the pilot will be forced to change level, before an appropriate ATC re-clearance can be obtained, e.g. power or pressurisation failure, freezing fuel, etc. Again, without surveillance or DCPC, there can be a significant lag between the aircraft's departure from its cleared level and any possible action from the controller to provide separation from any other potentially conflicting traffic.

9.1.4 It must be appreciated that the NAT MNPSA is the busiest oceanic airspace in the world. Furthermore, NAT traffic is comprised of a very wide range of aircraft types, flying a wide range of sector lengths and carrying a significant range of loads. As a result, optimum flight levels vary over the whole jet cruising range and nearly all the flight levels of the core tracks of the OTS, during peak hours, are fully occupied. Also, the Mach Numbers flown can vary significantly (e.g. typically between M0.78 and M0.86), resulting in up to 20 mins variation in NAT transit times. Given that the nominal longitudinal separation standard employed in the NAT MNPSA is 10 mins, one consequence of the foregoing is that it is rare for any NAT OTS flight to transit the NAT without overtaking, or being overtaken, by another aircraft at an adjacent level on the same track. It will therefore be seen that an on-track departure from cleared level in the NAT MNPSA will involve a significant risk of conflicting with other traffic. Furthermore, given the extreme accuracy of lateral track-keeping provided by modern LRNSs (e.g. GPS) such conflict risk can translate to a collision risk. **It is primarily with this in mind that the Strategic Lateral Offset Procedures** (see "Strategic Lateral Offset Procedures (SLOP)" above in Chapter 8 **have been established as a standard operating procedure in the NAT Region.**

Pre-Flight

9.1.5 For flight through the NAT MNPS Airspace the aircraft and the operator must have the appropriate State Approvals for both MNPS and RVSM operations. The crew must be qualified for flight in RVSM airspace and all aircraft intending to operate within NAT MNPS Airspace must be equipped with altimetry and height-keeping systems which meet RVSM Minimum Aircraft System Performance Specifications (MASPS). RVSM MASPS are contained in ICAO Doc 9574 (Manual on Implementation of a

300m (1 000ft) Vertical Separation Minimum between FL290 and FL410 inclusive.) and detailed in designated FAA document, AC91-85, and in *JAA document, TGL6, Revision 1* (i.e. *Temporary Guidance Leaflet No. 6*) (these documents can be accessed via:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/rvsm/
and <http://www.ecacnav.com/rvsm/library.htm> respectively).

9.1.6 The Minimum Equipment List (MEL) for RVSM operations must be strictly observed

9.1.7 A 'W' must be entered into Item 10 of the ICAO flight plan to indicate that the aircraft is approved for flight at RVSM levels; the letter 'X' must still be included to show that the aircraft satisfies MNPS lateral navigation performance requirements.

Note: With effect from 5 June 2008 the previous West Atlantic Route System (WATRS) together with the Atlantic portion of Miami Oceanic Airspace and the San Juan FIR has been designated "WATRS Plus Airspace". RNP-10 or RNP-4 Approval is required in order to benefit from the 50 NM minimum lateral separation employed here. Any MNPSA Aircraft intending to also fly in this WATRS Plus airspace should ensure that its RNP Approval status is included in the Flight Plan. Specifically such operators should:

- i) *annotate ICAO Flight Plan Item 10 (Equipment) with the letters "R" and "Z", and*
- ii) *annotate Item 18 (Other Information) with, as appropriate, "NAV/RNP10" or "NAV/RNP4" (no spaces).*

Full details can be found at

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/.

9.1.8 Most flights through the NAT MNPSA enter via European and/or North American RVSM airspace. These flights will have been required to perform standard pre-flight checks of altimeters for their initial operations in those continental RVSM areas. Other flights departing directly into the NAT Region should ensure that such checks are made.

9.1.9 Special arrangements exist for non-RVSM approved aircraft/operators to climb or descend through NAT RVSM airspace; and in very specific circumstances arrangements may be made for non-approved aircraft to fly at RVSM levels in the NAT Region. Both such arrangements are explained above in Chapter 1 (See Special Arrangements for Non-RVSM Approved Aircraft – paragraph 1.6).

In-Flight - Before Operating in MNPS Airspace

9.1.10 Most flights will approach the MNPSA through European or North American RVSM airspaces. It is therefore expected that continuous monitoring of the serviceability of the aircraft's height keeping systems will have been undertaken. Nevertheless, in view of the significant change of operating environment (i.e. to indirect surveillance and communications) it is recommended that a final confirmation of the aircraft systems serviceability is performed immediately prior to entering the NAT MNPSA. An altimeter cross check should be carried out; **at least two primary altimeters must agree within plus or minus 200 ft.** The readings of the primary and standby altimeters should be recorded to be available for use in any possible subsequent contingency situations.

In-Flight – Entering and Flying in MNPS Airspace

9.1.11 One automatic altitude-control system should be operative and engaged throughout the cruise. This system should only be disengaged when it is necessary to retrim the aircraft, or when the aircraft encounters turbulence and operating procedures dictate.

9.1.12 When passing waypoints, or at intervals not exceeding 60 minutes (whichever occurs earlier), or on reaching a new cleared flight level, a cross-check of primary altimeters should be conducted. **If at any time the readings of the two primary altimeters differ by more than 200 ft, the aircraft's altimetry system should be considered defective and ATC must be informed as soon as possible.**

9.1.13 To prevent unwanted TCAS/ACAS warnings or alerts, when first approaching any cleared flight level in NAT RVSM airspace, pilots should ensure that the vertical closure speed is not excessive. It is considered that, with about 1500 ft to go to a cleared flight level, vertical speed should be reduced to a maximum of 1500 ft per minute and ideally, to between 1000 ft per minute and 500 ft per minute. Additionally, it is important to ensure that the aeroplane neither undershoots nor overshoots the cleared level by more than 150 ft, manually overriding if necessary.

9.1.14 Abnormal operational circumstances (e.g. engine failures, pressurisation problems, freezing fuel, turbulence, etc.), sometimes require a pilot to change level prior to obtaining a re-clearance from ATC. Such a timely re-clearance is more difficult to obtain in oceanic or remote areas where DCPC are not necessarily available. This is indeed the case in NAT MNPS Airspace, in which the majority of ATS communications are conducted indirectly through a third party radio operator, utilising HF, SATCOM Voice or GP/VHF facilities. As previously indicated, extreme caution and vigilance should be exercised when executing any such (uncleared) level changes, as the potential collision risk (particularly in the OTS) is significant.

9.1.15 It must also be recognised that even under normal operations when using such indirect communication methods, there does exist the potential for misunderstanding between pilot and controller regarding the detail of any issued clearances or re-clearances. Occasionally, such “ATC Loop Errors” can lead to an aircraft being flown at a level other than that expected by the controller. In such circumstances separation safety margins may be eroded. To avoid possible risks from any of the foregoing situations, it is therefore essential in NAT MNPS Airspace that **pilots always report to ATC immediately on leaving the current cruising level and on reaching any new cruising level.**

9.1.16 The Strategic Lateral Offset Procedures (SLOP) described in Chapter 8, paragraph 8.5, have been established as a standard operating procedure in the NAT Region to assist in mitigating the potential risks of any of the foregoing height deviations or errors.

9.2 EQUIPMENT FAILURES

9.2.1 The following equipment failures must be reported to ATC as soon as practicable following their identification:

- a) loss of one or more primary altimetry systems; or
- b) failure of all automatic altitude-control systems

9.2.2 The aircraft should then follow the appropriate procedure described in Chapter 12 - “Special Procedures for In-Flight Contingencies”, or as instructed by the controlling ATC unit.

9.3 VERTICAL NAVIGATION PERFORMANCE MONITORING

9.3.1 The vertical navigation performance of operators within NAT MNPS Airspace is monitored on a continual basis by the NAT CMA. Such monitoring includes both measurement of the technical height-keeping accuracy of RVSM approved aircraft and assessment of collision risk associated with all reported operational deviations from cleared levels. Chapter 10 deals more fully with this matter.

CHAPTER 10: MONITORING OF AIRCRAFT SYSTEMS AND CREW PERFORMANCE

10.1 The Monitoring Process

10.1.1 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.

10.1.2 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.

10.1.3 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.

10.2 Monitoring of Horizontal Navigation Capability

Monitoring by the Operators

10.2.1 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, via ADS reports 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.**

10.2.2 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 Flight Management System, IRS or INS 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 matters concerning 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) detailed records of any contingency manoeuvres/procedures undertaken by the pilot;
- g) 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; details of any manual updates made to IRS/INS units; and
- h) where available, navigational and performance data contained in the aircraft's flight data recorders.

10.2.3 It is also important that any forms which are used make it easy to examine key factors. For instance, 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."

Monitoring of the Operator by the State

10.2.4 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.

Direct Action by ATS Provider States and the NAT CMA in the Monitoring Process

10.2.5 The navigation performance of operators within NAT MNPS Airspace is monitored on a continual basis. The navigation accuracy achieved by NAT MNPS aircraft is periodically measured and additionally all identified instances of significant deviation from cleared track are subject to thorough investigation by the NAT Central Monitoring Agency (CMA), currently operated on behalf of ICAO by the UK National Air Traffic Services Limited. The CMA also maintains a data base of all NAT MNPS Approvals. The CMA runs a continuous monitoring process to compare this Approvals list with the records of all aircraft flying in the NAT MNPS Airspace. The Approval status of any aircraft involved in a track deviation is specifically checked against the data base and in any cases of doubt the State of Registry is contacted.

10.2.6 When a navigation error is identified, follow-up action after flight is taken, both with the operator and, where the deviation is 25 NM or more (i.e. a GNE), the State of operator or State of Registry of the aircraft involved, to establish the circumstances and contributory factors. The format of the (navigation) Error Investigation Form used for follow-up action is as shown at Attachment 1. Operational errors can have a significant effect on the assessment of risk in the system. For their safety and the safety of other users, crews are reminded of the importance of co-operating with the reporting OAC in the provision of incident information.

10.2.7 The overall lateral navigation performance of all aircraft in the MNPS Airspace is continually assessed and compared to the standards established for the Region, to ensure that the TLS is being maintained.

Monitoring of Gross Navigation Errors

10.2.8 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.

10.2.9 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 less than 25 NM as required.

10.2.10 When a GNE or lateral deviation of less than 25NM 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 such reports of GNEs and other lateral deviations. 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.

10.3 Monitoring of Height-Keeping Performance

10.3.1 The vertical navigation performance of operators within NAT MNPS Airspace is monitored on a continual basis by the NAT CMA. Such monitoring includes both measurement of the technical height-keeping accuracy of RVSM approved aircraft and assessment of collision risk associated with all reported operational deviations from cleared levels.

10.3.2 All identified operational situations or errors which lead to aircraft deviating from ATC cleared levels are subject to thorough investigation. Follow-up action after flight is taken with the operator of the aircraft involved, to establish the reason for the deviation or cause of the error and to confirm the approval of the flight to operate in NAT MNPS and RVSM Airspace. Operational errors, particularly those in the vertical plane, can have a significant effect on risk in the system. For their safety and the safety of other users, crews are reminded of the importance of co-operating with the reporting OAC in the compilation of appropriate documentation including the completion of an 'Altitude Deviation Report Form', as illustrated at Attachment 2.

10.3.3 The detailed circumstances of all operational errors, both in the vertical and horizontal planes, are thoroughly reviewed by the CMA, together with the Scrutiny Group of the NAT SPG, which includes current NAT pilots and controllers. Any lessons learned from this review, which may help to limit the possibility of recurrences of such errors, are communicated back to NAT operators and ATS authorities. The intent is to improve standard operating procedures, thereby reducing the future frequency of operational errors and thus contribute to the safety of the overall system.

10.3.4 At RVSM levels, moderate and severe turbulence may also increase the level of system risk and crews should report **ALL** occasions, whilst flying in MNPS Airspace, whenever a vertical deviation of 300 ft or more occurs. The form at Attachment 2 may also be used for this purpose.

10.3.5 The technical height-keeping accuracy of aircraft flying at RVSM levels is passively monitored during flight over a Height Monitoring Unit (HMU) located near to Strumble in Wales. Alternatively, individual aircraft can be monitored through temporary carriage of portable GPS (Height) Monitoring Units (GMUs). Furthermore, height monitoring data is available to the NAT CMA from the 3 European HMUs. This monitoring allows the height-keeping accuracies of aircraft types and individual operator's fleets to be assessed. Individual airframes which do not meet required performance standards can also be identified. On such occasions the operator and the State of Registry are advised of the problem and corrective action must be undertaken before further flights in RVSM airspace are conducted.

10.3.6 The overall vertical navigation performance of all aircraft in NAT RVSM airspace is continually assessed and compared to the standards established for the Region, to assess whether the relevant TLS is being maintained.

Monitoring of Operational Height-keeping Performance

10.3.7 The introduction of RVSM Airspace into the NAT Region has increased the necessity for consistent and accurate reporting by pilots and ATC units, of all deviations of 90 m (300 ft) or more from the cleared flight level, whatever the cause.

Monitoring of Technical Height-keeping Performance

10.3.8 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, originally employing two height monitoring units (HMU) at Strumble (United Kingdom) and Gander (Canada), along with a number of portable GPS monitoring units (GMU). The Gander unit was subsequently decommissioned. 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. Revised Minimum Monitoring Requirements for RVSM Approval, as specified in ICAO Annex 6, will become effective in November 2010.

10.4 Monitoring of ACAS II Performance

10.4.1 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.

10.4.2 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.

10.5 Overall Navigation (and Systems) Performance

10.5.1 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.

10.5.2 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.

10.6 Tactical Monitoring of MNPS and RVSM Approvals

10.6.1 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 a clearance to operate outside MNPS/RVSM Airspace and a report is forwarded to the CMA for follow-up action.

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

Background

10.7.1 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.

10.7.2 In the early 1990s, as a consequence of the planned implementation of RVSM in NAT MNPS Airspace, the NAT CMA acquired 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, in conjunction with other Regional Monitoring Agencies, for setting the target monitoring requirements for the RVSM approval process.

Responsibilities

10.7.3 The CMA is operated on behalf of the NAT SPG by United Kingdom National Air Traffic Services Limited (NATS) and is responsible for the collection, analysis 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 regular summaries of operational performance to promote awareness of NAT system safety, and with any other pertinent information. The CMA is responsible for informing NAT ATS Provider States on safety issues, either directly or through the NAT SPG organisational mechanism.

Follow-up Action on Observed and Reported GNEs

10.7.4 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.

10.7.5 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.. 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.

10.7.6 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 operator or State of Registry.

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

10.7.7 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

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

10.7.9 For monitoring technical height-keeping accuracy, a hybrid system comprising a Height Monitoring Unit (HMU) and GPS Monitoring Systems (GMSs) is employed. The HMU is located near Strumble (in the 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.

10.7.10 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 (300 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) when receiving reports from ATS Provider units of height deviations of 90 m (300 ft) or more resulting from turbulence, TCAS manoeuvres or contingency action.

10.7.11 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

10.7.12 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) lateral deviations from cleared route of less than 25NM
- d) discrepancies of 5 minutes or more between an ETA/ATA at a waypoint; and
- e) occasions when an Operator is suspected of not being in possession of an MNPS/RVSM approval.

CHAPTER 11: PROCEDURES IN THE EVENT OF NAVIGATION SYSTEM DEGRADATION OR FAILURE

11.1 GENERAL

11.1.1 The navigation systems fitted to MNPS approved aircraft are generally very accurate and very reliable and GNEs as a result of system technical failures are rare in NAT MNPS Airspace. Nevertheless, the risks that such errors pose can be significant and crews must employ rigorous procedures to ensure early detection of any possible errors and hence mitigation of the ensuing risk. The NAT CMA thoroughly investigates the circumstances of all reported GNEs in the MNPS Airspace. The majority are the result of human error, and diligent application by crews of operating procedures such as those described in Chapter 8 should help to minimise the frequency of such errors. As previously stated, actual failures of navigation systems or equipment in MNPS approved aircraft occur very rarely. However, when they do occur, their potential effects on the aircraft's navigation capability can be subtle or progressive, resulting in a gradual and perhaps not immediately discernible degradation of performance. 'Vigilance' must be the watchword when navigating in NAT MNPS Airspace. 'Complacency' has no place here.

11.1.2 For unrestricted operation in MNPS Airspace an approved aircraft must be equipped with a minimum of **two fully serviceable** LRNSs. MNPS approved aircraft which have suffered any equipment failures prior to NAT entry that result in only a single LRNS remaining serviceable may still be flight planned and flown through the MNPS Airspace but only on specified routes established for this purpose. Aircraft may be approved for NAT MNPS operations with only a single LRNS. However, such aircraft are only permitted to plan and fly on these same specified routes and on certain other routes serving individual traffic axes e.g. the Tango Routes, Routes between the Iberian Peninsular and the Azores/Madeira and Routes between Iceland and Greenland (See Chapter 3 of this Manual).

11.1.3 If after take-off, abnormal navigation indications relating to INS or IRS systems occur, they should be analysed to discover their cause. Unless the flight can proceed safely using alternative approved navigation sources only, the pilot should consider landing at the nearest appropriate airfield to allow the problem to be fully investigated, using technical assistance if necessary. Under no circumstances should a flight continue into oceanic (MNPS) Airspace with unresolved navigation system errors, or with errors which have been established to have been caused by inertial platform misalignment or initial data input error.

11.1.4 Crew training and consequent approval for MNPS operations should include instruction on what actions are to be considered in the event of navigation system failures. This Chapter provides guidance on the detection of failures and what crew action should be considered, together with details of the routes that may be used when the aircraft's navigation capability is degraded below that required for unrestricted operations in NAT MNPS Airspace.

Detection of Failures

11.1.5 Normally, navigation installations include comparator and/or warning devices, but it is still necessary for the crew to make frequent comparison checks. When an aircraft is fitted with three independent systems, the identification of a defective system should be straightforward.

