
GEN 1.5 AIRCRAFT INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS**1. GENERAL**

- 1.1. Flight under IFR in Shannon FIR/UIR [Class A](#), [Class C](#) and [Class G](#) airspace must as a minimum be equipped with and use the following radio navigation equipment
- VHF RTF with Appropriate Frequencies available
 - VOR receiver
 - DME
 - ILS

- 1.2. No general exemption from these requirements will be granted, but relaxation of the requirement to have an ILS may be granted by the appropriate ATC unit for a single flight.

- 1.3. Non ACAS equipped aircraft must be equipped with an SSR transponder Modes A and C for flight in controlled airspace [Class A](#) and [Class C](#). Aircraft with transponder temporarily U/S may be admitted to airspace [Class C](#) only, at discretion of ATS Unit responsible for ATS provision in that airspace, provided the aircraft concerned immediately vacates such airspace when so instructed.

- 1.4 8.33 kHz Radio Equipment.

- 1.4.1 8.33 kHz Radio Equipment above FL195 in the Shannon FIR/UIR

With the exception of State aircraft, there are no exemptions to the requirements for the carriage and operation of 8.33 kHz spacing radio equipment above FL195 in the Shannon FIR/UIR.

Non-equipped flights must flight plan to operate below FL195.

Exemptions for State aircraft, from the mandatory carriage of 8.33 kHz spacing radio equipment are described in [ENR 1.8](#)

- 1.4.2 8.33 kHz Radio Equipment below FL195

Aircraft operated under IFR in Class C and Class G airspace are required to have 8.33 kHz spacing radio equipment. Aircraft operated under VFR in Class C and Class G airspace are required to have 8.33 kHz spacing radio equipment if communications are performed on 8.33 kHz spaced frequency assignments.

Exemptions from mandatory carriage of 8.33 kHz aircraft radio equipment are described in [ENR 1.8](#)

2. RVSM

- 2.1. This entry for Reduced Vertical Separation Minimum (RVSM) is published in accordance with European RVSM (EUR RVSM) implementation

- 2.2. Introduction

- 2.2.1. RVSM is the generic term for a reduction in vertical separation from 2000 ft to 1000 ft that can be applied to approved operators of approved aircraft operating between FL290 and FL410 inclusive. RVSM operations are mandated in the upper airspace of the Shannon FIR/UIR, NOTA and SOTA. RVSM airspace in the adjacent North Atlantic (NAT) region covers the same flight levels as in the EUR RVSM area. With the exception of State aircraft, non-RVSM Approved aircraft are not permitted to operate within the EUR RVSM airspace which includes the Shannon FIR/UIR, NOTA and SOTA,

- 2.2.2. The requirements for RVSM are published in the ICAO Regional Supplementary Procedures (Doc 7030 -EUR), Doc 9574 — Manual on Implementation of a 300 M (1 000 ft) Vertical Separation Minimum Between FL 290 and FL410 Inclusive. and Procedures for Air Navigation Services Air traffic Management (PANS ATM Doc 4444) plus JAA Temporary Guidance Leaflet No. 6 Revision 1 (TGL 6). Detailed information on RVSM NAT/EUR ENTRY/EXIT points are published in ENR 4.4