Methods of Determining which System is Faulty

11.1.6 With only two systems on board, identifying the defective unit can be difficult. If such a situation does arise in oceanic airspace any or all of the following actions should be considered:

- a) checking malfunction codes for indication of unserviceability
- b) obtaining a fix. It may be possible to use the following:
 - the weather radar (range marks and relative bearing lines) to determine the position relative to an identifiable landmark such as an island; or
 - the ADF to obtain bearings from a suitable long-range NDB, in which case magnetic variation at the position of the aircraft should be used to convert the RMI bearings to true; or
 - if within range, a VOR, in which case the magnetic variation at the VOR location should be used to convert the radial to a true bearing (except when flying in the Canadian Northern Domestic Airspace where VOR bearings may be oriented with reference to true as opposed to magnetic north).
- c) contacting a nearby aircraft on VHF, and comparing information on spot wind, or ground speed and drift.
- d) if such assistance is not available, and as a last resort, the flight plan wind speed and direction for the current DR position of the aircraft, can be compared with that from navigation system outputs.

Action if the Faulty System Cannot be Identified

11.1.7 Occasions may still arise when distance or cross track differences develop between systems, but the crew cannot determine which system is at fault. The majority of operators feel that the procedure most likely to limit gross tracking errors under such circumstances is to fly the aircraft half way between the cross track differences as long as the uncertainty exists. In such instances, ATC should be advised that the flight is experiencing navigation difficulties so that appropriate separation can be effected if necessary.

Guidance on What Constitutes a Failed System

11.1.8 Operations or navigation manuals should include guidelines on how to decide when a navigation system should be considered to have failed, e.g. failures may be indicated by a red warning light, or by self diagnosis indications, or by an error over a known position exceeding the value agreed between an operator and its certifying authority. As a generalisation, if there is a difference greater than 15 NM between two aircraft navigation systems (or between the three systems if it is not possible to detect which are the most reliable) it is advisable to split the difference between the readings when determining the aircraft's position. However, if the disparity exceeds 25 NM one or more of the navigation systems should be regarded as having failed, in which case ATC should be notified.

Inertial System Failures

11.1.9 INSs have proved to be highly accurate and very reliable in service. Manufacturers claim a drift rate of less than 2 NM per hour; however in practice IRSs with laser gyros are proving to be capable of maintaining accuracy to better than 1NM per hour. This in itself can lead to complacency, although failures do still occur. Close monitoring of divergence of output between individual systems is essential if errors are to be avoided and faulty units identified.

GPS Failures

11.1.10 If the GPS displays a “loss of navigation function alert”, the pilot should immediately revert to other available means of navigation, including DR procedures if necessary, until GPS navigation is regained. The pilot must report the degraded navigation capability to ATC.

Satellite Fault Detection Outage

11.1.11 If the GPS receiver displays an indication of a fault detection function outage (i.e. RAIM is not available), navigation integrity must be provided by comparing the GPS position with the position indicated by another LRNS sensor (i.e. other than GPS), if the aircraft is so equipped. However, if the only sensor for the approved LRNS is GPS, then comparison should be made with a position computed by extrapolating the last verified position with airspeed, heading and estimated winds. If the positions do not agree within 10 NM, the pilot should adopt navigation system failure procedures as subsequently described, until the exclusion function or navigation integrity is regained, and should report degraded navigation capability to ATC.

Fault Detection Alert

11.1.12 If the GPS receiver displays a fault detection alert (i.e. a failed satellite), the pilot may choose to continue to operate using the GPS-generated position if the current estimate of position uncertainty displayed on the GPS from the FDE algorithm is actively monitored. If this exceeds 10 nm, the pilot should immediately begin using the following navigation system failure procedures, until the exclusion function or navigation integrity is regained, and should report degraded navigation capability to ATC.

11.2 LOSS OF NAVIGATION/FMS CAPABILITY

11.2.1 Some aircraft carry triplex equipment (3 LRNSs) and hence if one system fails, even before take off, the two basic requirements for MNPS Airspace operations may still be met and the flight can proceed normally. The following guidance is offered for aircraft having state approval for unrestricted operations in MNPS airspace and which are equipped with only two operational LRNSs:

One System Fails Before Take-Off

11.2.2 The pilot must consider:

- a) delaying departure until repair is possible;
- b) obtaining a clearance above or below MNPS Airspace;
- c) planning on the special routes known as the 'Blue Spruce' Routes, which have been established for use by aircraft suffering partial loss of navigation capability (*Note: As indicated in Chapter 1, these routes may also be flown by aircraft approved for NAT MNPSA operations but equipped with only a single LRNS*). These Blue Spruce Routes are as follows:
 - MOXAL – RATSU (for flights departing Reykjavik Airport)
(VHF coverage exists. Non HF equipped aircraft can use this route)
 - OSKUM – RATSU (for flights departing Keflavik Airport)
(VHF coverage exists. Non HF equipped aircraft can use this route)
 - RATSU – ALDAN – KEF (Keflavik)
(VHF coverage exists. Non HF equipped aircraft can use this route)
 - ATSIX – 61°N 12°34'W – ALDAN – KEF
(HF is required on this route)
 - GOMUP – 60°N 15°W – 61°N 16°30'W – BREKI – KEF
(HF is required on this route)

- KEF – EMBLA – 63°N 30°W – 61°N 40°W – OZN
 - KEF – GIMLI – DA (Kulusuk) – SF (Kangerlussuaq) – YFB
 - SF (Kangerlussuaq) - 67°N 60°W - YXP
 - OZN – 59°N 50°W – PRAWN – YDP
 - OZN – 59°N 50°W – PORGY – HO
 - OZN – 58°N 50°W – LOACH – YYR
- d) The following special routes may also be flown without an LRNS (i.e. with only short-range navigation equipment such as VOR, DME, ADF), but it must be noted that State approval for operation within MNPS Airspace via these routes is still necessary:
- VALDI - MY (Myggenes) - ING – KEF
(G3)
 - GONUT - MY (Myggenes)
(G11)

11.2.3 Such use of the foregoing routes is subject to the following conditions:

- a) sufficient navigation capability remains to ensure that MNPS accuracy and the ICAO Annex 6 (Chapter 7 of Parts I and II) requirements for redundancy can be met by relying on short-range nav aids;
- b) a revised flight plan is filed with the appropriate ATS unit;
- c) an appropriate ATC clearance is obtained.

(Further information on the requisite procedures to follow can be obtained from *Section ENR 1.8-4 and 1.8-5 in AIP Iceland and in Section RAC 11.22 in AIP Canada.*)

Note: detailed information (including route definitions and operating procedures), which enables flight along other special routes within MNPS Airspace, may be found in relevant AIPs. This is specifically so, for aircraft operating without 2 LRNSs between Iceland and Greenland and between Greenland and Canada.

One System Fails Before the OCA Boundary is Reached

11.2.4 The pilot must consider:

- a) landing at a suitable aerodrome before the boundary or returning to the aerodrome of departure;
- b) diverting via one of the special routes described previously;
- c) obtaining a re-clearance above or below MNPS Airspace.

One System Fails After the OCA Boundary is Crossed

11.2.5 Once the aircraft has entered oceanic airspace, the pilot should normally continue to operate the aircraft in accordance with the Oceanic Clearance already received, appreciating that the reliability of the total navigation system has been significantly reduced.

11.2.6 The pilot should however,

- a) assess the prevailing circumstances (e.g. performance of the remaining system, remaining portion of the flight in MNPS Airspace, etc.);

- b) prepare a proposal to ATC with respect to the prevailing circumstances (e.g. request clearance above or below MNPS Airspace, turn-back, obtain clearance to fly along one of the special routes, etc.);
- c) advise and consult with ATC as to the most suitable action;
- d) obtain appropriate re-clearance prior to any deviation from the last acknowledged Oceanic Clearance.

11.2.7 When the flight continues in accordance with its original clearance (especially if the distance ahead within MNPS Airspace is significant), the pilot should begin a careful monitoring programme:

- a) to take special care in the operation of the remaining system bearing in mind that routine methods of error checking are no longer available;
- b) to check the main and standby compass systems frequently against the information which is still available;
- c) to check the performance record of the remaining equipment and if doubt arises regarding its performance and/or reliability, the following procedures should be considered:
 - attempting visual sighting of other aircraft or their contrails, which may provide a track indication;
 - calling the appropriate OAC for information on other aircraft adjacent to the aircraft's estimated position and/or calling on VHF to establish contact with such aircraft (preferably same track/level) to obtain from them information which could be useful. e.g. drift, groundspeed, wind details.

The Remaining System Fails After Entering MNPS Airspace

11.2.8 The pilot should:

- a) immediately notify ATC;
- b) make best use of procedures specified above relating to attempting visual sightings and establishing contact on VHF with adjacent aircraft for useful information;
- c) keep a special look-out for possible conflicting aircraft, and make maximum use of exterior lights;
- d) if no instructions are received from ATC within a reasonable period consider climbing or descending 500 feet, broadcasting action on 121.5 MHz and advising ATC as soon as possible.

Note: this procedure also applies when a single remaining system gives an indication of degradation of performance, or neither system fails completely but the system indications diverge widely and the defective system cannot be determined.

Complete Failure of Navigation Systems Computers

11.2.9 A characteristic of the navigation computer system is that the computer element might fail, and thus deprive the aircraft of steering guidance and the indication of position relative to cleared track, but the basic outputs of the IRS (LAT/LONG, Drift and Groundspeed) are left unimpaired. A typical drill to minimise the effects of a total navigation computer system failure is suggested below. It requires comprehensive use of the plotting chart.

- a) use the basic IRS/GPS outputs to adjust heading to maintain mean track and to calculate ETAs.
- b) draw the cleared route on a chart and extract mean true tracks between waypoints.

- c) at intervals of not more than 15 minutes plot position (LAT/LONG) on the chart and adjust heading to regain track.

Note: EAG Chart AT (H) 1; No 1 AIDU (MOD) Charts AT(H)1, 2, 3 & 4; the Jeppesen North/Mid Atlantic Plotting Charts and the NOAA/FAA North Atlantic Route Chart are considered suitable for this purpose.

CHAPTER 12: SPECIAL PROCEDURES FOR IN-FLIGHT CONTINGENCIES

12.1 INTRODUCTION

12.1.1 Situations can be anticipated in which the provision of Air Traffic Management to flights within the NAT Region might be affected. NAT ATS Providers have developed arrangements which would, in such events, be put in place to ensure, as far as possible, the continued safety of air navigation. These arrangements include required contingency actions by pilots and operators of any affected flights. They are detailed in “The North Atlantic Air Traffic Management Operational Contingency Plan – Doc.006” which can be downloaded from the ICAO Paris website at <http://www.paris.icao.int/>. See Chapter 6 - Para 6.7 for further details.

12.1.2 However, circumstances can also occur which affect individual aircraft. The remainder of this Chapter details guidance to pilots on contingency actions to follow to protect the safety of the flight in such circumstances.

12.1.3 The following procedures are intended for guidance only. Although all possible contingencies cannot be covered, they provide for such cases as:

- a) inability to maintain assigned level due to weather (for example severe turbulence);
- b) aircraft performance problems; or
- c) pressurisation failure.

12.1.4 They are applicable primarily when rapid descent, turn-back, or diversion to an alternate aerodrome is required. The pilot's judgement will determine the specific sequence of actions taken, having regard to the prevailing circumstances.

12.2 GENERAL PROCEDURES

12.2.1 If an aircraft is unable to continue its flight in accordance with its ATC clearance, a revised clearance should be obtained whenever possible, prior to initiating any action, using the radio telephony distress (MAYDAY) signal or urgency (PAN PAN) signal as appropriate.

12.2.2 If prior clearance cannot be obtained, an ATC clearance should be obtained at the earliest possible time and, in the meantime, the aircraft should broadcast its position (including the ATS Route designator or the Track Code as appropriate) and its intentions, at frequent intervals on 121.5 MHz (with 123.45 MHz as a back-up frequency). It must be recognised that due to the use of CPDLC, station-to-station SATCOM Voice and SELCAL with HF communications in North Atlantic operations, pilots' situation awareness, of other potentially conflicting traffic, may be non-existent or incomplete. If, however, the aircraft is in an area where ATC communications are being conducted on VHF, pending receipt of any reclearance, the position and intentions should be broadcast on the current control frequency, rather than 123.45 MHz.

12.2.3 Until a revised clearance is obtained the specified NAT in-flight contingency procedures should be carefully followed. Procedures for general use in Oceanic airspace are contained within the ICAO PANS ATM (Doc. 4444), specifically Amendment 2 effective November 2009. Procedures particular to the NAT MNPSA environment are contained in ICAO *NAT Regional Supplementary Procedures (Doc.7030)* and appropriate NAT Provider States' *AIPs*. The procedures are paraphrased below.

12.2.4 In general terms, the aircraft should be flown at a flight level and/or on a track where other aircraft are least likely to be encountered. Maximum use of aircraft lighting should be made and a good look-out maintained. If TCAS is carried, the displayed information should be used to assist in sighting proximate traffic.

12.3 SPECIAL PROCEDURES

12.3.1 The general concept of these Oceanic in-flight contingency procedures is, whenever operationally feasible, to offset from the assigned route by 15 NM and climb or descend to a level which differs from those normally used by 500 ft if below FL410 or by 1000 ft if above FL410.

Initial Action

12.3.2 The aircraft should leave its assigned route or track by initially turning at least 45° to the right or left whenever this is feasible. The direction of the turn should, where appropriate, be determined by the position of the aircraft relative to any organised route or track system (e.g. whether the aircraft is outside, at the edge of, or within the system). Other factors which may affect the direction of turn are: direction to an alternate airport, terrain clearance, levels allocated on adjacent routes or tracks and any known SLOP off sets adopted by other nearby traffic.

Subsequent Action

12.3.3 An aircraft that is able to maintain its assigned flight level, after deviating 10 NM from its original cleared track centreline and therefore clear of any potentially conflicting traffic above or below following the same track, should :

- a) climb or descend 1000 ft if above FL410
- b) climb or descend 500 ft when below FL410
- c) climb 1000 ft or descend 500 ft if at FL410

12.3.4 An aircraft that is unable to maintain its assigned flight level should, whenever possible, initially minimise its rate of descent when leaving its original track centreline and then when expected to be clear of any possible traffic following the same track at lower levels, expedite descent to an operationally feasible flight level, which differs from those normally used by 500 ft if below FL410 (or by 1000 ft if above FL410).

12.3.5 Before commencing any diversion across the flow of adjacent traffic, aircraft should, whilst maintaining the 15 NM offset track, expedite climb above or descent below the vast majority of NAT traffic (i.e. to a level above FL410 or below FL280), and then maintain a flight level which differs from those normally used: by 1000 ft if above FL410, or by 500 ft if below FL410. However, if the pilot is unable or unwilling to carry out a major climb or descent, then any diversion should be carried out at a level 500 ft different from those in use within MNPS Airspace, until a new ATC clearance is obtained.

12.3.6 If these contingency procedures are employed by a twin engine aircraft as a result of the shutdown of a power unit or the failure of a primary aircraft system the pilot should advise ATC as soon as practicable of the situation, reminding ATC of the type of aircraft involved and requesting expeditious handling.

12.4 DEVIATIONS AROUND SEVERE WEATHER

12.4.1 If the aircraft is required to deviate from track to avoid weather (e.g. thunderstorms), the pilot should request a revised clearance from ATC and obtain essential traffic information prior to deviating. This is the case even when a pilot expects to have to deviate by a relatively small distance (e.g. less than 10 NM). If, however, if such prior ATC clearance cannot be obtained, the procedures described below should be adopted and in the meantime efforts should be continued to obtain an appropriate ATC clearance.

- a) If possible, deviate away from the organised track or route system;
- b) Establish communications with and alert nearby aircraft broadcasting, at suitable intervals: aircraft identification, flight level, aircraft position (including ATS route designator or the track code) and intentions, on the frequency in use and on frequency 121.5 MHz (or, as a back-up, on the VHF inter-pilot air-to-air frequency 123.45 MHz);
- c) Watch for conflicting traffic both visually and by reference to ACAS/TCAS (if equipped);
- d) Turn on all aircraft exterior lights.
- e) For deviations of less than 10 NM, aircraft should remain at the level assigned by ATC;
- f) For deviations of greater than 10 NM, when the aircraft is approximately 10 NM from track, initiate a level change of 300 ft.
 - If flying generally Eastbound (i.e. a magnetic track of 000° to 179°) and deviating left (ie north) of track then **descend** 300 ft; if, however, deviating right (i.e. south) of track then **climb** 300 ft.
 - If flying generally Westbound (i.e. a magnetic track of 180° to 359°) and deviating left (i.e. south) of track then **climb** 300 ft; if, however, deviating right (i.e. north) of track then **descend** 300 ft.

i.e.

<i>Route centre line track</i>	<i>Deviations > 19 km (10 NM)</i>	<i>Level change</i>
EAST (000° 179° magnetic)	LEFT RIGHT	DESCEND 90 m (300 ft) CLIMB 90 m (300 ft)
WEST (180° 359° magnetic)	LEFT RIGHT	CLIMB 90 m (300 ft) DESCEND 90 m (300 ft)

- g) When returning to track, regain the last assigned flight level, when the aircraft is within approximately 10 NM of centre line.

12.4.2 The pilot should inform ATC when weather deviation is no longer required, or when a weather deviation has been completed and the aircraft has returned to the centre line (or previously adopted SLOP Offset) of its cleared route.

12.5 WAKE TURBULENCE

12.5.1 ICAO established a worldwide programme in 2008 for collecting data on wave vortex encounters. Most wake vortex encounters occur in terminal operations and indeed this is where the aircraft type wake categorization scheme is used to regulate separations. The ICAO programme was aimed at reviewing the categorization scheme in light of the recent introduction into service of a new type of very large aircraft.

12.5.2 Wake vortex encounters are, however, also experienced en-route, although less frequently. To accommodate the predominantly uni-directional diurnal traffic flows through the NAT Region, on many routes all adjacent flights levels are simultaneously used for a given traffic flow. While this arrangement may not be unique, it is not one that is commonly employed in many other areas of the world. As a result many, if not most, en-route wake vortex encounters outside the NAT Region arise from opposite direction passings or route crossing situations. In the NAT Region en-route wake vortices are encountered more commonly from a preceding aircraft following the same track, usually at the next higher level. In the early days of RVSM implementation in the NAT Region a number of such reported encounters led to the development of a “wake turbulence offset procedure”. This has now been subsumed into SLOP which is a standard operating procedure throughout the NAT Region and is required to mitigate the risk of vertical navigation errors. Any pilot who encounters a wake turbulence event when flying in NAT MNPS Airspace should ensure that a detailed report is provided and that a copy is forwarded to the North Atlantic Central Monitoring Agency. After the expiry of the current ICAO programme, and in the absence of any other relevant mandatory reporting arrangements, the reporting form included at Attachment 3 to this Manual could be used for this purpose.