- 2.3. Means of Compliance

- 2.3.1. Except for State aircraft, operators intending to conduct flights within the EUR RVSM airspace require a RVSM approval from the State in which the operator is based or from the State in which the aircraft is registered. To obtain such an RVSM approval operators shall satisfy the said State that:
- a. aircraft for which an approval is sought have the vertical navigation performance capability required for RVSM operations through compliance with the criteria of the RVSM minimum aviation system performance standards (MASPS);
 - b. they have instituted procedures in respect of continued airworthiness (maintenance and repair) practices and programmes; and
 - c. they have instituted operational procedures and a programme of flight crew training so that they have an in depth knowledge of the criteria for operating in RVSM airspace and this should include both initial and recurrent training
- 2.3.2. Once obtained the RVSM approval is not restricted to a specific region. Instead it is valid globally, where RVSM procedures are applied, on the understanding that any operating procedures specific to a given region should be stated in the operations manual or appropriate crew guidance.
- 2.3.3. Aircraft that have received State approval for RVSM operations will be referred to as 'RVSM approved aircraft' while those aircraft that have not received such approval will be referred to as 'non-RVSM approved aircraft'. State aircraft that have not been granted RVSM approval should be granted access to RVSM airspace and ATC will apply a 2000 ft separation from other traffic.
- 2.4. Flight Crew Operating Practices and Procedures
- 2.4.1. All RVSM airspace is defined by ICAO as 'special qualification airspace'. Accordingly it is important that all operators provide their flight crews with a resume of any special procedures or phraseology applicable to a given RVSM operation. Holders of AOCs are required to have an 'operations manual' in which all pertinent details and procedures are specified. Non-AOC holders are required to submit to the IAA for approval RVSM operations instructions/ procedures for use by flight crews.
- 2.4.2. Operations manuals should include sections on:
- a. Equipment Requirements and Minima;
 - b. Flight Planning;
 - c. Pre-Flight, In-Flight and Post-Flight Procedures;
 - d. Contingencies;
 - e. TCAS/ACAS Alerts;
 - f. R/T Phraseology;
 - g. Height Monitoring Requirements;
- 2.5. Contingencies - Applicable to all RVSM Airspace
- 2.5.1. General
- 2.5.1.1. Flight crews are to report to ATC as soon as practicable any event that may affect their ability to comply with the ATC clearance, examples being: severe turbulence, loss of thrust, loss of pressurisation, need to divert, uncertainty of present position, etc. If, at any time, it is not possible to notify ATC immediately that a problem has occurred and obtain a new clearance before departing from the old, comply as accurately as possible with any procedures that may be specified for the airspace, e.g. IAA contingency Procedures. In all cases a good lookout should be maintained and if the aeroplane is equipped with TCAS/ACAS the visual display should be used to assist in the sighting of proximate traffic.
- 2.5.1.2. The following equipment failures must be reported to ATC:
- a. Loss of thrust on one or more engines necessitating descent;
 - b. Loss of one or more altimetry systems;

- c. c. Failure of all automatic altitude control systems;
 - d. d. Failure of any other equipment that could affect the ability of the aeroplane to maintain flight as cleared.
- 2.5.1.3. In RVSM airspace it is expected that all aeroplanes will be in continuous radio contact with ATC either on the assigned frequency or on the distress and emergency frequency (121.500 MHz). They will therefore be able to advise ATC of any abnormal circumstances where RVSM performance requirements cannot be met, including encounters with turbulence greater than 'moderate'. ATC will then respond and issue an appropriate revised clearance before the pilot initiates a deviation from the original clearance. It is recognised, however, that there may be some circumstances (such as emergency descent following the loss of cabin pressurisation) where deviations may have to occur with little or no prior notice to ATC. In such cases the pilot will need to obtain a revised clearance as soon as possible after the deviation.
- 2.5.1.4. North Atlantic and other Oceanic or Remote RVSM Airspace (if applicable)
- For oceanic and remote area RVSM application, where continuous direct controller-pilot communication may not always be possible, a range of contingencies have been considered which allow independent action by flight crews. In general they permit crews, in exceptional circumstances, to deviate from assigned clearances by selecting flight levels and/or tracks where other aeroplanes are least likely to be encountered. During such deviations crews are required to make maximum use of aeroplane lighting and to transmit relevant information on all appropriate frequencies, including the distress and emergency frequency. Once contact with ATC has been re-established, the crew will be assisted and issued with new clearances as required. Offset track procedures may be permitted if an encounter with turbulence is considered to be due to wake vortex in accordance with PANS ATM (Section 15.2.4).
- 2.6. TCAS/ACAS Alerts and Warnings
- Procedures for dealing with TCAS/ACAS Alerts and Warnings are contained in Procedures for Air Navigation Services Aircraft Operations (PANS OPS, ICAO Doc 8168), Part 3, Section 3, Chapter 3. Where fitted, TCAS should be operated in the TA/RA mode during all operations. Any TA/RA should be treated as genuine. Flight crews should respond and report them as specified in their Operations Manual.
- 2.7. RT Phraseology
- Phraseology associated with RVSM operations has been developed for European wide use. All flights must use this phraseology whilst operating, or intending to operate, between FL290 and FL410 inclusive in the Shannon FIR/UIR, NOTA and SOTA. Aircraft operators are reminded that, within Irish airspace, when responding to ATC the pilot is to append the call sign at the end of the message and not at the beginning. ATC are to use the controller-controller RVSM phraseology for co-ordination between Air Traffic Service Units (ATSUs). In the event of ATC being advised by the pilot that the aircraft is no longer capable of RVSM operations, it is particularly important that the first ATSU that is made aware of the failure generates the appropriate co-ordination, e.g. the pilot calls for start-up and declares 'unable RVSM due equipment' and the airport ATSU then passes this message on to the first Air Traffic Control Centre involved with the flight.
- 2.8. Irish Specific RVSM Exemptions
- 2.9. Completion of Flight Plans - Additional Flight Planning Requirements (see ICAO Doc 7030 - EUR Regional Supplementary Procedures)
- 2.9.1. For all Flights, in Item 15 file a maximum level of FL 280 to the point where the flight wishes to enter RVSM airspace (otherwise if GAT the FPL will be rejected by CFMU). Do not enter RFL details at FL290 or above anywhere in item 15. A verbal request to ATC for flight above FL280 will ensure the FPL is not rejected by CFMU.
- 2.9.2. For all flights, in Item 18 include the RVSM Status and Exemption Serial No. in the Remarks, i.e.: **'STS/NONRVSM' 'RMK/(STATE) RVSM EXEMPT... Serial No.'**
- Note 1:** Operators of Non-RVSM Approved aircraft are not to enter 'W' in item 10 even with this specific exemption.
- Note 2:** Having an RVSM Exemption does not confer any right to enter RVSM airspace as GAT unless specifically agreed by the appropriate ATC agency on the day. Any such penetration of RVSM airspace must be subject to the prevailing traffic conditions and controller workload.

2.9.3. Flight Testing or IAA Airworthiness Test Flights by Non-RVSM Approved Aircraft - In Item 15, enter route details within the area in which the flight intends to operate, then the return joining point for the ATS route structure to destination at a level not above FL280. If aerodrome of departure is outside the ATS route structure insert the appropriate routing; if the final intention is to re-join the ATS route structure, file to re-join at the appropriate point not above FL280. In Item 18, insert RVSM Status and Exemption Serial No. (if applicable) and 'RMK/Flight Testing' or 'RMK/IAA Airworthiness Flight Test' as appropriate with requested flight level in RVSM airspace.

2.10. Air Traffic Control (ATC) Procedures for all Flights

When Non-RVSM aircraft are ready to enter RVSM airspace, the appropriate clearance is to be obtained from ATC. Note that, due to the need to provide 2000 ft separation, controllers need to co-ordinate the flight with other RVSM approved aircraft. These flights therefore create extra workload and a slight delay in receiving such clearances should be anticipated. It would therefore be helpful if pilots can provide as much notice as possible prior to requesting flight levels above FL280. Pilots must comply with any requirements stated in the RVSM Exemption unless otherwise instructed by ATC. Pilots are also reminded to include their Non-RVSM status (call sign: NEGATIVE RVSM) in the initial call on any frequency within RVSM airspace and subsequent frequency changes, when requesting level changes pertaining to flight levels in RVSM airspace and in all read backs to flight level clearances pertaining to flight levels in RVSM airspace.

2.11. Height Monitoring Requirements

2.11.1. There is an on-going requirement for height monitoring within the EUR RVSM airspace in order to monitor safety levels of RVSM operations. Aircraft operators are therefore required to continue participating in on-going monitoring activities and this may involve the re-monitoring of aircraft that have previously gone through the process. Non-participation can result in the withdrawal of RVSM approval. This monitoring requirement is, in its current form, applicable for EUR RVSM operations specifically to fulfil the requirements for on-going EUR RVSM Safety Assessments. However, activities are under way to harmonise the detailed monitoring requirements globally. The IAA is obliged, by ICAO, to keep a database of all Irish registered RVSM approved aircraft. Therefore, operators are to inform the IAA (RVSM Approvals) both when they add aircraft to their fleet and of any aircraft they intend to remove from their fleet of RVSM approved aircraft. The IAA will pass this information to the appropriate Regional Monitoring Agency (RMA). For EUR RVSM, EUROCONTROL will act as the RMA. This is in addition to any requirements to comply with any EUROCONTROL notification procedures.