12.5.3 The Strategic Lateral Offset Procedures (see Chapter 8) are now standard operating procedures throughout the NAT Region. Thus when flying within NAT MNPS Airspace, if the aircraft encounters wake turbulence and the pilot considers it necessary to offset from the current track then the pilot may only elect to fly another of the three options allowable in SLOP (i.e. Cleared Track centre-line, or 1 NM or 2 NM right of centre-line). It is no longer possible to offset left of the track centre-line to avoid wake turbulence. If neither of the remaining SLOP offset tracks are upwind of the other aircraft which is causing the wake turbulence, then the pilot should co-ordinate with the other aircraft via the inter-pilot frequency 123.45 MHz, and perhaps request that the other aircraft adopt an alternative (SLOP) allowable downwind offset. If wake turbulence is encountered, even if it is subsequently avoided by judicious use of offsets, a report should still be made. If turbulence is encountered but the pilot is unsure whether the cause is wake vortex or perhaps Clear Air Turbulence, a report should be submitted annotated to this effect.

12.6 ACAS/TCAS ALERTS AND WARNINGS

12.6.1 With effect from 01 January 2005 all turbine-engined aircraft with a certificated take-off mass exceeding 5,700 Kgs or authorised to carry more than 19 passengers are required to carry and operate ACAS II in the NAT Region. It should be noted that TCAS Version 7.0 meets the ICAO technical specifications for ACAS II as described in ICAO Annex 10 Volume IV.

12.6.2 The provisions relating to the carriage and use of ACAS II are contained in ICAO Annexes 2, 6, 10 & 11 and in the Procedures for Air Navigation Services (PANS) Ops & ATM. Operational procedures are fully detailed in PANS-OPS Doc 8168, Volume 1, Part VIII, Chapter 3

12.6.3 All Resolution Advisories (RAs) should be reported to ATC:

- a) verbally, as soon as practicable; and
- b) in writing, to the Controlling Authority, after the flight has landed, using the necessary procedure and forms, including, when appropriate, the ‘Altitude Deviation Report Form’ shown at Attachment 2 to this Manual.

Possible traffic alerts resulting from ATC use of the 5 minutes GNSS climb/descent through procedure

12.6.4 TCAS registers targets up to 40 NMs. Depending upon OAT/ambient air density, a Mach of about 0.85 equates to a TAS of approx 480 Kts, or 8 NMs per minute. Since the longitudinal separation standard employed in the North Atlantic is 10 minutes, pilots would consequently not normally expect their TCAS to register targets at the same level, whether these may be in-trail, crossing, climbing or descending

through their level. However, since January 2009, some NAT ATC units are utilising a procedure which permits ATC to clear an aircraft to climb or descend through the level of another aircraft, with as little as 5 minutes longitudinal separation, provided that both aircraft are using GNSS (GPS) for position determination and reporting. Many NAT aircraft request and are cleared at lesser Machs than 0.85. A 5 minutes in trail separation between two aircraft flying at M0.80 and experiencing a headwind component of 30 Kts (not unusual for W/B NAT flights), will equate to approx 35 NMs. Furthermore, depending upon the rounding/truncating protocols used by pilots, FMSs and/or ATC Flight Data Processing Systems (for “minutes and seconds” to “minutes”), a nominal 5 minutes separation can in fact be close to an actual 4 minutes (it can, of course, also be 6 minutes). In such a circumstance the actual longitudinal separation could be less than 30 NMs. In these cases TCAS may register targets.

12.6.5 The rule allowing ATC to use this procedure includes a caveat that the climb or descent needs to be undertaken within 10 minutes of the time that the second aircraft in the pair has passed a common reporting point. Consequently, the pilot of an aircraft cleared for a climb or descent of more than a single flight level, should be alerted to the possibility of a potential TCAS alert by the controller’s use of the conditional phrase “By” or “At or Before” in the clearance received. However, the pilot of the “passive participant” aircraft of the 5 minutes separated pair, if it is the following aircraft, could be presented with a “pop-up” TCAS target without such a warning. The bulletin announcing the introduction of this procedure in the North Atlantic includes the following instruction;- “If there is any concern regarding the proximity of another aircraft, flight crews must not hesitate to clarify the situation and take appropriate action to ensure the safety of the flight.” However, given the air/ground communications methods employed in the NAT, the pilot may not receive a response to such a request for “clarification” prior to the other aircraft passing its flight level. Nevertheless, even at these separations, Resolution Advisories are not anticipated and it is not expected that pilots will consider deviating from their clearance as “appropriate action”.

CHAPTER 13: CHECK LISTS FOR PILOTS OPERATING IN NAT MNPS AIRSPACE

13.1 INTRODUCTION

13.1.1 The North Atlantic MNPS Airspace is the busiest Oceanic environment anywhere in the world. To safely and efficiently accommodate the high traffic volumes here, unique traffic organization and management techniques are employed and pilots are required to rigorously utilize particular operating procedures. The following Check Lists are provided as guidance. Operators without an oceanic checklist are encouraged to use these and tailor them to their specific needs and approvals.

13.2 SPECIAL NAT MNPSA ITEMS

13.2.1 To assist those pilots who are less familiar with operating in NAT MNPS Airspace, below is a list of questions which address the unique and/or particularly important NAT MNPSA check list elements.

1. Are you sure that your State of Registry has granted approval for both RVSM and MNPS operations in connection with this flight by this aircraft ? (See Chapter 1 – “Operational Approval and Aircraft System Requirements for Flight in the NAT MNPS Airspace”)
2. If it has, are the letters ‘X’ and ‘W’ in Item 10 of your flight plan?
3. If you are intending to follow an organised track, and bearing in mind that the OTS changes every 12 hours, do you have a copy of the valid track message, including when applicable, any “TMI Alpha Suffixed” changes to it? (See THE NAT TRACK MESSAGE in Chapter 2 – “The Organised Track System (OTS)”.
4. Are you familiar with the Mach Number Technique? (See Chapter 7 – “Application of Mach Number Technique”)
5. Have you had an accurate time check referenced to UTC, and is the system you will be using on the flight deck for MNPS operation also accurately referenced to UTC? Is this time accuracy going to be maintained for the planned duration of the flight ? (See Chapter 8 – “Importance of Accurate Time”)
6. If using GPS, have you checked the latest NOTAMs regarding the serviceability of GPS satellites and have you performed a Satellite Navigation Availability Prediction Programme analysis? (See Chapter 8: MNPS Flight Operation & Navigation Procedures)
7. If flying via the special Greenland/Iceland routes, have you checked the serviceability of your one remaining LRNS and of your short range navigation systems plus the ground navigation aids which you will use? (See Chapter 11 - Partial or Complete Loss of Navigation/FMS Capability by Aircraft having State Approval for Unrestricted Operations in MNPS Airspace)
8. If flying a non-HF equipped aircraft, is your route approved for VHF only? (See Chapter 4, Flights Planning to Operate Without HF Communications, paragraph 4.2.12.)
9. If flying other than on the special routes, are you sure that both your LRNSs are fully operational?

10. Have you planned ahead for any actions you might need to take should you suffer a failure of one LRNS? (See Chapter 11: Procedures in the Event of Navigation System Degradation or Failure).
11. Are you sure that both your primary altimetry systems and at least one altitude alerter and one autopilot are fully operational ?
12. Are you familiar with the required procedures for flight at RVSM levels? (See Chapter 9).

13.2.2 If, as a pilot, you have any doubt about your answers to these questions, it may be necessary for you to consult with the Civil Aviation Department of your State of Registry.

13.3 SAMPLE NAT MNPS CHECK LIST

13.3.1 ICAO North Atlantic Working Groups composed of industry, ATC and state regulators have created a sample oceanic checklist. It is published on the ICAO website as a NAT OPS Bulletin and may be found at www.paris.icao.int/. It is provided as guidance and is not intended to replace an operator's oceanic checklist. However, Operators without an oceanic checklist are encouraged to use this sample and tailor it to their specific needs and approvals. This checklist focuses on an orderly flow and ways to reduce oceanic errors. The detail of and the rationale for the proposed actions listed are described in the "Expanded Check List", which is also published as a NAT OPS Bulletin and similarly available at www.paris.icao.int/. Operators should use an oceanic check list as part of their Safety Management System (SMS). Operators are also encouraged to study the "Oceanic Errors Safety Bulletin (OESB)". The OESB is also published as a NAT OPS Bulletin.

CHAPTER 14: GUARDING AGAINST COMPLACENCY

14.1 INTRODUCTION

14.1.1 Since 1977, when the MNPS rules were introduced, careful monitoring procedures have provided a good indication both of the frequency with which navigation errors occur and their causes. Their frequency is low: only one flight in around ten thousand commits a serious navigation error. However because of the accuracy and reliability of modern navigation systems, the errors which do occur are most often seen to be as a result of aircrew error.

14.1.2 Operational errors in the vertical plane also occur. Aircraft are sometimes flown at levels other than those for which ATC clearance has been issued. In preparation for the introduction of RVSM in the NAT Region (1997) a comprehensive data collection programme for vertical deviations was implemented, together with an annual assessment of the resulting collision risks. As in the horizontal plane, the frequency of vertical errors is low. However, the potential risk of even a single incidence of flying at an uncleared level can be very significant. Currently, the NAT MNPSA risk estimates in the vertical plane, as a result of operational errors or uncleared departures from flight level, exceed those arising from lateral gross navigation errors.

14.1.3 It is therefore essential that crews do not take modern technology for granted. They should at all times, especially during periods of low workload, guard against complacency and over-confidence, by adhering rigidly to approved cockpit/flight deck procedures which have been formulated over many years, in order to help stop operational errors from being an inevitability.

14.1.4 This chapter lists some of the errors that have been recorded in the NAT during recent years. Also the NATSPG commissioned the UK National Air Traffic Services to produce an interactive DVD ROM, "On the Right Track", which highlights many of the common errors and discusses their causes. The DVD ROM additionally contains general information on Air Traffic Control in the North Atlantic Region. The DVD ROM, like this Manual, is aimed at pilots, dispatchers and others concerned in operations on the North Atlantic. It is available at no charge to *bona fide* operators on application to: customerhelp@nats.co.uk. Furthermore, an Oceanic Errors Safety Bulletin is available for downloading from the ICAO EUR/NAT website (<http://www.paris.icao.int/>) and is updated every 6 months. This is currently augmented by a NAT Safety Alert. It is suggested that pilots consult these sources regularly.

14.2 OPERATIONAL HEIGHT ERRORS

14.2.1 The most common height errors are caused by:

- a) executing an uncleared climb.

e.g. the crew of an aircraft entering Reykjavik OCA from Edmonton FIR encountered HF Blackout conditions prior to reaching the Reykjavik OCA boundary and before receiving an Oceanic Clearance. During the subsequent more than two hours of flight in the MNPSA, the crew executed two step climbs before re-establishing contact with ATC.

Aircraft following an ATC clearance are assured of separation from other potentially conflicting traffic. In HF Blackout conditions if an aircraft unilaterally changes level, ATC has no means to advise or intervene with other traffic and separation can no longer be assured. In such a circumstance, if a climb without ATC clearance is imperative then this should be treated as a contingency and the appropriate track offset of 15 NM should be flown.

- b) misinterpreting an ATC acknowledgement of a request as a clearance

e.g. a crew requested a step climb from Shanwick OAC using HF Voice through the Shannon aeradio station. The radio operator acknowledged the request to the aircraft and forwarded it to the Shanwick controller for review and action. The crew interpreted the radio operator's acknowledgement as an approval of the request and immediately executed the step climb. The controller subsequently denied the request due to conflicting traffic with inadequate longitudinal separation at the requested higher level. The requesting aircraft had reached the new level and therefore violated separation minima before receiving the denial. Similar incidents have occurred during NAT CPDLC trials when crews have misinterpreted a technical acknowledgement of a datalink request for an ATC approval.

When DCPC is unavailable and air/ground ATS communications are via a third party (whether radio operator or datalink service provider) crews must be aware that acknowledgements of requests do not constitute approval.

- c) not climbing or descending as cleared

e.g. a crew was cleared for a climb to cross 4030W at FL350. The crew mis-interpreted the clearance and took it to mean climb to cross 40°N 30°W (instead of 40° 30'W) at FL350.

While this was caused by a seemingly ambiguous clearance, crews must be on their guard and query the clearance if in any doubt. Crews should be aware of the risks of non-compliance with a clearance, or with a restriction within a clearance. A significant number of height deviations have been reported where an aircraft had been cleared to change level after the next route waypoint and has done so immediately or has been cleared to change level immediately and had not done so until a later time. Both cases can very easily result in the loss of safe separation with other traffic. Such instances are often, but by no means exclusively, associated with misinterpretation of CPDLC message sets (a crew training/familiarity issue) whereby the words AT or BY are interpreted differently from their intended meaning. This is a problem particularly (but not exclusively) with crew members whose first language is not English. It is compounded in the cases of languages which have no directly equivalent words to differentiate between AT or BY, or perhaps use the same word for each (this is apparently true of a number of European languages, for example). The dangers associated with misinterpretation of conditional clearances must be appreciated. If an aircraft climbs or descends too soon or too late it is almost inevitable that it will lose separation with the other traffic, that was the reason for the condition being applied by ATC.

- d) not following the correct contingency procedures

e.g. following an engine failure a crew descended the aircraft on track rather than carrying out the correct contingency procedures (see Chapter 12).

Particularly when flying in the OTS, crews must appreciate that there is a significant likelihood of conflict with other aircraft at lower levels unless the appropriate contingency offset procedure is adopted. (See paragraph 12.3.4)

- e) entering the NAT MNPSA at a level different from that contained in the received Oceanic Clearance.

e.g. a crew flying through Brest FIR at FL310 en route to the Shanwick OCA boundary received an oceanic clearance for FL330. The crew requested a climb from Brest but it had not been received when the aircraft reached the Shanwick boundary. The crew elected to

continue into the NAT MNPSA at FL310. Separation was immediately lost with a preceding aircraft at that flight level.

Crews are responsible for requesting and obtaining any domestic ATC clearance necessary to climb (or descend) to the initial flight level specified in their received Oceanic Clearance, prior to reaching the oceanic boundary. While adjacent ACCs generally use their best endeavours to get an aircraft to its oceanic level before the boundary, it must be recognized that entry into NAT MNPSA at the cleared oceanic level is entirely the responsibility of the crew. It does appear from the relative frequency of this type of error that this is not widely understood. It should also be appreciated that such requests must be made sufficiently early to allow the domestic ATC unit time to respond.

f) An occasional error is to fly at one (uncleared) level and report at the (different) cleared level !

e.g. the crew of a major airline reported at FL360 (the cleared level), all the way across the ocean but were in fact flying at FL350!! They had been cleared to cross 40°W at FL360 and correctly entered the cleared level into the FMC but did not execute the command prior to 40°W. During position reporting the aircraft level was reported by reference to the FMC altitude hold box.

Without SSR ATC must rely upon crew position report data to plan for the safe separation of all traffic. If any such data is in error actual separations can be compromised.

14.3 LATERAL NAVIGATION ERRORS

More Common Causes Of Lateral Navigation Errors

14.3.1 The most common causes of GNEs, in approximate order of frequency, have been as follows:

- a) having already inserted the filed flight plan route co-ordinates into the navigation computers, the crew have been re-cleared by ATC, or have asked for and obtained a re-clearance, but have then omitted to re-program the navigation system(s), amend the Master Document or update the plotting chart accordingly.
- b) a mistake of one degree of latitude has been made in inserting a forward waypoint. There seems to be a greater tendency for this error to be made when a track, after passing through the same latitude at several waypoints (e.g. 57°N 50°W, 57°N 40°W, 57°N 30°W) then changes by one degree of latitude (e.g. 56°N 20°W). Other circumstances which can lead to this mistake being made include receiving a re-clearance in flight.
- c) the autopilot has been inadvertently left in the heading or de-coupled mode after avoiding weather, or left in the VOR position after leaving the last domestic airspace VOR. In some cases, the mistake has arisen during distraction caused by SELCAL or by some flight deck warning indication.
- d) an error has arisen in the ATC Controller/Pilot communications loop, so that the controller and the crew have had different understandings of the clearance. In some cases, the pilot has heard not what was said, but what he/she was expecting to hear.

Rare Causes Of Lateral Navigation Errors

14.3.2 To illustrate the surprising nature of things which can go wrong, the following are examples of some extremely rare faults which have occurred:

- a) the lat/long co-ordinates displayed near the gate position at one international airport were wrong.
- b) because of a defective component in one of the INS systems on an aircraft, although the correct forward waypoint latitude was inserted by the crew (51°) it subsequently jumped by one degree (to 52°).
- c) the aircraft was equipped with an advanced system with all the co-ordinates of the waypoints of the intended route already in a database; the crew assumed that these co-ordinates were correct, but one was not.
- d) when crossing longitude 40°W westbound the Captain asked what co-ordinates he should insert for the 50°W waypoint and was told 48 50. He wrongly assumed this to mean 48°50'N at 50°00'W (when it really meant 48°N 50°W) and as a result deviated 50 NM from track.
- e) the flight crew had available to them the correct co-ordinates for their cleared track, but unfortunately the data which they inserted into the navigation computer was from the company flight plan, in which an error had been made.
- f) at least twice since 1989, longitude has been inserted with an error of magnitude of times 10. e.g. 100°W instead of 10°W, or 5°W instead of 50°W. Because of low angles of bank, the aircraft departed from track without the crews being aware, and both lateral and longitudinal separations with other aircraft were compromised.
- g) a crew based at and usually operating from London Heathrow was positioned at London Gatwick for a particular flight. One pilot inadvertently loaded the Heathrow co-ordinates into the INS, instead of those for Gatwick. This initialisation error was only discovered when the aircraft had turned back within the NAT after experiencing a GNE.
- h) the pilot of a flight departing from the Caribbean area input the wrong departure airfield co-ordinates prior to departure. This error was discovered when deviation from cleared route seriously eroded separation with two other opposite direction aircraft.

14.4 LESSONS TO BE LEARNED

- **Never relax or be casual in respect of cross-check procedures.** This is especially important towards the end of a long night flight.
- **Avoid casual R/T procedures.** A number of GNEs have been the result of a misunderstanding between pilot and controller as to the cleared route and/or flight level. Adhere strictly to proper R/T phraseology and do not be tempted to clip or abbreviate details of waypoint co-ordinates.
- **Make an independent check on the gate position.** Do not assume that the gate co-ordinates are correct without cross-checking with an authoritative source. Normally one expects co-ordinates to be to the nearest tenth of a minute. Therefore, ensure that the display is not to the hundredth, or in minutes and seconds. If the aircraft is near to the Zero Degree E/W (Greenwich) Meridian, remember the risk of confusing east and west.
- **Before entering Oceanic Airspace** make a careful check of LRNS positions at or near to the last navigation facility – or perhaps the last but one.

- **Never initiate an on-track uncleared level change.** If a change of level is essential and prior ATC clearance cannot be obtained, treat this situation as a contingency and execute the appropriate contingency offset procedure, when possible before leaving the last cleared flight level. Inform ATC as soon as practicable.
- **Do not assume** that the aircraft is at a waypoint merely because the alert annunciator so indicates. Cross-check by reading present position.
- **Flight deck drills.** There are some tasks on the flight deck which can safely be delegated to one member of the crew, but navigation using automated systems is emphatically not one of them, and the Captain should participate in all navigation cross-check procedures. All such cross-checks should be performed independently by at least two pilots.
- **Initialisation errors.** Always return to the ramp and re-initialise inertial systems if the aircraft is moved before the navigation mode is selected. If after getting airborne, it is found that during initialisation a longitude insertion error has been made, unless the crew thoroughly understand what they are doing, and have also either had recent training on the method or carry written drills on how to achieve the objective, the aircraft should not proceed into MNPS Airspace, but should turn back or make an en route stop.
- **Waypoint loading.** Before departure, at least two pilots should independently check that the following agree: computer flight plan, ICAO flight plan, track plotted on chart, and if appropriate, the track message. In flight, involve two different sources in the cross-checking, if possible. Do not be so hurried in loading waypoints that mistakes become likely, and always check waypoints against the current ATC clearance. Always be aware that the cleared route may differ from that contained in the filed flight plan. Prior to entering the NAT MNPSA ensure that the waypoints programmed into the navigation computer reflect the Oceanic Clearance received and not any different previously entered planned or requested route.
- **Use a flight progress chart on the flight deck.** It has been found that making periodic plots of position on a suitable chart and comparing with current cleared track, greatly helps in the identification of errors before getting too far from track.
- **Consider making a simple use of basic DR Navigation as a back-up.** Outside polar regions, provided that the magnetic course (track) is available on the flight log, a check against the magnetic heading being flown, plus or minus drift, is likely to indicate any gross tracking error.
- **Always remember** that something absurd may have happened in the last half-hour. There are often ways in which an overall awareness of directional progress can be maintained; the position of the sun or stars; disposition of contrails; islands or coast-lines which can be seen directly or by using radar; radio nav aids, and so forth. This is obvious and basic, but some of the errors which have occurred could have been prevented if the crew had shown more of this type of awareness.
- **If the crew suspects** that equipment failure may be leading to divergence from cleared track, it is better to advise ATC sooner rather than later.

In conclusion, navigation equipment installations vary greatly between operators; but lessons learned from past mistakes may help to prevent mistakes of a similar nature occurring to others in the future.

CHAPTER 15: THE PREVENTION OF DEVIATIONS FROM TRACK AS A RESULT OF WAYPOINT INSERTION ERRORS

15.1 THE PROBLEM

15.1.1 During the monitoring of navigation performance in the NAT MNPS Airspace, a number of GNEs are reported. There were 20 in 2007 and 25 in 2008. Such errors are normally detected by means of long range radars as aircraft leave oceanic airspace but are increasingly confirmed by means of ADS-C waypoint reporting. In addition, however, on 143 occasions in 2007 and 148 occasions in 2008, potential navigation errors were identified by ATC from routine aircraft position reports (from “next” or “next plus one” waypoints) and ATC were able to intervene to prevent incorrect routing by the aircraft. The vast majority of these instances were attributable to crew errors.

15.1.2 Investigations into the causes of all recent deviations show that about 25% are attributable to equipment control errors by crews and that almost all of these errors are the result of programming the navigation system(s) with incorrect waypoint data – otherwise known as waypoint insertion errors. The remainder comprise mainly the following of the filed flight plan route rather than the cleared route (the primary cause of some 80% of the ATC Interventions described in 14.1.1 above).

15.2 THE CURE

15.2.1 Waypoint insertion errors can be virtually eliminated if all operators/crews adhere at all times to approved operating procedures and cross checking drills. This Manual provides a considerable amount of guidance and advice based on experience gained the hard way, but it is quite impossible to provide specific advice for each of the many variations of navigation systems fit.

15.2.2 The following procedures are recommended as being a good basis for MNPS operating drills/checks:

- a) Record the initialisation position programmed into the navigation computer. This serves two purposes:
 - it establishes the starting point for the navigation computations; and
 - in the event of navigation difficulties it facilitates a diagnosis of the problem.
- b) Ensure that your flight log has adequate space for the ATC cleared track co-ordinates, and always record them. This part of the flight log then becomes the flight deck Master Document for:
 - read back of clearance;
 - entering the route into the navigation system;
 - plotting the route on your chart.
- c) Plot the cleared route on a chart with a scale suitable for the purpose (e.g. Aerad, Jeppesen, NOAA en route charts). This allows for a visual check on the reasonableness of the route profile and on its relationship to the OTS, other aircraft tracks/positions, diversion airfields, etc.
- d) Plot your Present Position regularly on your chart.
 - this may seem old-fashioned but, since the present position output cannot normally be interfered with and its calculation is independent of the waypoint data, it is the one output which can be relied upon to detect gross tracking errors. **A position should be checked and**

preferably plotted approximately 10 minutes after passing each waypoint, and, if circumstances dictate, midway between waypoints. e.g. if one system has failed.

- e) Check the present, next and next+1 waypoint co-ordinates as shown on the Master Document against those in the steering CDU before transmitting position reports (in performing these checks review the LRNS stored co-ordinates in expanded Lat/Long format (not abbreviated ARINC 424 format).
- f) Check the LRNS indicated magnetic heading and distance to the next waypoint against those listed on the Master Document.

15.2.3 The procedures outlined in this Section will detect any incipient gross errors, providing that the recorded/plotted cleared route is the same as that provided by the controlling ATS authority. If there has been a misunderstanding between the pilot and controller over the actual route to be flown (i.e. an ATC loop error has occurred), then the last drill above, together with the subsequent passing of the position report, will allow the ATS authority the opportunity to correct such misunderstanding before a hazardous track deviation can develop. The vast majority of instances of waypoint insertion errors occur when the ATC cleared oceanic route segment differs (partly or wholly) from that included in the filed flight plan or that requested by the pilot. Thorough and diligent checking and cross-checking, by more than one crew member, of the waypoints entered into the navigation computer, against the received Oceanic Clearance would eliminate most of these unnecessary and avoidable errors.

CHAPTER 16: GUIDANCE FOR DISPATCHERS

16.1 General

16.1.1 The North Atlantic Region is essentially divided into two distinct areas for flight operation, i.e. MNPS Airspace and non-MNPS airspace. Operations within MNPS Airspace require the user to adhere to very specific operating protocols. The vertical dimension of MNPS Airspace is between FL285 and FL420 (i.e. in terms of normally used cruising levels, from FL290 to FL410 inclusive).

16.1.2 The lateral dimensions include the following Areas:

- a) Those portions of the NEW YORK OCEANIC North of 27°N but excluding the area west of 60°W and south of 38°30'N;
- b) And all of the REYKJAVIK, SHANWICK, GANDER and SANTA MARIA OCEANIC Control Areas (CTAs).

16.2 Regulatory Requirements and Consequential Routing Limitations

State Approvals (MNPS/RVSM)

16.2.1 Before planning any operations within the North Atlantic MNPS Airspace operators and pilots must ensure that the specific State MNPS and RVSM Approvals are in place. These requirements are addressed in Chapter 1 of this Manual at paragraphs 1.1.1, 1.1.2 and 1.1.3.

Minimum Equipage (Navigation/Altimetry/Communications)

16.2.2 Section 1.3 discusses the minimum navigation equipage requirements for unrestricted flight in NAT MNPS Airspace.

16.2.3 The Minimum Aircraft Systems Performance Specifications for RVSM operations are common world-wide standards and are contained in ICAO Doc 9574 (Manual on Implementation of a 300m (1 000ft) Vertical Separation Minimum between FL290 and FL410 inclusive.). They are also detailed in designated FAA document, AC91-85, and in JAA document, TGL6, Revision 1 (i.e. Temporary Guidance Leaflet No. 6) These two documents can be accessed via:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/rvsm/
and <http://www.ecacnav.com/rvsm/library.htm>,

respectively. However, notwithstanding the worldwide nature of RVSM MASPS, it must be recognised, as indicated in Chapter 1 paragraph 1.2.2 above, that special provisions apply in the North Atlantic MNPS Airspace and in consequence all NAT crews/operators must **be State approved specifically for NAT RVSM operations.**

16.2.4 Most NAT air/ground ATC communications are conducted on single side-band HF frequencies. For unrestricted operations in the NAT Region fully functioning HF Communications equipment is required. While SATCOM Voice and Datalink communications are being gradually introduced into NAT operations, HF may still be required as back-up.

Special non-compliance routings

16.2.5 Aircraft not equipped with two functioning Long Range Navigation Systems may only fly through NAT MNPS Airspace via special designated routes. This is discussed in Chapter 1 at paragraph 1.4. Details of these special routes are contained in Chapter 11 at paragraph 11.2.2.

16.2.6 Aircraft not approved for MNPS/RVSM operations may climb and descend through NAT MNPS/RVSM Airspace and in very limited, specified circumstances an MNPS Approved aircraft that is not Approved for RVSM operations may be granted permission to flight plan and operate through MNPS Airspace at RVSM levels. (See Chapter 1 at 1.5 and 1.6).

16.2.7 Routings that may be flight planned and operated through NAT MNPS Airspace by aircraft without functioning HF Communications equipment may be limited by the State of Registry of the operator or by the ATC Provider. This is discussed above in more detail at paragraph 4.2.12.

16.3 Route Planning

Lateral separation minima & resulting route definition conventions

16.3.1 In the North Atlantic MNPS Airspace the lateral separation standard is 60 NM. Since 60 NM is equivalent to one degree of latitude along any meridian and given that the vast majority of flights through this airspace are generally eastbound or westbound, this standard is deemed to be met by tracks separated by one degree of latitude at common meridians.

16.3.2 Radar/ADS-B data is only available in very limited areas of the North Atlantic Region. Therefore, ATC must depend upon aircraft supplied position reports for flight progress information. In order to provide separation assurance, ATC requires updates on the progress of flights at no more than hourly intervals. It has been determined that this criteria is met over a wide range of ground speeds if eastbound or westbound NAT flights report on passing each ten degrees of longitude. The criteria is also met by northbound or southbound flights reporting on passing each five degrees of latitude. In consequence, all flights which will generally route in an eastbound or westbound direction should normally be flight planned by specifying significant points at whole degrees of latitude at each crossed ten degrees of longitude (20°W, 30°W, 40°W etc.); and all generally northbound or southbound flights should normally be flight planned so that specified parallels of latitude spaced at five degree intervals (65°N, 60°N, 55°N etc.) are crossed at whole degrees of longitude. (N.B. North of 70°N the east/west distance between successive ten degree longitudes is less than 200 NM, or approximately 25 mins flight time. Consequently, eastbound/westbound NAT routings north of 70°N need only be defined by significant points at each twenty degrees of longitude (i.e at 0°W, 20°W, 40°W, 60°W)).

OTS – Rationale, Structure, CDM & Track Message

16.3.3 As a result of passenger demand, time zone differences and airport noise restrictions, much of the North Atlantic (NAT) air traffic contributes to two major alternating 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 crossing the 30W longitude between 1130 UTC and 1900 UTC and peak eastbound traffic crossing the 30W longitude between 0100 UTC and 0800 UTC.

16.3.4 The NAT MNPS Airspace is consequently congested at peak hours and in order to provide the best service to the bulk of the traffic, a system of organised tracks is constructed to accommodate as many flights as possible within the major flows, on or close to their minimum time tracks and altitude profiles. Due to the energetic nature of the NAT weather patterns, including the presence of jet streams,

consecutive eastbound and westbound minimum time tracks are seldom identical. The creation of a different organised track system is therefore necessary for each of the major flows. Separate Organised Track System (OTS) structures are therefore published each day for eastbound and westbound flows.

16.3.5 The construction of these OTS structures is accomplished through a formal process of cooperation between ATC and the operators. Details of this process are explained in Section 2.2 above. The resulting structures are published (twice each day) in the form of a “NAT Track Message” via the AFTN. This Message and its correct interpretation are detailed above in Section 2.3 and examples are shown at the end of Chapter 2.

16.3.6 If orientation/location of the published OTS structure appear to be appropriate for the origin and destination of a particular flight, then the operator is encouraged to flight plan the NAT route segment via one of the published tracks. Currently about half of NAT flights utilise the OTS.

Random Routings

16.3.7 Use of OTS tracks is not mandatory. The orientation/location of the published OTS may not be appropriate for the origin and/or destination of a particular flight. A NAT route segment that does not follow a published OTS track, in its entirety, is known as a “Random Route”. Aircraft may fly on random routes which remain clear of the OTS or may fly on any route that joins or leaves an outer track of the OTS. There is also nothing to prevent an operator from planning a route which crosses the OTS. However, in this case, operators must be aware that whilst ATC will make every effort to clear random traffic across the OTS at published levels, re-routes or significant changes in flight level from those planned are very likely to be necessary during most of the OTS peak traffic periods.

16.3.8 Outside of the OTS periods operators may flight plan any random routing, except that during the hour prior to each OTS period some additional restrictions apply. These are detailed in Section 4.1.6 above.

Adjacent Airspace, Route Structures, Links & Constraints

16.3.9 A large majority of flights through the NAT MNPS Airspace enter and/or leave it via the European and/or North American Regions. To facilitate these busy flows of traffic, various transitional airspaces and linking route structures have been established in and through the adjacent EUR and NAM areas. These are described in Chapter 3 above. Of particular significance are the NAR, NER, NOROTS and the US East Coast Link Route structures. Details of these routes and their associated procedures are contained in the AIS of the relevant authorities and/or via their websites. The necessary Internet Links to obtain this information are listed above in Chapter 3. Account must be taken of these route structures in planning any flight through the NAT Region that starts or ends in either or both of the European and North American Regions.

16.4 Altitude & Speed

Flight Levels

16.4.1 During the OTS Periods (eastbound 0100-0800 UTC, westbound 1130-1900 UTC) aircraft intending to follow an OTS Track for its entire length may plan at any of the levels as published for that track on the relevant current daily OTS Message. Aircraft following a “random route” (see above definition) or flying outside the OTS time periods, should normally be planned at flight level(s) appropriate to the direction of flight. (*Note: “Appropriate Direction Levels” within the NAT MNPSA are specified by the Semi-circular Rule Per ICAO Annex 2, Appendix 3, Table a*). Planners should note however that the NAT Provider State AIPs specify some exceptions to use of “Appropriate Direction Levels” both during the OTS

time periods and outside them. At specified times, some appropriate direction levels are in fact reserved for use by the opposite direction traffic flows that then predominate. The current usage allocation of flight levels in the NAT MNPSA is published in the UK and Canadian AIPs and shown at Attachment 6 as the NAT Flight Level Allocation Scheme (FLAS). Hence, pilots and planners should always consult the current AIPs and any supporting NOTAMs when flight planning random routes through NAT MNPS Airspace. If a flight is expected to be level critical, operators should contact the initial OAC prior to filing of the flight plan to determine the likely availability of specific flight levels.

Mach Number

16.4.2 In NAT MNPS Airspace the Mach Number technique is used to manage longitudinal separations between aircraft following the same track. Chapter 7 above provides more detailed information. Consequently, flight plans for the NAT MNPS segment of flight must define aircraft speed in terms of a Mach Number. This is true even if procedures dictate that aircraft speed be defined in terms of TAS for other (continental airspace) segments of that same flight. Oceanic clearances include a True Mach Number to follow and because this is used by ATC to regulate longitudinal separations, no tolerance is permissible. Consequently, NAT flights should **not** be planned or flown on the assumption that LRC or ECON fuel regimes may be used.

16.5 ATC FPL Completion

16.5.1 It is important that all of the foregoing conventions and protocols are adhered to when planning a flight through NAT MNPS Airspace. Summarised guidance on the flight planning requirements for specific routes is given above at Paragraph 4.2. Correct completion and addressing of the filed ATC flight plan is extremely important. Non-observance of any of the foregoing NAT MNPS Airspace planning principles, or even simple syntax errors in the filed FPL, can lead to delays in data processing and/or to the subsequent issuing of clearances to the flights concerned. Despite the growing use of automated flight planning systems a significant proportion of ATC Flight Plans submitted in respect of flights through the North Atlantic Region continue to contain errors. In some instances these errors are such that the Flight Plan is rejected and the Operator is required to re-submit a corrected version. Full and detailed explanations of how to complete an ATC Flight Plan in respect of the NAT portion of a flight are shown at Attachment 4. This document highlights the more common completion errors that are made and includes example, correctly-completed-ICAO Flight Plans. New and/or infrequent North Atlantic operators are earnestly recommended to make diligent reference to this document. Furthermore it should be noted that a free text editor is available on the Eurocontrol website that can validate any proposed ICAO flight plan before filing. It will advise if a flight plan is acceptable for routes, altitudes and transitions. If the flight plan would be rejected, this editor will describe what is wrong, thereby allowing the operator to repair it before filing.