2.11.2. In order to have sufficient confidence in safety assessment results sufficient monitoring data is required. Due to the potential changes to altimetry performance over time, there is a limitation on the age of data that can be used for the assessments. Therefore there is a need to obtain new data and this may result in the re-monitoring of certain aircraft types and airframes. Data will be obtained through monitoring by the existing ground based Height Monitoring Units (HMUs) near STRUMBLE (United Kingdom) and GANDER (Canada). Since much of the data is obtained automatically, no specific action is required from operators unless they are approached by the RMA. Where such an approach is made, the operator is required to cooperate by arranging a special flight to over-fly an HMU. Lack of co-operation by an operator would be reported to the state issuing the approval and could result in the withdrawal of RVSM approval for the aircraft and/or operator in question. For aircraft operator specific information, such as how many of his/her aircraft of a particular type need to be monitored and within what time frame, the operator may contact the RMA direct.

2.12. Organisation of Monitoring Activities

On behalf of ICAO the EUROCONTROL Agency acts as the RMA. The information which will be obtained through the monitoring programme on aircraft compliance status and measured height keeping performance will be combined with the information available from monitoring agencies in other regions. The RMA will support operators and approval authorities on any issue related to RVSM approval and monitoring. The RMA will require information on the aircraft which are intended to operate in EUR RVSM airspace, and which will, therefore, need to be monitored on a periodic basis as part of the continuing safety assessment. To this end the RMA will also be in contact with State approval authorities. The RMA is based at the EUROCONTROL headquarters in Brussels, Belgium. The RMA will ensure the continuous operation of the monitoring systems and will manage the measured height keeping

performance data. The RMA will identify any height deviations that are outside the specifications of the ICAO RVSM performance requirements, and will follow-up as required.

2.13. Wake Vortex Issues

2.13.1. The purpose of this section is to present information in respect of wake vortex and to notify pilots and controllers of the relevant procedures in the event of a wake vortex encounter with specific regard to EUR RVSM operations. The EUROCONTROL scheme is recording those encounters that take place in RVSM airspace and does not in any way replace the Irish reporting scheme which records all wake vortex encounters in Irish airspace (including those at RVSM levels).

2.13.2. Wake Vortices in EUR RVSM Airspace

Prior to the implementation of RVSM in the EUR region an independent study concluded that the 'probability of hazardous encounters with wake vortices are not expected to increase but that nuisance encounters would increase'. Since August 2000 EUROCONTROL has been collating wake vortex encounters in the European airspace at FL 245 and above. These encounters have been subject to further independent analysis which has confirmed the findings of the above mentioned study. It is vital, however, that pilots continue to provide reports of wake vortex encounters in RVSM airspace. Any pilot who encounters a wake turbulence incident when flying in EUR RVSM airspace or within an adjacent RVSM transition area should ensure that a detailed report is provided to EUROCONTROL and State Regulation Authorities.

2.13.3. Wake Vortices Encounters

ICAO Document 7030 'Regional Supplementary Procedures' recognises wake turbulence as a factor in European and North Atlantic RVSM operations. In the North Atlantic, due to the special nature of the airspace and frequent poor communications, procedures have been developed which allow action by flight crews independent of ATC involvement. These procedures are not applicable to EUR RVSM airspace, where direct pilot/controller communication exists together with sufficient radar coverage to enable ATC to manage required flight deviations. In addition the vertical separation between aircraft can be increased tactically should this be necessary.

2.13.4. Pilot Actions:

2.13.4.1. When an aircraft is operating in the EUR RVSM airspace and encounters severe turbulence due to weather or wake vortex, and the Pilot-in-Command believes the vertical navigation performance requirements for EUR RVSM airspace cannot be maintained, the pilot shall:

- a. inform ATC as soon as possible ('UNABLE RVSM DUE TURBULENCE');
- b. obtain a revised ATC clearance prior to initiating any deviation from cleared route or flight level;
- c. where such revised ATC clearance could not be obtained prior to such a deviation, obtain a revised clearance as soon as possible thereafter.

2.13.4.2. These procedures should not be interpreted in any way that prejudices the final authority and responsibility of the Pilot-in-Command for the safe operation of the aircraft.

2.13.5. Controller Actions:

The ATC controller:

- a. shall establish either an appropriate horizontal separation or an increased vertical separation of 600 M (2000ft);
- b. shall, to the extent possible, accommodate the pilot's request for flight level and/or route changes and pass traffic information as required;
- c. confirm that the pilot is ready to resume RVSM operations ('REPORT READY TO RESUME RVSM').