16.5.2 If filing via an OTS track, particularly during peak traffic periods, it must be appreciated that ATC may not be able to clear the aircraft as planned. ATC will, if possible, first offer a clearance on the planned track but at a different Flight Level. If, however, no reasonable alternative level is available, or if the offered Flight Level is unacceptable to the pilot, then ATC will clear the aircraft via another OTS track. When filing the ATC Flight Plan, the Dispatcher may enter the details of such an acceptable alternative track in Field 18 of the ICAO FPL. This will be taken into account by ATC if indeed having to clear the aircraft via a route other than that planned.

16.5.3 In order to signify that a flight is approved to operate in NAT MNPS Airspace, the letter 'X' shall be inserted, in addition to the letter 'S', within Item 10 of the flight plan. A 'W' must also be included in Item 10 to indicate that the flight is approved for RVSM operations.

16.5.4 For flights which also intend to operate through the WATRS Plus Airspace RNP-10 or RNP-4 approval is required in order to benefit from 50NM lateral separation employed here. Any MNPSA aircraft

intending to also fly in this WATRS Plus airspace should ensure that its RNP approval status is included in the flight plan. In field 18 this should be annotated as NAV/RNP10 or NAV/RNP4 (see paragraph 4.1.12).

16.6 Dispatch Functions

General

16.6.1 All US FAR Part 121 carriers (domestic and flag operators) and many non-US carriers employ aircraft dispatchers or flight operations officers (hereafter referred to as dispatchers) to provide flight planning, flight watch and/or flight monitoring services. Most of the information presented here is included in other chapters of this manual but since this chapter deals with issues primarily important to dispatchers, the information is sometimes repeated here for emphasis and additional guidance.

16.6.2 Nothing in this chapter should be construed as to take precedence over appropriate government regulations or individual company policy.

16.6.3 The dispatcher is responsible for providing the pilot-in-command with information necessary to conduct a flight safely and legally under appropriate State civil aviation authority regulatory requirements. ICAO Annex 6 defines the requirement for an en route aircraft, but when operating under US FAR Part 121 or/and certain other State civil aviation rules, the dispatcher shares responsibility for exercising operational control with the pilot-in-command of the flight. A successful flight will always start with an intelligent, informed and conservative plan.

Flight Planning

Route Planning

16.6.4 The daily published OTS tracks provide near to optimum NAT segment routings for about half of all the flights between Europe and North America. For many other flights the location of the OTS structure on the day may constrain available random routings. Consequently, the development of a successful NAT flight plan almost always requires consideration of the detail of the relevant OTS structure. Operators can influence the OTS construction process by providing Preferred Route Messages and participating in this collaborative decision making (See Chapter 2, paragraphs 2.2.3 and 2.2.4).

16.6.5 The eastbound and westbound OTS structures are the subject of separate “NAT Track Messages” published via the AFTN. A detailed description of the NAT Track message is provided in Chapter 2.

Planning on an OTS Track

16.6.6 Dispatchers must pay particular attention to defined co-ordinates, domestic entry and exit routings, allowable altitudes, Track message identification number (TMI) and any other information included in the remarks section. They must also take care to be apprised of any amendments or corrections that may be subsequently issued. When such amendments are issued the TMI is appended with an alpha suffix (e.g. “123A”). Since track messages are often manually entered into company flight planning systems, dispatchers should verify that all waypoints on flight plans comply with the current OTS message.

- It is important for dispatchers to understand that transition routes specified in the NAT Track message are as important as the tracks themselves. The transition route systems in Europe – the North Atlantic European Routing Scheme (NERS) and in North America – the North American Routes (NARs) and the Northern Organised Track System (NOROTS) and the US East Coast routes are described in Chapter 3. Dispatchers should comply with any specified transition

route requirements in all regions. Failure to comply may result in rejected flight plans, lengthy delays and operating penalties such as in-flight re-routes and/or the flight not receiving requested altitudes.

- If (and only if) the flight is planned to operate along the entire length of one of the organized tracks, from oceanic entry point to oceanic exit point, as detailed in the NAT track message, should the intended track be defined in Item 15 of the ICAO flight plan using the abbreviation "NAT" followed by the code letter assigned to the track.
- The planned Mach number and flight level at the commencement point of the track should be specified at the organised track commencement point.
- Each point at which a change of Mach Number or flight level is requested must be specified as geographical co-ordinates in latitude and longitude or as a named point.
- For flights operating along the entire length of an OTS track, estimated elapsed times (EET/ in Item 18) are only required for the commencement point of the track and for FIR boundaries.

Planning a Random Route

16.6.7 A Random route is any route that is not planned to operate along the entire length of the organised track from oceanic entry point to oceanic exit point.

16.6.8 A Random route is described as follows : -

- For generally East/West flights south of 70N, by significant points formed by the intersection of half or whole degrees of latitude with meridians spaced at intervals of 10 degrees from Greenwich meridian to longitude 70 degrees West.
- For generally East/West flights north on 70N, by significant points formed by the intersection of parallels of latitude expressed in degrees and minutes with meridians spaced at intervals of 20 degrees from the Greenwich meridian to longitude 60 degrees West.
- For generally North/South flights, formed by the intersection of half or whole degrees of longitude with specified parallels of latitude which are separated at 5 degrees interval from 20 degrees North to 90 degrees North.

16.6.9 Random routes can be planned anywhere within MNPS Airspace but the dispatcher should sensibly avoid those routes that conflict directly with the OTS. Examples of sensibly planned random routes include routes that:

- Remain clear of the OTS by at least 1 deg;
- Leave or join outer tracks of the OTS;
- Are above or below the OTS flight level stratum;
- Are planned on track co-ordinates before/after valid OTS times.

16.6.10 Care should be taken when planning random routes and it would be prudent to plan sufficient fuel to allow for potential re-routes or non-optimum altitudes. The following examples illustrate particular issues to consider.

Examples:

- Flights planned to initially operate below MNPS Airspace/RVSM flight levels at FL280 on routes that pass under the OTS should not plan to climb until 1 degree clear of the OTS.
- Planning to join an outer track is allowable. However, the dispatcher should be aware that the clearance may not be given due to the adverse impact on track capacity. Leaving an outer track

is seldom a problem as long as at least 1 degree of separation is subsequently maintained from other tracks.

- Random routes paralleling the OTS 1 or 2 degrees north or south can be as busy as the OTS itself.

16.6.11 Dispatchers planning NAT flights originating in south Florida or the Caribbean should consider the effect of traffic from South America operating north eastwards to the USA, when deciding on flight levels. Although the dispatcher should plan optimum flight levels, adequate fuel should be carried so that a NAT flight can accept a lower altitude (FL260 or FL280) until east of 70 °W.

16.6.12 Any flight planning to leave an OTS track after the oceanic entry point must be treated as a random route. The track letter must not be used to abbreviate the route description.

16.6.13 Flights operated against the peak traffic flows should plan to avoid the opposite direction OTS. Even if operating outside of the validity periods of the OTS some restrictions on routings may apply. These can affect Eastbound traffic crossing 30W at 1030 UTC or later; and Westbound traffic crossing 30W at 2400 UTC and later (See Chapter 4, paragraph 4.1.6). If in any doubt it would be prudent to co-ordinate any such routes directly with appropriate OACs.

Flight Levels

16.6.14 Flight Dispatchers should be aware of the North Atlantic Flight Level Allocation Scheme (FLAS). This is subject to change and the current FLAS is published in the UK and Canadian AIPs and shown at Attachment 6.

16.6.15 Chapters 2 and 4 contain details on RVSM flight level guidance. Since virtually all airspace adjoining MNPS airspace is now RVSM, transition problems are no longer a major issue for ATC or dispatchers. Nevertheless dispatchers should be aware that some “opposite direction” levels, which may be flight planned for the NAT segment of a flight, may not be similarly allowed in adjacent domestic areas. Guidance for RVSM flight procedures in MNPS airspace can be found in Chapter 9 of this Manual.

16.6.16 RVSM allows more flight levels for planning and therefore provides better opportunity to fly closer to an optimum route/profile. As aircraft fly towards their destination they become lighter as fuel on-board is consumed and they are then able to climb to more fuel efficient altitudes. It is acceptable to plan and/or request step climbs within the OTS but because of traffic volumes and the difference in aircraft performance it is wise to plan conservatively. Climbs on random routes that are totally north or south of the track system are more readily approved. If a flight is planned without profiling a climb crews should be encouraged to request a climb as aircraft decreasing weight permits.

Communications

16.6.17 The availability of functioning HF ATS communications is mandatory for flights through the Shanwick OCA. Many States of Registry insist on two functioning long range communications systems for flights in Oceanic or Remote areas. Some States of Registry will allow their operators to substitute SATCOM Voice for one HF system. Dispatchers should ensure that they are fully aware of their State of Registry requirements in this regard. VHF communications (freq 123.45 or 121.5) can be used as to relay air-ground ATS communications as backup in case of en route HF failure.

16.6.18 Many operators now use ADS-C (automatic dependent surveillance) and CPDLC (controller pilot data link communications) for oceanic position reporting and clearance updating. These features improve position reporting speed and accuracy. They also reduce the chance of errors. Advanced registration with the ATS Providers may be required if ADS/CPDLC are to be used in the NAT Region.

MEL Compliance

- a) Dispatchers planning flights within MNPS Airspace must ensure that the allocated aircraft has the minimum required navigation, communications and altitude alerting/reporting equipment on board. Flight procedures for minimum equipment and standards can be found in Chapter 8 and Chapter 11 of this Manual. Particular attention must be paid to MEL Items that may affect the aircraft. Be aware that the company MEL or Operations Specifications may be more restrictive than general MNPS requirements. HF is required for entering the Shanwick OAC. Many airline Operations Specifications require dual HF for operation in Remote or Oceanic airspace, even when aircraft is SATCOM Voice equipped. However some States may permit Dispatch with only one serviceable HF system providing the aircraft is equipped with SATCOM Voice.
- b) Even though a flight, that suffers a failure of a system (or component) once en route, is not directly mandated to abide by MEL restrictions, it is important that any failures that will affect either MNPS or RVSM operations be promptly advised to, and closely co-ordinated with, the appropriate ATS facility.
- c) If an aircraft MEL (navigation, communications or altitude alerting/reporting system) prohibits operations in MNPS airspace it will be necessary to modify an aircraft's originally intended route of flight. An example would be an aircraft not equipped with two Long Range Navigation Systems (or LRNS's that are fully serviceable). This situation could occur before departure or once en route but before entering MNPS Airspace. Options that should be considered by the dispatcher are:

operate above or below MNPS Airspace;

fly on special routes developed for aircraft equipped with limited LRNS equipment – see Chapters 1, paragraph 1.4, Chapter 3, paragraph 3.2 & Chapter 11, paragraph 11.2.

ETOPS/LROPS

16.6.19 A large portion of NAT crossings are ETOPS operations. ETOPS rules require that one or more suitable en route alternate airports are named prior to dispatch and then monitored while aircraft are en route. En route alternate airports in the NAT Region are limited to those in the Azores, Bermuda, Greenland and Iceland. In determining ETOPS alternate minima, the dispatcher must consider weather conditions, airport conditions (in addition to simple runway lengths), navigation approach aids, and the availability of ATS and ARFF facilities.

16.6.20 Recent changes have begun to attach additional conditions to 3-4 engine aircraft long range operations. In situations requiring the aircraft to operate long distances from adequate en route airports, more stringent planning conditions may apply. Guidance can be obtained from appropriate government and industry websites.

CDM TOOLS

16.6.21 It would not be practical to list all available CDM tools and available websites here. Refer to the bibliography at the end of this manual for a more complete list. The following are some of the most important sites for managing the daily operation of flights.

- Nav Canada TDA (Traffic Density Analyser.) Website
This tool was designed to Introduce Collaborative Decision Making during the NAT OTS design phase. The OTS are posted in advance of formal publication so the user community can comment on whether or not they agree with the proposed OTS. A USER ID and Password can be obtained from

NAV CANADA. Track Loading Information is available and it is possible to view all filed Flight Plans on the OTS and random routes.

- Eurocontrol CFMU (Central Flow Management Unit) Website
This website contains a wealth of tactical information regarding restrictions, delays, weather problems, military activity, CDR routes, preferred routing schemes and transition routes.
(http://www.cfm.eurocontrol.int/cfm/public/subsite_homepage/homepage.html)
There is a free text editor that will validate ICAO flight plan before filing and advise if the flight plan is acceptable for routes, altitudes and transitions. If the flight plan would be rejected, this editor will describe what is wrong, allowing the dispatcher to repair it before filing the ICAO flight plan.
- FAA Websites
These websites contain complete FAR section, Airport information, airport capacity (real time) advisories with airport delays and status, NOTAMS, weather Information, RVSM and statistical data. They include www.faa.gov and www.fly.faa.gov. Also for CDM participants, the Air Traffic Control System Command Center intranet site, www.atcsc.faa.gov is available.

Flight Monitoring

Oceanic ATC Clearances

16.6.22 The Pilot can obtain Oceanic clearances by VHF, HF, domestic ATC agencies or data link. Chapter 5 of this manual can be referenced for complete oceanic clearance requirements. Be aware that for airports located close to oceanic boundaries (Prestwick, Shannon, Glasgow, Dublin, Belfast, Bristol, Edinburgh, Gander, Goose Bay and St Johns, etc.) oceanic clearances must be obtained before departure. Indeed on the east side of the NAT this will apply to departures from all Irish airfields, all UK airfields west of 2 degrees 30 minutes West and all French Airfields west of 0 degrees longitude. Oceanic Clearances for controlled flights leaving airports within the region (e.g airports in Iceland, Greenland or the Azores) are issued by the relevant ATS unit prior to departure.

16.6.23 It is important for dispatchers to verify the contents of the oceanic clearance and check it against the filed route. If the flight has received a re-route or a different altitude the Dispatcher may provide the flight with re-analysis data for fuel consumption along the revised route.

Transponder Use

16.6.24 All aircraft flying in MNPS Airspace will set their transponders as follows:

16.6.25 Thirty minutes after oceanic entry crews should Squawk 2000, if applicable. There may be regional differences such as maintaining last assigned Squawk in the West Atlantic Route System (WATRS). Crews transiting Reykjavik's airspace must maintain last assigned Squawk until advised by ATC.

Re-Routes.

16.6.26 When traffic exceeds track capacity, ATS providers may not be able to accommodate a flight's filed altitude or routing. A different flight level on the planned route will be offered as the first option. If this is not possible, ATC will offer an alternative route that may be stated in Field 18 of the ICAO flight plan. On an eastbound flight the pilot should anticipate a preferred route within the domestic route structure appropriate to the oceanic exit point of the re-route. For westbound flights into Canada, ATC will normally attempt to route the flight back to its original route unless the crew requests a new domestic routing. Many operators attach secondary flight plans on adjacent tracks that will include the preferred domestic routings. This will help flight crews evaluate and more quickly adjust when re-route situations are required.

En route Contingencies

16.6.27 Dispatchers must also be aware of special procedures for In-Flight contingencies as published in Chapter 12 of this manual. They include procedures for use in the event that the aircraft is unable to maintain assigned altitude for weather, turbulence, aircraft performance or maintenance problems or loss of pressurization. The general concept of the in-flight contingency procedures is to offset from the assigned track by 15 NM and climb or descend to a level differing from those normally used by 500 ft if below FL410 or 1000 ft if above FL410.

16.6.28 Procedures for loss of communications and HF failure are contained in Chapter 6 at paragraphs 6.6 of this manual.

Dispatcher guidance for NAT RVSM operations.

References

16.6.29 The FAA Guidance AC91-85 was developed by ICAO sponsored international working groups, to provide guidance on airworthiness and operations programmes for RVSM. ICAO has recommended that State CAA's use FAA Guidance AC91-85 or an equivalent State document for approval of aircraft and operators to conduct RVSM operations. Appendices 4 and 5 of AC91-85 contain practices and procedures for pilots and dispatchers involved in RVSM operations. This particular dispatcher guidance was developed using those appendices as the reference. This document is available at http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/rvsm/

Flight Planning

NAT RVSM Airspace

This is defined as any airspace between FL 285 - FL 420 where 1,000 ft vertical separation is applied (i.e. FLs 290 thru 410 inclusive).

Limits of Operational Authorisation

At the flight planning stage, the dispatcher is responsible for selecting and filing a route that is consistent with the carrier's operational authorisation (e.g. Operations Specifications), taking account of all route, aircraft and weather considerations, crew constraints and other limitations.

MEL

When planning and filing to fly within NAT RVSM airspace, the dispatcher must ensure that the route meets the requirements of the paragraph above and that the aircraft also meets certain MEL provisions.

TCAS (Traffic Collision Avoidance System)/ACAS (Airborne Collision Avoidance System)

Aircraft operating in the MNPS are required to have TCAS/ACAS installed. However, MEL relief is provided for inoperative TCAS/ACAS, for dispatch into MNPS Airspace. TCAS/ACAS improves operational safety by enhancing pilot situational awareness and by providing a system for collision avoidance – particularly in densely populated airspace.

Note: For flights in the North Atlantic Region ACAS II (TCAS Version 7.0) has been mandated as a requirement since January 1, 2005 for all aircraft having more than 19 seats or a certified take-off mass of more than 5,700 Kgs. (Other standards may be in effect in other parts of the world) However, there are provisions for MEL relief.

Maintenance Flights

NAT ATS providers have established a policy to enable an aircraft that is temporarily non-RVSM compliant to fly in NAT RVSM Airspace for the purpose of positioning the aircraft at a maintenance facility (see Chapter 1 in this Manual). This policy may vary and requires prior co-ordination with appropriate ATC centres so that 2,000 ft separation can be applied between the non-compliant aircraft and other aircraft. These requests must be co-ordinated with each individual OAC. The dispatcher must be aware of the policy for such operations, as published in NOTAMS, AIPs and other appropriate documents. States of Registry also vary in their policies on Maintenance Ferry Flights. Dispatchers should ensure that they fully understand any additional restrictions or limitations that may be imposed by their State of Registry.

Delivery and Humanitarian Flights

ATS Providers allow limited operations by aircraft not approved for RVSM but which are engaged on delivery or humanitarian flights. For such flights, the dispatcher must also comply with the policies published in State AIPs, NOTAMS and other appropriate documents. Co-ordinate directly with appropriate ATC facilities and the aircraft's State of Registry.

En route Equipage Failures

Prior to entering NAT RVSM Airspace

The following equipment is required to be operational:

- i) two independent primary altimetry systems;
- ii) one automatic altitude control system; and
- iii) one altitude alerting device

If any required equipment fails prior to entering NAT RVSM Airspace, the pilot-in-command will notify ATS and obtain a new Oceanic Clearance to fly above or below NAT RVSM Airspace. The pilot should accept the new clearance contingent upon review by the dispatcher. Dispatcher actions are based on the options, identified as OPTION 1 to OPTION 3, outlined later in this chapter.

After entering NAT RVSM Airspace.

The appropriate State RVSM guidance material provides for pilot and controller actions if RVSM required aircraft equipment fails after entry into NAT RVSM Airspace, or the aircraft encounters turbulence that affects the aircraft's ability to maintain its level. Should any required RVSM equipment fail, or turbulence greater than moderate be encountered, then the pilot-in-command is expected to notify ATS of the intended course of action.

Pilot-in-command options are to:

- (1) continue with the original clearance if ATC can apply another form of aircraft separation (i.e. lateral, longitudinal or 2,000 ft vertical separation);
- (2) request ATC clearance to climb above or descend below NAT RVSM Airspace if ATC cannot provide adequate separation from other traffic; or
- (3) execute contingency procedures to offset from track and flight level if ATC cannot provide adequate separation from other aircraft. The pilot-in-command will maintain any offsets until a revised ATC clearance can be obtained.

Dispatcher Actions

OPTION 1 - if the pilot-in-command elects for Option (1) then no Dispatcher action is required.

OPTION 2 - if the pilot-in-command elects to follow Option (2) then the pilot-in-command should contact the dispatcher who will evaluate the clearance with due consideration for the effect on fuel consumption, time en route, any MEL/CDL issues and/or other operational factors. The dispatcher

shall make a recommendation to the pilot-in command on whether to continue on to the destination, or the dispatcher will amend the release to allow the aircraft to proceed to an intermediate airport or return back to the departure airport. The pilot will then either confirm the new clearance with ATC or request a new clearance to another airport. The final decision rests with the pilot-in command.

OPTION 3 - if the pilot-in-command elects to follow Option (3), then when time permits, the pilot-in command will advise the dispatcher of any offset made from track or/and flight level. No action by the dispatcher is required since the effect on performance should be minimal.

Checklist for Aircraft Dispatch into NAT RVSM Airspace.

The dispatcher must:

- i) Determine the minimum and maximum flight levels plus the horizontal boundaries of NAT RVSM Airspace;
- ii) Verify that the airframe is RVSM approved;
- iii) Determine if any operating restrictions (e.g. speed or altitude limitations) apply to the aircraft for RVSM operation;
- iv) Check the MEL for system requirements related to RVSM;
- v) Check Field 10 (Equipment) of the ICAO ATS flight plan to ensure that it correctly reflects RVSM approval status. For North Atlantic operation, insertion of letter “W” indicates that the operator and aircraft are RVSM approved;
- vi) Review reported and forecast weather en route, with specific emphasis on conditions such as turbulence, which may affect an aircraft’s ability to maintain its level; and
- vii) Determine if TCAS/ACAS is operational.

Flight of non-RVSM compliant aircraft

The dispatcher must comply with any ATS requirements regarding flight of non-RVSM compliant aircraft for maintenance, aircraft delivery or humanitarian flights (See Chapter 1, paragraph 1.6.2).

ATTACHMENT 1 - 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, -c/o National Air Traffic Services - Room G41 - Scottish & Oceanic Area Control Centre, Sherwood Road,- Prestwick, Ayrshire - KA9 2NR</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 and Navigation Equipment Fit				
Number Type	INS	GNSS	IRS/FMS	OTHER (please specify)
Single				
Dual				
Triple				
Model No				
Navigation system Programme No				
State which system coupled to autopilot				
Aircraft Registration and Model/Series				

<p>Part 3 – Detailed description of incident</p> <p><i>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)</i></p>													
<p>Part 4 – Only to be completed in the event of Partial or Full Navigation failure</p>													
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

ATTACHMENT 2 - ALTITUDE DEVIATION REPORT FORM**MESSAGE FORMAT FOR A REPORT TO THE CENTRAL MONITORING AGENCY 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 / OTS¹
6. FLIGHT IDENTIFICATION AND TYPE
7. FLIGHT LEVEL ASSIGNED
8. OBSERVED / REPORTED¹ FINAL FLIGHT LEVEL² MODE "C" / PILOT REPORT¹
9. DURATION AT FLIGHT LEVEL
10. CAUSE OF DEVIATION
11. OTHER TRAFFIC
12. CREW COMMENTS WHEN NOTIFIED
13. REMARKS³

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 this form to:

North Atlantic Central Monitoring Agency
c/o National Air Traffic Services
Room G41
Scottish & Oceanic Area Control Centre,
Sherwood Road,
Prestwick, Ayrshire - KA9 2NR

nacma@nats.co.uk

ATTACHMENT 3 - WAKE TURBULENCE REPORT FORM

For use by pilots involved in Wake Vortex incidents which have occurred in NAT MNPS Airspace.

This information is requested by the North Atlantic Central Monitoring Agency and will be forwarded for inclusion in the UK National Air Traffic Services Limited Wake Vortex database.

SECTION A

DATE OF OCCURRENCE	TIME (UTC) *DAY/NIGHT	OPERATOR	FLIGHT NUMBER
AIRCRAFT TYPE & SERIES		REGISTRATION	AIRCRAFT WEIGHT (KG)
ORIGIN & DESTINATION	POSITION IN LAT & LONG	CLEARED TRACK CO-ORDINATES	
FLIGHT LEVEL	SPEED/MACH NBR.	FLIGHT PHASE: *CRUISE/CLIMB/DESCENT	WERE YOU TURNING? *YES/NO
DID YOU APPLY A TRACK OFFSET? *YES/NO	SIZE OF TRACK OFFSET? Nautical Miles	WAS ATC INFORMED? *YES/NO	
MET CONDITIONS IMC VMC	ACTUAL WEATHER WIND VISIBILITY CLOUD TEMPERATURE / km / °C	DEGREE OF TURBULENCE *LIGHT/MODERATE/SEVERE	
OTHER SIGNIFICANT WEATHER?			

(*Circle the appropriate reply only)

SECTION B

- 1 What made you suspect Wake Vortex as the cause of the disturbance? _____

- 2 Did you experience vertical acceleration? *YES/NO
If YES please describe briefly _____

- 3 What was the change in attitude? (please estimate angle)
Pitch _____° Roll _____° Yaw _____°
- 4 What was the change in height if any? _____ *INCREASE/DECREASE

5 Was there buffeting? *YES/NO

6 Was there stick shake? *YES/NO

7 Was the Autopilot engaged? *YES/NO

8 Was the Auto throttle engaged? *YES/NO

9 What control action was taken?

Please describe briefly _____

10 Could you see the aircraft suspected of causing the wake vortex? *YES/NO

11 Did you contact the aircraft suspected of causing the vortex? *YES/NO

12 Was the aircraft suspected of causing the vortex detected by TCAS? *YES/NO

If YES to any of questions 10 to 12, what type of aircraft was it? _____

_____ and where was it relative to your position? _____

(Estimated separation distance) _____

Were you aware of the preceding aircraft before the incident? *YES/NO

OTHER INFORMATION

13 Have you any other comments that you think may be useful? _____

Signed _____

Name (BLOCK CAPITALS) _____ DATE _____

(*Circle the appropriate reply only)

When complete send this form to: North Atlantic Central Monitoring Agency
c/o National Air Traffic Services
Room G41
Scottish & Oceanic Area Control Centre,
Sherwood Road,
Prestwick, Ayrshire - KA9 2NR

natcma@nats.co.uk

ATTACHMENT 4 – ICAO FPL COMPLETION FOR A NAT FLIGHT**1. Introduction**

This document outlines the requirements and procedures necessary for the correct filing of flight plans for flights operating in the North Atlantic Region. It includes examples of the more common errors which lead to a failure of automatic processing of these flight plans. Information is also provided on the availability of Flight Levels at various times.

This document is for guidance only and must be read in conjunction with the following publications, which detail the regulatory material relating to North Atlantic aircraft operations:

ICAO PANS/ATM (DOC 4444).

ICAO Regional Supplementary Procedures (DOC 7030/4).

UK CAP 694 – “The UK Flight Plan Guide”.

Relevant parts of State Aeronautical Information Publications (AIP) and Aeronautical Information Circulars (AIC).

2. General**2.1 General Principles**

(a) USE BLOCK CAPITALS;

(b) Adhere to the prescribed formats and manner of specifying data;

(c) Insert all clock times and estimated elapsed times, in hours and minutes, as four figures, UTC, or as six digits if including the date;

(d) Shaded areas preceding Item 3 to be completed by ATS and COM services;

Fields 3 to 19 to be completed only as indicated below.

3. Instructions for the Completion of the Flight Plan Message**3.1 Message Envelope:**

The Message Envelope is that part of the flight plan outside the open and close brackets. It should not contain any information other than the Annex 10 message header and optional extra addresses (for IFPS, see below). Any other information inserted into the message envelope will invalidate the entire message and prevent its correct processing.

Message addressing

Flight plans for flights operating to or from the IFPS zone in Europe should be filed with IFPS, not the individual NAT centres. However, with the exception of the Santa Maria FIR and Bodö FIR, the NAT region lies outside the IFPS zone. When submitting flight plans for trans-Atlantic flights to IFPS, operators should therefore specify the relevant NAT centre(s) using the IFPS "extra address" feature. Note that flight plans for flights not entering the IFPS zone will not be accepted by IFPS and should therefore be sent directly to the relevant centre(s).

3.2 General Message Content

The letter “O” and the digit “0” are not interchangeable. Inappropriate use of these characters will prevent the correct processing of the flight plan.

The line length must not exceed 69 character columns. Lines exceeding the Annex 10 maximum of 69 columns are invariably broken at that position by intervening AFTN communication centres, without any regard for content, causing the creation of unintelligible fragments.

3.3 Field 3: Message Type

To be completed when the responsibility for originating flight plan messages has been delegated.

For filing of subsequent flight plans use either the “modification” (CHG) or “cancellation” (CNL) format as outlined in ICAO DOC 4444.

Common Error:

It is common for CNL messages to be received without a subsequent FPL message. This is equivalent to having received no flight plan at all. If an Airline Operator still intends to operate the flight, another FPL must be sent.

Also note that there is no guarantee messages are received in the same order they are transmitted. If a CNL (referring to a previous FPL) is sent and immediately followed by a new FPL it is quite possible that the FPL arrives first and is then immediately cancelled by the delayed CNL.

Creative use of time stamps does not help, it is the arrival sequence rather than the time stamp that determines how messages are processed. It is therefore recommended that a few minutes be allowed to elapse between the CNL and a subsequent FPL.

Another common error occurs when using CHG messages. Transmitting only those parts of a field that have changed is not acceptable because the new field will replace the entire contents of that field in the original message.

3.4 Field 7: Aircraft Identification (ACID)

One of the following ACIDs must be included:

- (a) The registration marking of the aircraft (e.g. EIAKO, 4XBCD, N2567GA)
- (b) The ICAO designator for the aircraft operating agency followed by the flight identification (e.g. KLM511, NGA213).
- (c) The call sign determined by the military authorities if this will be used to identify the aircraft during flight.

Common Errors:

The ACID must not exceed 7 characters. An ACID of more than 7 characters will invalidate the message. Furthermore it will be impossible to manually correct the data as computer systems are only designed to handle the ICAO stipulated maximum of 7 digit aircraft identification strings.

The hyphen, often used in the graphical representation of aircraft registration, is also used as the field separator in all flight related ICAO messages and so must not be used in the flight plan ACID.

All-numeric ACIDs must be avoided. Even when the registration of a military flight is all numeric it is expected to be preceded by the operating agency descriptor assigned to the military operator in question.

3.5 Field 8: Flight Rules and Type of Flight

Flight Rules

Insert one of the following letters to denote the category of flight rules with which the pilot intends to comply:

- | | |
|---|---------|
| I | if IFR; |
| V | if VFR; |

Y	if IFR first
Z	if VFR first

Specify in item 15 the point(s) where the change of flight rules is planned.

Type of Flight

Insert one of the following letters to denote the type of flight:

S	if Scheduled Air Service;
N	if Non-scheduled Air Transport Operation;
G	if General Aviation;
M	if Military;
X	if the type of flight does not match any of the predefined categories.

Common Error:

It is imperative that the letter 'X' is used when the type of flight does not match any of the predefined categories. Failure to do so causes the message to fail processing.

3.6 Field 9: Number and Type of Aircraft and Wake Turbulence category

Number of Aircraft

Insert the number of aircraft only when that number exceeds one, using two digits (e.g. 03).

Type of Aircraft

Insert the appropriate designator as specified in ICAO DOC 8643 – “Aircraft Type Designators”,

OR

If no designator has been allocated insert ZZZZ and specify in Item 18 the type of aircraft, using the “TYP/...” sub-field and free text.

OR

In the case of flight plans covering more than one aircraft type, insert ZZZZ and specify in Item 18 the types of aircraft using the “TYP/...” sub-field with the format used in Item 9 (e.g. TYP/02F18 KC135).

Common Errors:

Including the number of aircraft as 1 or 01. ICAO DOCs clearly state that the number of aircraft shall only be specified when there are more than 1.

Inserting a space between the number and type of aircraft. The correct format is to specify the number and type as a single group, any intervening blanks will cause a syntax error.

Wake Turbulence Category

Insert an oblique stroke followed by one of the following letters to indicate the wake turbulence category of the aircraft:

H	HEAVY, to indicate an aircraft type with a maximum certificated take-off weight of 136 000 kg (300 000 lb) or more;
M	MEDIUM, to indicate an aircraft type with a maximum certificated take-off weight of less than 136 000 kg (300 000 lb) but more than 7 000 kg (15 500 lb);
L	LIGHT, to indicate an aircraft type with a maximum certificated take-off weight of 7 000 kg (15 500 lb) or less.

3.7 Field 10: Equipment

Radio Communication, Navigation and Approach Equipment

Preceding the oblique stroke insert one or more of the following letters as appropriate:

N if no COM/NAV/Approach aid equipment for the route to be flown is carried, or if the equipment is unserviceable;

OR

S if the prescribed COM/NAV/Approach aid equipment for the route to be flown is carried and is serviceable;

AND/OR

D DME;
 F ADF;
 G GNSS;
 H HF RTF;
 I Inertial Navigation;
 J Data Link (see note i);
 K MLS;
 L ILS;
 O VOR;
 R RNP type certification;
 T TACAN;
 U UHF RTF;
 V VHF RTF;
 W RVSM certified;
 X MNPS certified;
 Y Radio with 8.33 kHz spacing;
 Z Other equipment carried (see note ii).

Notes:

- The definition of “prescribed equipment” allowing the use of the letter “S” (“standard”) is the carriage of the equipment represented by the letters “V”, “F”, “O” and “L”.
- If the letter “J” is used, specify the equipment carried in Item 18 with DAT/ followed by one or more of the following letters:
 - H HF;
 - M Mode S;
 - S Satellite;
 - V VHF.
- If the letter “Z” is used, specify the other equipment carried in field 18, preceded by COM/ and/or NAV/ as appropriate.
- If an aircraft is suitably equipped, the letters “W” and “X” must be included, even if the FPL is for a flight which does not penetrate RVSM and/or MNPS airspace.

SSR Equipment

Following the oblique stroke insert one of the following letters to describe the serviceable SSR equipment carried:

N	Nil;
A	Transponder – Mode A – 4096 Codes;
C	Transponder – Mode A – 4096 Codes and Mode C;
I	Transponder – Mode S with aircraft identification transmission but without pressure altitude transmission;
P	Transponder – Mode S with pressure altitude transmission but without aircraft identification transmission;
S	Transponder – Mode S with both aircraft identification and pressure altitude transmission;
X	Transponder – Mode S without pressure altitude transmission and without aircraft identification transmission.

Note:

Aircraft capable of establishing ADS contracts should indicate this by the use of the additional letter D, regardless of whether the capability represents the ICAO SARPS-compliant ATN-based version or a FANS-1/A implementation.

Common Errors

The filing of correct and complete NAV codes in Fields 10 and 18 is important. Within the NAT Region some procedures and separation standards employed by ATC depend upon ATC's knowledge of the equipment and/or the approval status of individual aircraft/crew. The following errors in completing these fields have been noted. These errors create difficulties for ATC and can result in unnecessary penalties or unachieved benefits for the flights involved.

- The filing of only a "G" or "I" rather than filing both when the aircraft is so equipped.
- The filing of only a "R" and not filing any NAV codes for detailing the actual equipment.
- The filing of a "Z" with no further explanation and either not expanding in Field 18 or putting information in Field 18 that is irrelevant to oceanic operations (e.g. RNP-5).

3.8 Field 13: Departure aerodrome and time

Insert the ICAO four-letter location indicator of the aerodrome of departure and, without a space, the estimated off-block time.

Note:

If no location indicator has been assigned, use ZZZZ and insert in Item 18 the group DEP/ followed immediately by the name of the aerodrome.

3.9 Field 15: Route

This field starts with the initial cruising speed and level. The basic structure of the field following this group consists of a sequence of entries, each of which contains a route (or the text "DCT" to signal a direct routing) and a fix. In addition, a diagonal slash and a new speed/level group can be appended to a fix.

Exceptions to this simple structure are:

- a) The route part may be omitted from the first entry.
- b) The route part may be omitted between points encoded as geographic coordinate.
- c) The fix part may be omitted from the last entry.