3. PERFORMANCE BASED NAVIGATION (PBN)

3.1. Introduction

- 3.1.1. Performance-Based Navigation (ICAO Doc 9613) specifies that aircraft RNAV and RNP system performance requirements be defined in terms of the accuracy, integrity, continuity and functionality, which are needed for the proposed operations in the context of a particular airspace concept. The PBN concept represents a shift from sensor based to performance-based navigation. Performance requirements are identified in navigation specifications, which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements.
- 3.1.2. Whilst the ICAO PBN Manual was published in 2008, the navigation specifications contained within the manual have captured a number of existing navigation applications e.g., ECAC Basic RNAV (en-route) and Precision RNAV (terminal airspace), RNP 4 (oceanic) and RNP Approach (final approach).
- 3.1.3. At the 37th General Assembly held in 2010, Resolution A37-114 required States to implement navigation applications in accordance with the Assembly Resolution, which requires that States complete a PBN implementation plan (<http://www.iaa.ie>) as a matter of urgency to achieve:
1. Implementation of RNAV and RNP operations (where required) for en-route and terminal areas and;
 2. Implementation of Approach Procedures with Vertical guidance (APV), either Barometric Vertical Navigation (Baro-VNAV) and/or augmented GNSS, including Lateral Navigation (LNAV) only minima for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016;
 3. Implementation of straight-in LNAV only procedures (as an exception to 2. above) where the fleet is not APV capable.
- 3.2. Flight planning of RNAV and RNP designations
- Manual or automated notification of an aircraft's qualification to operate along an ATS route, on a procedure or in airspace is provided to ATC via the Flight Plan. Flight Plan procedures are addressed in Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM) (Doc 4444).
- 3.3. Navaid infrastructure
- The NAVAID Infrastructure refers to ground- or space-based NAVAIDs. Ground-based NAVAIDs include DME and VOR. Space-based NAVAIDs include GNSS elements as defined in Annex 10 — Aeronautical Telecommunications
- 3.4. Airworthiness
- The airworthiness element consists of ensuring that the aircraft meets the aircraft eligibility requirements for the functions and performance requirements defined in the navigation specifications (or other referenced certification standards) as well as the installation meeting the relevant airworthiness standards. The airworthiness element may also include applicable non-navigation equipment required to conduct the operation such as communications and surveillance equipment (US 14 CFR / EASA CS Part 25).
- 3.5. Continued Airworthiness
- For the continued airworthiness operational approval, the operator is expected to be able to demonstrate that the navigation system will be maintained compliant with the type design. For navigation system installations there are few specific continued airworthiness requirements other than database and configuration management, systems modifications and software revisions but the element is included here for completeness and consistency with other CNS / ATM operational approvals e.g. RVSM. The continued airworthiness element of the operational approval is not directly addressed in the PBN Manual since it is inherent in the aircraft airworthiness approval through the airworthiness requirements (US 14 CFR / EASA CS Part 25).
- 3.6. Operational Approval
- The operational approval assessment takes account of the following:
- a. Aircraft eligibility and airworthiness compliance;

- b. Operating procedures for the navigation systems used;
 - c. Control of operating procedures (documented in the operations manual);
 - d. Flight crew initial training and competency requirements and continuing competency requirements.
 - e. Dispatch training requirements;
 - f. Control of navigation database procedures. Commercial operators need to have documented procedures for the management of navigation databases. These procedures will define the data validation procedures for navigation databases and the installation of new databases into aircraft so that they remain current with the AIRAC cycle; and
 - g. Continued Airworthiness. Operators should have procedures for assessing and incorporating instructions for continued airworthiness and maintenance or inspection information concerning system modifications, software revisions, etc.
- 3.7. Minimum navigation performance specifications (MNPS)
- 3.7.1 Pre-PBN navigation Specifications
- 3.7.1.1 Area of applicability
- 3.7.1.1.1 The MNPS shall be applicable in that volume of airspace between FL285 and FL420 within the Oceanic Control Areas of Santa Maria, Shanwick, Reykjavik, Gander Oceanic and New York Oceanic, excluding the area west of 60deg. W and South of 38deg 30'N.
Note: - This volume of airspace is referred to as the 'MNPS airspace'
- 3.7.1.1.2 Except for those flights specified in [3.7.1.1.8](#), aircraft operating within the volumes of airspace specified in [3.7.1.1.1](#) shall have lateral navigation performance capability such that:
- a. The standard deviation of lateral track errors shall be less than 11.7Km (6.3NM);
 - b. The proportion of the total flight time spent by aircraft 56Km (30NM) or more off the cleared track shall be less than 5.3×10^{-4} ; and
 - c. The proportion of the total flight time spent by aircraft between 93 and 130Km (50 and 70 NM) off the cleared track shall be less than 1.3×10^{-4}
- 3.7.1.1.3 The State of Registry or the State of the Operator, as appropriate, should verify that the lateral navigation capability of approved aircraft meets the requirements specified in [3.7.1.1.2](#).
Note.-Guidance material of use to those involved in the initial achievement and continued maintenance of the navigation capability set forth in [3.7.1.1.2](#) has been issued by ICAO under the title North Atlantic Operations Manual (NAT Doc 007) and will be supplemented and updated as required and as new material becomes available
- 3.7.1.1.4 Aircraft that have been approved by the State of Registry or the State of the Operator, as appropriate, for RNP 10 (PBN application of RNAV10) or RNP4 are considered to meet the requirements specified in [3.7.1.1.2.a](#))
Note.- The performance -based Navigation (PBN) Manual (Doc 9613) provides guidance on aircraft approval, operations and maintenance programmes for initial achievement and continued compliance with RNAV 10 (Designated and Authorised as RNP) 10 and RNP 4
- 3.7.1.1.5 From 1 January 2015 the means of compliance for demonstrating performance to [3.7.1.1.2.a](#) above shall be in accordance with the RNAV 10 or RNP 4 navigation specifications as detailed in the *Performance Based Navigation Manual* (Doc 9613). Aircraft that have been MNPS approved by the State of Registry or the State of the Operator based on standard deviation of lateral track error of 11.7Km (6.3NM) before 1 January 2015 shall be permitted to operate in NAT MNPS airspace until 1 January 2020.
- 3.7.1.1.6 When granting approval for operations in MNPS airspace, States should take account of the RNP 10 time limits for aircraft equipped with dual INS or inertial reference unit (IRU) systems.
Note. - RNP 10 time limits are discussed in (DOC 9613) Part B, Volume II Chapter 1.
- 3.7.1.1.7 When granting approval for operations in MNPS airspace, State of Registry shall ensure that in-flight operations

drills include mandatory navigation cross-checking procedures which will identify navigation errors in sufficient time to prevent the aircraft inadvertently deviating from the ATC-cleared route. Guidance on procedures are detailed in NAT Doc 007.

- 3.7.1.1.8 Flights not subject to an Oceanic Clearance, which flight plan to route through Brest Oceanic Transition Area (BOTA) and/or Shannon Oceanic Transition Area (SOTA), are not subject to MNPS approval.

Note 1.- SOTA is defined as that airspace from DINIM (510000N 0150000W) - LESLU (510000N 0080000W) - 483000N 0080000W - BEDRA (490000N 0150000W) to DINIM (510000N 0150000W)

Note 2. - BOTA is defined as that airspace from 483400N 0084500W - 483000N - 0080000W - 450000N 0080000W - 450000N 0084500W to 483400N 0084500W.

The requirements for MNPS are set out in the Guidance concerning Air Navigation in and above the North Atlantic MNPS Airspace (NAT Doc 007) (available at <http://www.paris.icao.int>). ([Refer to MNPS](#))

- 3.8. Area Navigation (RNAV)

Background

- 3.8.1. RNAV is defined as “a method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced NAVAIDs or within the limits of the capability of self-contained aids, or a combination of these.” This removes the restriction imposed on conventional routes and procedures where the aircraft must overfly referenced NAVAIDs, thereby permitting operational flexibility and efficiency. RNAV is the less capable of the two families of PBN navigation specifications. RNAV is suited to current and legacy aircraft operations however as a stand-alone specification it is insufficient to support many of the new Air Traffic Management (ATM) applications envisaged in strategic plans (e.g. 3D, 4D ATM concepts). RNAV specifications do not require on board navigation performance monitoring and alerting. RNAV tracks (e.g.: RNAV 5, RNAV 2, RNAV 1) will normally require monitoring by ATC surveillance systems to achieve desired performance and separation safety standards. This requirement implies near universal surveillance coverage for RNAV specifications. A network of radar systems (PSR & MSSR) is employed to facilitate ATS provision in airspace designated to Irish ANSPs (PSRs providing primary coverage for the Dublin, Shannon and Cork terminal areas supported by longer range Mode S capable SSRs covering en-route airspace). In addition, an ASMGCS is deployed at Dublin airport.