The following example shows a typical route broken down into such entries:

```

>___ GELKI<                               (note a)
>UP600 GOW/N0473F360<
>UN615 STN<
>UN601 AKIVO<
>UP60 ATSIX/M081F360<
>DCT 62N020W<
>___ 63N030W<                             (note b)
>___ 63N040W<                             (note b)
>___ 62N050W<                             (note b)
>___ 62N060W<                             (note b)
>DCT TANTI/N0467F380<
>DCT FEDDY<
>SCAI 5321N09000W/N0459F390<
>SCAI YRL/N0338F160<
>V304 VBI/N0466F410<
>J538 DLH<
>J89 BAE<
>V63 JVL<
>JVL4 ___<                               (note c)

```

It will be obvious from this description that listing routes without an intervening fix is an error, so is a sequence of fixes without either a route or the text “DCT” connecting them (except as per c) above) – or indeed any text that doesn’t adhere to this format.

Requirements for Flight Plans on Random Route Segments at or South of 070N

Turbo-jet aircraft should indicate their proposed speeds in the following sequence:

- a) Cruising speed (TAS) in knots;
- b) North Atlantic Airspace oceanic entry point and cruising Mach number;
- c) North Atlantic Airspace oceanic exit point and cruising speed (TAS) in knots.

All other aircraft should indicate their proposed speeds in terms of TAS in knots.

Flight level for ocean entry should be specified at either the last domestic reporting point prior to ocean entry or when at the Oceanic Control Area (OCA) boundary.

The oceanic route of flight should be specified in terms of the following significant points:

- a) Last domestic reporting point prior to the OCA boundary;
- b) Oceanic entry point (only required by the Shanwick, New York, and Santa Maria Oceanic Area Control Centres (OACCs));
- c) Significant points formed by the intersection of half or whole degrees of latitude with meridians spaced at intervals of 10 degrees from the Greenwich meridian to longitude 070W;

- d) Oceanic exit point (only required by the Shanwick, New York and Santa Maria OACCs);
- e) First domestic reporting point after the ocean exit

Note:

Each point at which either a change in speed and/or level is requested must be specified and followed in each case by the next significant point.

Requirements for Flight Plans on Organised Track System (OTS) South of 070N

Insert speed in terms of Mach number at commencement point of OTS.

Insert flight level requested at commencement point of OTS.

Insert the abbreviation “NAT” followed, without a space, by the code letter assigned to the track if, and only if, the flight is planned to operate along the whole length of one of the organised tracks as detailed in the NAT track message.

Notes:

- *Flights wishing to join or leave an organised track, or change from one organised track to another, at some intermediate point are considered to be random route aircraft and full details must be specified in the flight plan. The track letter should not be used to abbreviate any portion of the route in these circumstances.*
- *Each point at which either a change in speed and/or level is requested must be specified as geographical co-ordinates in latitude and longitude, or as a named waypoint.*

Requirements for Flight Plans on Random Route Segments North of 070N

As above, except that:

Significant points shall be expressed in terms of meridians spaced at intervals of 20 degrees from the Greenwich meridian to longitude 060W (e.g. 000W, 020W, 040W, 060W);

Requirements for Flight Plans Predominantly North/South or South/North

Insert speed in terms of Mach number for turbo-jet aircraft, and TAS in knots for all other aircraft.

The speed is to be specified at either the last domestic reporting point prior to ocean entry or the oceanic entry point.

Insert the flight level for ocean entry, specified at either the last domestic reporting point prior to ocean entry or the oceanic entry point.

Insert the route of the flight described in terms of the following significant points:

- i) Last domestic reporting point prior to ocean entry;
- ii) Oceanic entry point (only required by the Shanwick, New York and Santa Maria OACCs);
- iii) Significant points formed by the intersection of whole degrees of longitude with specified parallels of latitude which are spaced at 5 degree intervals from 20N to 90N;
- iv) Oceanic exit point (only required by the Shanwick, New York and Santa Maria OACCs)
- v) First domestic reporting point after ocean exit.

Note:

Each point at which either a change in speed and/or level is requested must be specified and followed in each case by the next significant point.

Requirements for Flight Plans on NAM/CAR Route Structure

Insert speed in terms of Mach number for turbo-jet aircraft, and TAS in knots for all other aircraft.

The speed is to be specified at the commencement point of the NAM/CAR route structure.

Insert the flight level for oceanic entry point specified at the commencement point of the NAM/CAR route structure.

Insert the route of flight described in terms of NAM/CAR ATS route identifier(s).

Note:

Each point at which either a change in speed and/or level is requested must be specified and followed in each case by the next route segment expressed by the appropriate ATS route identifier(s), or as a named waypoint.

Flights Outside Designated ATS Routes

Insert DCT between successive points unless both points are defined by geographical co-ordinates or by bearing and distance.

USE ONLY the conventions in (1) to (5) below and SEPARATE each sub-item by a SPACE.

- (1) ATS Route (2 to 7 characters)

The coded designator assigned to the route or route segment (e.g. BCN1, B1, R14, UB10, KODAP2A)

- (2) Significant Point (2 to 11 characters)

The coded designator (2 to 5 characters) assigned to the point (e.g. LN, MAY, HADDY)

OR

If no coded designator has been assigned, one of the following ways:

Degrees only (7 characters)

Two figures describing latitude in degrees followed by “N” (North) or “S” (South), followed by three figures describing longitude in degrees followed by “E” (East) or “W” (West). Where necessary make up the correct number of figures by insertion of zeros (e.g. 46N050W).

Degrees and minutes (11 characters)

Four figures describing latitude in degrees and tens and units of minutes followed by “N” (North) or “S” (South), followed by five figures describing longitude in degrees and tens and units of minutes followed by “E” (East) or “W” (West). Where necessary make up the correct number of figures by insertion of zeros (e.g. 4620N05005W).

Common Error:

It is often observed that a mixture of the above is used e.g- 46N05461W, 5455N030W. This is not an acceptable format.

Bearing and distance from a navigation aid (9 characters)

The identification of the navigation aid (normally a VOR) in the form of two or three characters, followed by the bearing from the aid in the form of three figures giving degrees magnetic, followed by the distance from the aid in the form of three figures expressing nautical miles.

Where necessary make up the correct number of figures by insertion of zeros (e.g. a point on radial 180 at a distance of 40 NM from VOR “DUB” should be expressed as DUB180040).

Change of Speed or Level (maximum 21 characters)

The point at which a change of speed (5% TAS or 0.01 Mach or more) or a change of level is planned, expressed exactly as in (2) above, followed by an oblique stroke and both the cruising speed and the cruising level, WITHOUT A SPACE BETWEEN THEM, even when only one of those quantities will be changed.

Examples

LN/N0284A045;

MAY/N0305F180;

HADDY/M084F330;

4620N05005W/M082F350.

Note:

“N” = knots; “M” = Mach; “F” = flight level; “A” = altitude in hundreds of feet. (for other expressions of height see ICAO Doc 4444).

Cruise Climb (maximum 28 characters)

The letter C followed by an oblique stroke then the point at which cruise climb is planned to start, expressed exactly as in (2) above, followed by an oblique stroke; then the speed to be maintained during cruise climb followed by the two levels defining the layer to be occupied during cruise climb, or the level at which cruise climb is planned followed by the letters “PLUS”, WITHOUT A SPACE BETWEEN THEM.

Examples

C/48N050W/M082F290F350;

C/48N050W/M082F290PLUS;

3.10 Field 16: Destination Aerodrome and Total Estimated Elapsed Time, Alternate Aerodrome(s)

Destination Aerodrome and Time (8 characters)

Insert the ICAO four-letter location indicator of the destination aerodrome followed, WITHOUT A SPACE, by the total estimated elapsed time,

OR

If no location indicator has been assigned, insert ZZZZ followed, WITHOUT A SPACE, by the total estimated elapsed time, and specify in Item 18 the name of the aerodrome preceded by DEST/.

Notes:

a) Total Estimated Elapsed Time

- i) For IFR flights this is the total estimated time from take-off until arriving over the designated point from which it is intended that an Instrument Approach Procedure, defined by reference to navigation aids, will commence, or, if no navigation aid is associated with the destination aerodrome, until arriving over the destination aerodrome itself.*
- ii) For VFR flights this is the total estimated time from take-off until arriving over the destination aerodrome.*

- b) *For a flight plan received from an aircraft in flight, total estimated elapsed time starts from the first point of the route to which the flight plan applies.*

Alternate Aerodrome(s) (4 characters)

Insert the ICAO four-letter location indicator(s) of not more than two alternate aerodromes, SEPARATED BY A SPACE.

OR

If no location indicator has been assigned to an alternate aerodrome insert ZZZZ and specify in Item 18 the name of the aerodrome preceded by ALTN/.

Common Errors:

The use of spurious names for unnamed fixes (typically extracted from navigation data bases) is to be avoided. In addition to being undefined the names fail to adhere to the format specified for fixes (five alphabetical characters) and so cause a syntax error in addition to the logical error. ARINC 424 type position reports are not to be used.

When specifying speeds in knots a leading zero is required if the speed is less than 1000 knots.

No blank spaces are to be inserted between speed and level.

The ICAO convention for specifying latitude and longitude in flight plan related messages differs from that used by data base vendors in that the hemisphere indicators (N/S, E/W) should follow, not precede, the numeric component. Therefore specifying a position as “N60W010” represents an error.

The use of FIR designators as fix names is invalid, these designators should only be used in the EET sub-field of Item 18. Some flight plans contain such designators in Item 15 to indicate the transition between two FIRs at an unnamed fix. This is a syntax error. The latitude and longitude should be used.

3.11 Field 18: Other Information

Insert the following information, in the preferred sequence shown below, which should always be included for North Atlantic flights. Additional information, as contained in ICAO Doc. 4444, appendix 3, may be included as appropriate.

Note:

The preface to the description of this Item in ICAO Doc. 4444 specifically states that only those sub-fields for which there is data to report should be included in Item 18. A sub-field header with no content constitutes a syntax error and will fail automatic processing.

EET/

Followed by waypoints or FIR Boundary designators plus accumulated estimated elapsed times from take-off to such points.

For flights conducted in the NAT Region on random routes, accumulated estimated elapsed times will be required for:

- a) The last domestic reporting point prior to ocean entry.
- b) The oceanic entry point.
- c) Each significant point described in Item 15. (see note 2)
- d) The oceanic exit point.
- e) The first reporting point on the domestic track.

For flights operating along the entire length of a NAT organised track, estimated elapsed times will be required for the commencement point of the track and for FIR boundaries.

For flights operating along the entire length of one of the PTS tracks, accumulated estimated elapsed times will be required for the commencement point and for each significant point of the track thereafter.

For flights operating along the fixed ATS route network between NAM/CAR, no EETs are required.

Examples: EET/CAP0745 XYZ0830

EET/EISN0204

Notes:

Elapsed times to the oceanic entry point (e.g. EGGX0105) are required by Shanwick, New York and Santa Maria OACCs only.

REG/

The registration markings of the aircraft, if different from the aircraft identification in Field 7. (Aircraft registration should be assigned to this field for MNPS flights)

Notes:

If the aircraft registration is missing, or if it is different from that contained in the AFN CONTACT message, the ground system will not establish a CPDLC connection with that aircraft.

Hyphens contained in an aircraft registration must not be entered into the ICAO flight plan form.

SEL/

SELCAL code, if so prescribed by the appropriate ATS authority.

Note:

As directed above, if no SELCAL code has been prescribed, this sub-field should be omitted rather than inserting such data as, e.g., SEL/NIL or SEL/NONE or SEL/ followed by no data.

RMK/

Being a free text field, this is a useful sub-field for the inclusion of data only defined in particular regions (e.g. RMK/AGCS EQUIPPED RVR/800). Unrecognised sub-fields embedded within the RMK/ sub-field would simply form part of the remarks and would not be processed. Hyphens must not be used in this sub-field.

NAV/

For flights intending to operate through the WATRS Plus Airspace RNP-10 or RNP-4 approval is required in order to benefit from 50NM lateral separation employed here. Any MNPSA aircraft intending to also fly in this WATRS Plus airspace should ensure that its RNP approval status is included in the flight plan. Annotate as NAV/RNP10 or NAV/RNP4 (see paragraph 4.1.12).

**ATTACHMENT 5 – VHF AIR/GROUND COMMUNICATIONS COVERAGE
EXISTING IN THE NAT REGION AT FL 300**



ATTACHMENT 6 – NORTH ATLANTIC FLIGHT LEVEL ALLOCATION SCHEME

Flight Level Availability

Introduction

Following statistical analysis and discussions between the NAT ATSU's, the North Atlantic Flight Level Allocation System has been agreed to:

- (i) Utilise additional levels, made available by RVSM expansion.
- (ii) Standardise the flight level profiles available for eastbound traffic, originating in the New York/ Santa Maria areas, during the eastbound flow, with a view to incorporating the functionality of ADT links.
- (iii) Ensure that economic profiles are available for westbound aircraft routing from Reykjavik OACC.

The procedures entail the establishment of a Night Datum Line, south of which is reserved principally for traffic originating in New York/ Santa Maria.

The procedures entail the establishment of a North Datum Line, on or north of which is reserved for late running westbound traffic from Reykjavik to Gander.

Aircraft Operators are advised to Flight Plan using the flight levels specified in this document, relative to their particular flight(s).

Procedures

General

These procedures involve the dedication of particular levels for use by Eastbound traffic and the allocation of these levels to specific OACC's by the use of a Night Datum line.

The westbound OTS signal will be published using FL310 to FL390. Gander will publish the eastbound OTS signal using FL310 to FL400. However, FL310 will only be used for "New York Tracks" *{Note to NAT DMO – there needs to be a cross reference to the section titled "Eastbound Traffic Originating in New York/Santa Maria, during the eastbound OTS" – in particular, the 4th paragraph}*

The activation times of the westbound OTS shall be published as 1130 to 1900 at 30W.

The activation times of the eastbound OTS shall be published as 0100 to 0800 at 30W.

Delegated Opposite Direction Levels (ODLs)

Gander will accept FL310 as a westbound level H24 subject to eastbound CAR/SAM traffic, as described in *{Note to NAT DMO – there needs to be a cross reference to the section titled "Eastbound Traffic Originating in New York/Santa Maria, during the eastbound OTS}*

During the eastbound OTS, a static Datum Line, known as the Night Datum Line, is established with the following co-ordinates:

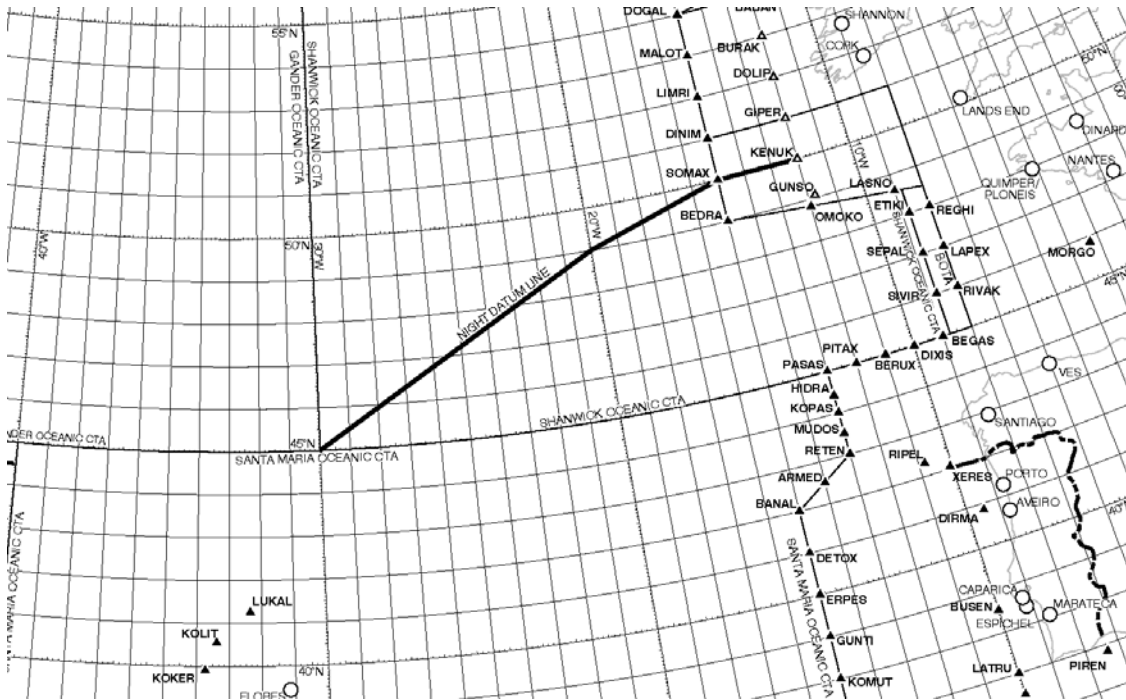
45N030W 49N020W SOMAX KENUK.

On and to the north of the Night Datum Line FL360 and FL380 are delegated to Gander for use by Eastbound traffic.

To the south of the Night Datum Line FL360 will not be used for Gander eastbound traffic.

To the south of the Night Datum Line or the eastbound OTS, whichever is further South, FL380 will not be used for Gander eastbound traffic.

During the westbound OTS, FL330 is delegated by Gander to Shanwick for use by westbound traffic.