- 3.8.2. Accommodation of non RNAV Approved Aircraft in the Terminal Airspace

Attention is drawn to the fact that aircraft which are not RNAV approved, may be subject to less optimal routeings, track mileage, fuel burn, and increased delays.

- 3.9. Required Navigation Performance (RNP)

Basic Functions

- 3.9.1. An RNP system is an RNAV system whose functionality supports on-board performance monitoring and alerting. Current specific requirements include:
- Capability to follow a desired ground track with reliability, repeatability and predictability, (including optional curved path); and
 - Where vertical profiles are included for vertical guidance, use of vertical angles or specified altitude constraints to define a desired vertical path.
- 3.9.2. On-board performance monitoring and alerting capabilities may be provided in different forms depending on the system installation, architecture and configurations, including:
- Display and indication of both the required and the estimated navigation system performance;
 - Monitoring of the system performance and alerting the crew when RNP requirements are not met; and
 - Cross track deviation displays scaled to RNP, in conjunction with separate monitoring and alerting for

navigation integrity.

3.9.3. An RNP system utilizes its navigation sensors, system architecture and modes of operation to satisfy the RNP navigation specification requirements. It must perform the integrity and reasonableness checks of the sensors and data, and may provide a means to deselect specific types of NAVAIDs to prevent reversion to an inadequate sensor. RNP requirements may limit the modes of operation of the aircraft, e.g. for low RNP, where flight technical error is a significant factor, manual flight by the crew may not be allowed. Dual system/sensor installations may also be required depending on the intended operation or need

3.10. Required Navigation Performance Authorisation required (RNP AR)

Background

RNP AR APCH is a “high-end” instrument approach navigation specification. RNP AR provides an added level of assurance over standard operations and as the designation indicates, a special authorisation is required. ICAO has identified specific instrument approach design criteria in the RNP AR Manual (Doc 9905) and whilst criteria in this and the PBN Manual cater today for approach operations, work is underway to update both to address Departures. The advanced features of RNP AR include operations with navigation accuracy less than 0.3 NM, use of Radius to Fix (RF) Path Terminator in all flight segments and reduced obstacle assessment criteria reflecting the assurance accounted for in a Flight Operations Safety Assessment (FOSA).

3.11. Current Airspace Application / Navigation Specification and Applicable Regulatory Guidance

Airspace Application	Navigation Specification	Applicable Regulatory Guidance
Oceanic & Remote	RNAV 10	FAA order 8400.12A / EASA AMC 20- 12
	RNP 4	FAA order 8400.33 / EASA Rule making Task No. MDM.062 (JAA CNS/ATM SG pp045)
	RNP 2	To Be Developed
	Advanced RNP	
Continental En-route	RNAV 5	FAA AC 20-138B, AC 90-96A / EASA AMC 20-4
	RNAV 2	FAA AC 90-100A
	RNAV 1 / P-RNAV	FAA AC 90-100A / JAA TGL 10 Rev 1
	RNP 2	To Be Developed
	Advanced RNP	To Be Developed
	RNP 0.3	To Be Developed
Terminal Airspace	RNAV 5	FAA AC 20-138B, AC 90-96A / EASA AMC 20-4
	RNAV 2	FAA AC 90-100A
	RNAV 1 / P-RNAV	FAA AC 90-100A / JAA TGL 10 Rev 1
	RNP 1	FAA AC 20-138B, AC 90-105
	Advanced RNP	To Be Developed
	RNP 0.3	To Be Developed

Airspace Application	Navigation Specification	Applicable Regulatory Guidance
Approach Operations	RNAV 1 / P-RNAV	FAA AC 90-100A / JAA TGL 10 Rev 1
	RNP 1	FAA AC 20-138B, AC 90-105
	Advanced RNP	To Be Developed
	RNP APCH (Initial, Intermediate and Missed Approach Segments, with or without RF legs)	FAA AC 20-138B, AC 90-105 / EASA AMC 20-27
	RNP APCH (Final Approach Segment of instrument approach procedure, designed to LNAV and/or LNAV/VNAV minima)	FAA AC 20-138B, AC 90-105 / EASA AMC 20-27
	RNP APCH (Final Approach Segment of instrument approach procedure, designed to LP or LPV minima)	FAA AC 20-138B, AC 90-107 / EASA NPA 2009-04 (AMC 20-28)
	RNP AR Operations	FAA AC 90-101A / EASA AMC 20-26
	RNP 0.3	To Be Developed

3.12. Contingency Procedures

ICAO Doc 7030 Regional Supplementary Procedures detail the contingency procedures.