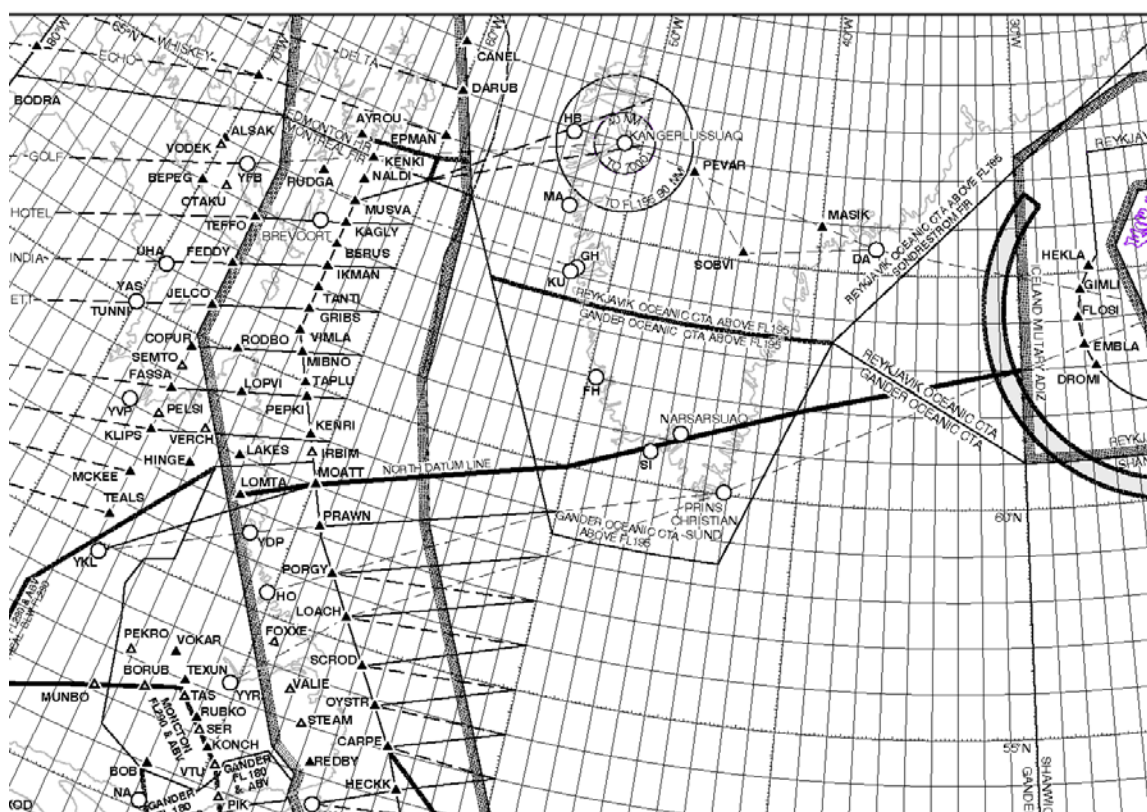


Between 0300Z and 0700Z, a static Datum Line, known as the North Datum Line, is established with the following coordinates:

LOMTA MOATT 60N50W 62N40W 63N30W

On and to the north of the North Datum Line FL380 is delegated to Reykjavik for use by Westbound traffic.

In the event of a high volume of North Random Flights and/or OTS Tracks the North Datum Line may be suspended to accommodate the dominate Eastbound flow.



Eastbound Traffic originating in New York/Santa Maria, during the eastbound OTS.

Eastbound traffic routing, both south of the Night Datum Line, and the main OTS, should flight plan using FL310, FL340, FL360 or FL380.

Eastbound traffic remaining south of the Night Datum Line should flight plan using FL310 or FL360.

The levels allocated to New York Tracks entering Shanwick which cross, or route south of, the Night Datum Line, may be any combination of FL310, FL340, FL360 or FL380, as agreed between Santa Maria and New York.

For this procedure, “New York Tracks” are eastbound OTS Tracks which originate in the New York area and are separated from the main OTS by more than one degree at 30W.

Iberian Tracks

Iberian Tracks are eastbound or westbound organised Tracks, routing between New York and Santa Maria, which do not enter Gander or Shanwick airspace.

The Flight Levels allocated to Iberian Tracks will be any combination of FL330, 350 and/or FL370, as agreed between Santa Maria and New York.

OTS Design & Use

For all westbound Tracks which landfall at or north of PRAWN, Reykjavik require FL340 to be omitted from that Track to allow profiles for aircraft originating in the Reykjavik OCA.

During the westbound OTS times, Controllers at Shanwick shall not clear westbound aircraft which landfall at PRAWN or north of, at FL340, except for random flights which cross 61N at or east of 20W and route ay or north of 63N030W.

Summary

The availability of RVSM levels, between 0100 and 0800 (at 30W), is summarised in the following diagrams.

Diagram 1 below illustrates the use of the Night Datum line (coloured red) in a situation when there are no Gander eastbound NAT Tracks in the vicinity.

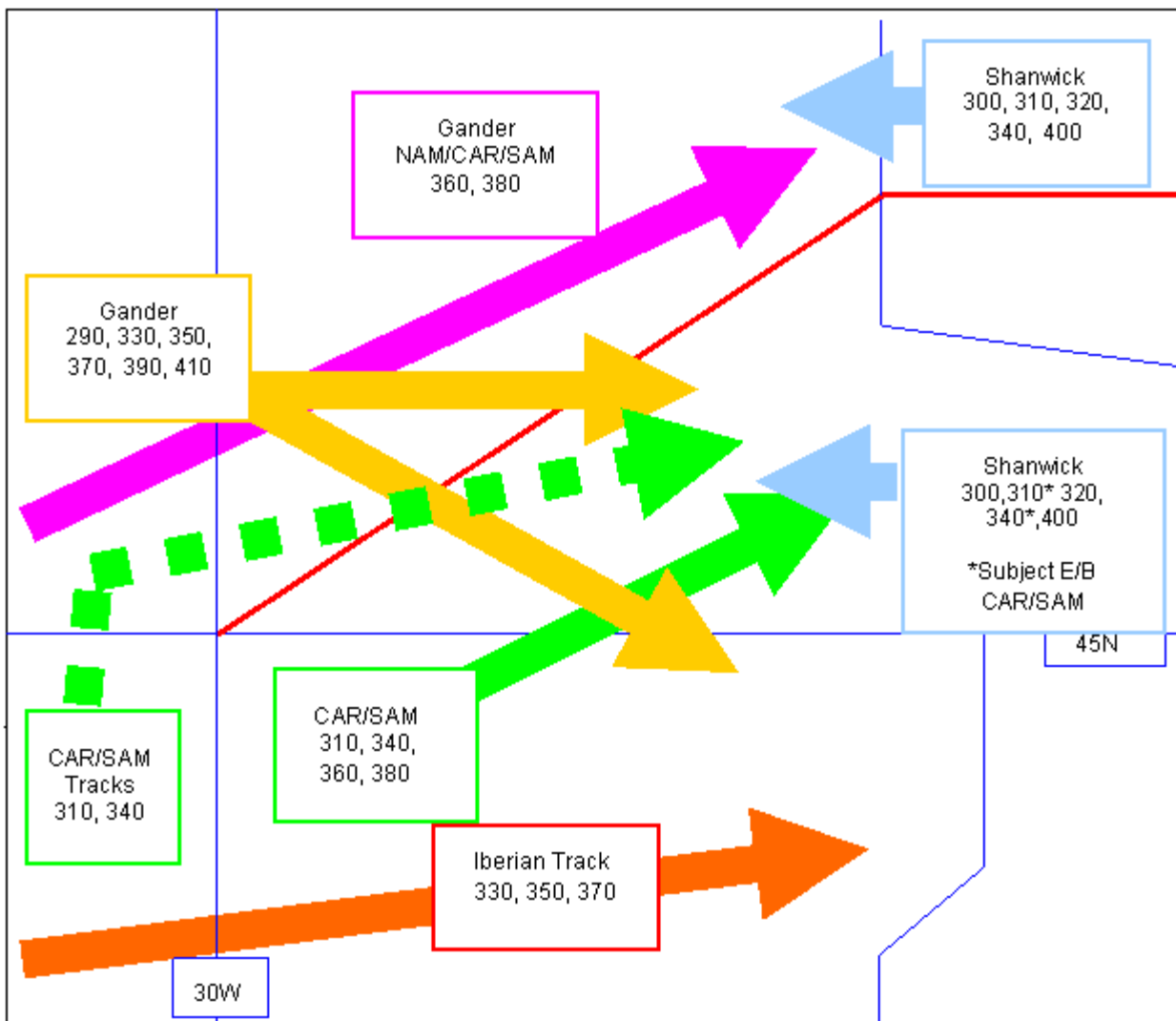


Diagram 1

Diagram 2 illustrates the situation when there are Gander eastbound NAT Tracks in the vicinity.

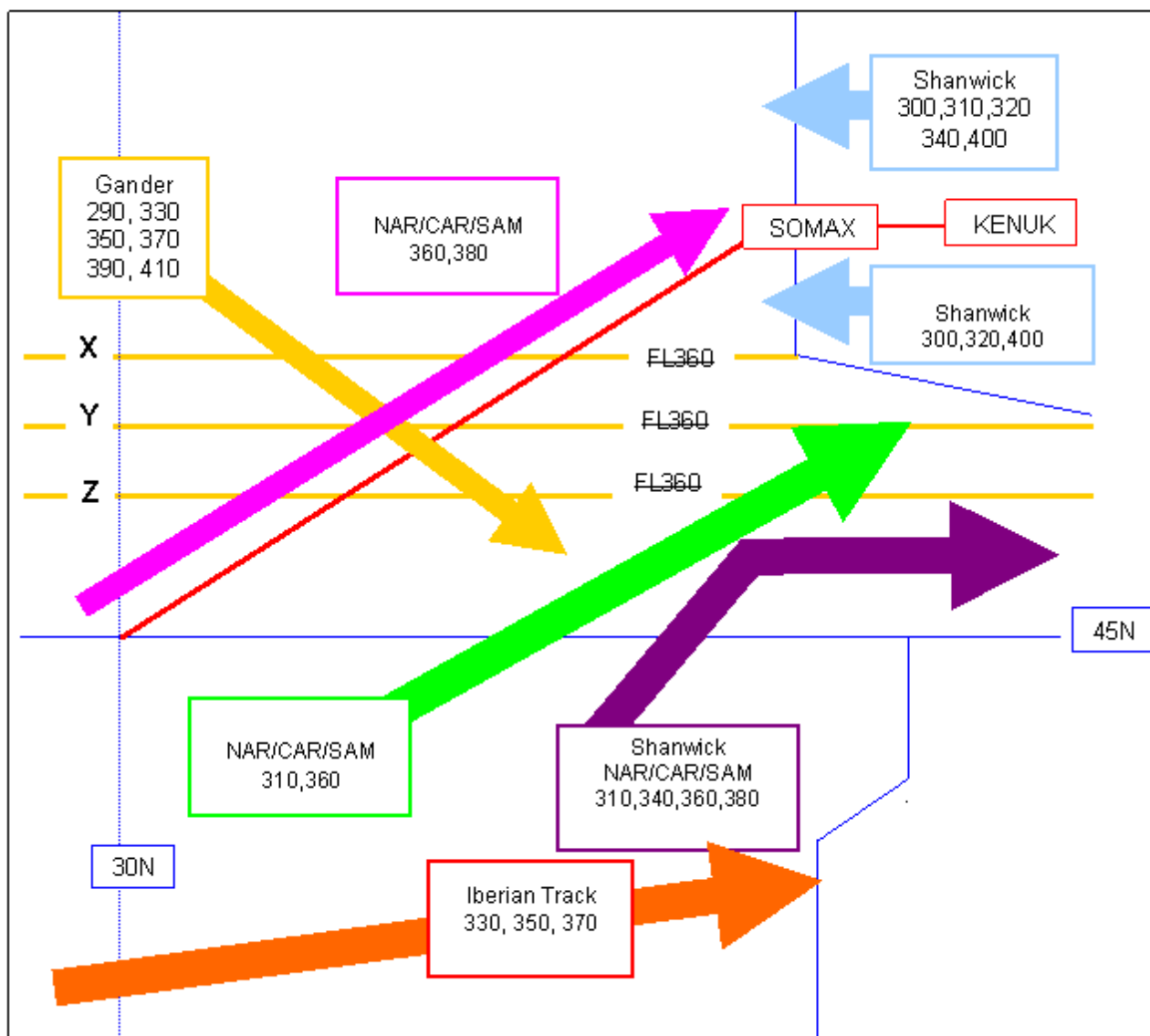


Diagram 2

Transition Periods

The time period between one set of OTS expiring and another set commencing is known as the transition period. The following procedures are in place to accommodate the majority of aircraft:

Basic Principles:

All times relate to 30W.

OTS Transition rules apply between 0801 to 1129UTC and 1901 to 0059UTC. During these times flight levels shall be applied in accordance with direction of flight other than as stated below.

General principles:

Westbound traffic crossing 30W, 2230 to 0059UTC, shall remain clear of the incoming OTS and shall not use delegated ODLs (FL360 and FL380). After 2230, the OTS and ODLs (F360 and F380) are released to

Gander, who may clear eastbound aircraft, taking cognisance of, and giving priority to, already cleared westbound aircraft.

Eastbound traffic crossing 30W 1000 to 1129UTC, shall remain clear of the incoming OTS at FL350 and shall not use delegated ODL (FL330). After 1000, the OTS (at FL330 and FL350) and ODL (F330) are released to Shanwick, who may clear westbound aircraft, taking cognisance of, and giving priority to, already cleared eastbound aircraft.

Eastbound traffic, at FL370 and FL390, crossing 30W 1030 to 1129UTC, shall remain clear of the incoming OTS. After 1030, the OTS (at FL370 and FL390) are released to Shanwick, who may clear westbound aircraft, taking cognisance of, and giving priority to, already cleared eastbound aircraft.

At the day-OTS end-time, Westbound aircraft crossing 30W up to 1900, at ODLs (F330) or on the OTS, shall have priority over eastbound aircraft. Eastbound aircraft shall be cleared, taking cognisance of, and giving priority to, already cleared westbound aircraft.

At the night-OTS end-time, Eastbound aircraft crossing 30W up to 0800, at ODLs (F360,F380) or on the OTS, shall have priority over westbound aircraft. Westbound aircraft shall be cleared, taking cognisance of, and giving priority to, already cleared eastbound aircraft.

The table below summarises the above:

Level	Time	Direction
FL430	H24	Westbound. May be Flight Planned as eastbound by non-RVSM aircraft.
FL410	H24	Eastbound.
FL400	0801 – 2229 2230 – 0059 0100 - 0800	Westbound. Westbound (avoiding OTS). Eastbound OTS (subject to westbounds). Westbound (avoiding OTS). Eastbound (OTS).
FL390	1901 – 1029 1030 – 1129 1130 - 1900	Eastbound. Eastbound (avoiding OTS). Westbound OTS (subject to eastbounds). Eastbound (avoiding OTS). Westbound (OTS).
FL380	0300-0700 0801 – 2229 2230 – 0059 0100 - 0800	Westbound (ODL). Westbound. Eastbound (subject to westbounds). Eastbound (OTS and ODL).
FL370	1901 – 1029 1030 – 1129 1130 - 1900	Eastbound. Eastbound (avoiding OTS). Westbound OTS (subject to eastbounds). Eastbound (avoiding OTS). Westbound (OTS).
FL360	0801 – 2229 2230 – 0059 0100 - 0800	Westbound. Eastbound (subject to westbounds). Eastbound (OTS and ODL).
FL350	1901 – 0959 1000 – 1129 1130 - 1900	Eastbound. Eastbound (avoiding OTS). Westbound OTS (subject to eastbounds). Eastbound (avoiding OTS). Westbound (OTS).

FL340	0801 – 2229 2230 – 0059 0100 - 0800	Westbound. Westbound (avoiding OTS). Eastbound OTS (subject to westbounds). Westbound (avoiding OTS). Eastbound (OTS).
FL330	1901 – 0959 1000 – 1129 1130 - 1900	Eastbound. Westbound (subject to eastbounds). Westbound (OTS and ODL).
FL320	0801 – 2229 2230 – 0059 0100 - 0800	Westbound. Westbound (avoiding OTS). Eastbound OTS (subject to westbounds). Westbound (avoiding OTS). Eastbound (OTS).
FL310	H24	Westbound.
FL300	H24	Westbound.
FL290	H24	Eastbound.

BIBLIOGRAPHY

ICAO Annex 2 * – Rules of the Air

www.icao.int

ICAO Annex 6 * Operation of aircraft

www.icao.int

ICAO Annex 10 * Aeronautical communications

www.icao.int

ICAO Doc 4444* Procedures for Air Navigation Services. Air Traffic Management

www.icao.int

ICAO Doc 7030* (Regional Supplementary Procedures (SUPPS))

www.icao.int

ICAO Doc 9574* Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive

www.icao.int

ICAO Doc 9613 *(PBN) Performance-Based Navigation Manual

www.icao.int

ICAO NAT HF Guidance Material – Doc 003

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

ICAO Sample Oceanic Checklist

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

ICAO Sample Oceanic Expanded Checklist

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

ICAO Oceanic Errors Safety Bulletin

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

Canada AIP

<http://www.NAVCANADA.ca/>

Canadian NOTAM (PRMs)

http://www.NAVCANADA_ca/

Canadian Flight Supplement

<http://www.navcanada.ca/NavCanada.asp?Language=en&Content=ContentDefinitionFiles%5CPublications%5CAeronauticalInfoProducts%5CPublications%5Cdefault.xml>

CFMU Route Availability Doc Annex NAT (NERs)

http://www.cfm.eurocontrol.int/cfmu/opsd/public/standard_page/operational_services_rad.html

Global Operational Data Link Document (GOLD)

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

JAA TGL-6 –Revision 1

<http://www.ecacnav.com/rvsm/library.htm>

ETSO-C219a

http://www.easa.europa.eu/ws_prod/g/doc/Agency_Mesures/Certification%20Spec/CS-ETSO.pdf

Iceland AIP

<http://www.isavia.is>

Ireland AIP

http://www.iaa.ie/safe_reg/default.asp

UK AIC 55/2003**NAT Flight Planning Guidance**

http://www.nats-uk.ead-it.com/aip/current/aic/yellow/EG_Circ_2003_Y_055_en.pdf

UK AIP

www.ais.org.uk

UK NOTAMs (PRMs)

www.ais.org.uk

USA FAA TSO-C129

http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgWebcomponents.nsf/HomeFrame?OpenFrameSet

USA FAA AC91-85

<http://www.faa.gov/ats/ato/rvsm1.htm>

USA US Airport Facility Directory (NARs)

http://www.naco.faa.gov/index.asp?xml=naco/catalog/charts/supplementary/af_directory

USA US AIP (WATRS)

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/WATRS_Plus/

USA US Coastguard GPS NOTAMs

<http://www.navcen.uscg.gov>

(*) ICAO saleable documents - Please contact ICAO Headquarters, Montreal sales@icao.int

– END –