4. RNAV (GNSS) INSTRUMENT APPROACH PROCEDURES

To be developed

5. MNPS

5.1. Application of Minimum Navigation Performance Specification (MNPS)

5.1.1. MNPS applies in that part of the Shanwick Oceanic Control Area from FL285 to FL420 inclusive. Aircraft using the MNPS Airspace are required to have a navigation performance capability such that:

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

5.1.2. These mathematical standards can be approximated operationally as follows:

- a. Aircraft must be operated so that lateral deviations from track remain less than 12.6 NM for at least 95 per cent of the time the system is required for navigation;
- b. The navigation system must demonstrate a continuing capability to keep lateral deviations from cleared track in excess of 30 NM to less than 53 per 100 000 flight hours in the system; and
- c. Keep lateral deviations between 50nm and 70 NM from cleared track, to less than 13 per 100 000 flight hours in the system.

5.1.3. In order to ensure that the required navigation standards are being observed within the MNPS airspace, a continuous monitoring of the navigation accuracy of aircraft in this airspace takes place using land based radars in Canada, Ireland, France, Iceland and the UK. Where large navigation errors are observed the pilot of the aircraft concerned will be notified by the ATC Unit observing the error. The subsequent investigation to determine the cause of the error will involve the ATC Unit, the operator, and the State of Registry. On the basis of such monitoring it has been agreed that the lateral separation minimum for aircraft operating in the MNPSA shall be 60 NM. It is implicit in the concept of MNPS and essential to the application of this quoted lateral separation minimum, that all operations in the MNPSA - be they Public Transport or General Aviation - achieve the highest standards of navigation

performance accuracy. Thus all flights within the Irish MNPSA must have the specific approval of either the State of Registry of the aircraft, or the State of Registry of the Operator, for such operations. Irish Registered aircraft are approved by the IAA. Such approvals will encompass all aspects of the expected navigation performance accuracy of the aircraft; navigation equipment carried; installation and maintenance procedures and crew navigation procedures and training. The inherent obligations placed upon crews and operators of Irish registered aircraft by the Irish MNPSA requirements can be summarized as follows:

- a. The flight **MUST** have prior approval for operations in Irish MNPSA;
- b. The approved aircraft minimum navigation installation **MUST** be serviceable and **MUST** have been checked for accuracy prior to entry into MNPSA;
- c. Whilst in MNPSA the approved operating procedures **MUST** be adhered to. Except in emergency, diversions from the ATC cleared track **MUST NOT** be made without prior approval of the controlling ATC Unit;
- d. If subsequent un-serviceability reduces the navigational capability below the required minimum for MNPS operations after entry into MNPS Airspace then the controlling ATC Unit **MUST** be advised so as to allow for any adjustments of separation from adjacent aircraft;
- e. There **MUST** be a high standard of supervision, monitoring and cross checking of data inserted into automatic navigation system to prevent large errors arising from erroneous waypoint entries;
- f. There **MUST** be a high standard of co-ordination with ATC Units to ensure that misunderstandings over the route to be flown do not occur.

5.1.4. Westbound flights requesting clearance from Shanwick to enter North Atlantic (NAT) Minimum Navigation Performance Specification Airspace (MNPSA) may be invited to confirm that they have been approved for operating within MNPSA by their State of Registry or their State of Operator. The submission of a Flight Plan alone does **NOT** constitute NAT MNPS operating approval. Pilots/Operators unable to provide such confirmation will be issued an Oceanic Clearance to operate outside MNPSA (below FL 285 or above FL 420). Details of the flight will be passed to the relevant State Aviation Authority for follow-up action.

5.2. Navigation Equipment for Unrestricted MNPS Operations

5.2.1. In order to justify consideration for State approval for future unrestricted operation in the MNPSA an aircraft will be required to be equipped as follows:

- a. Two fully serviceable Long Range Navigation Systems (LRNS). A LRNS may be one of the following:
 - i. One Inertial Navigation System (INS);
 - ii. One Global Navigation Satellite System (GNSS); or
 - iii. One navigation system using the inputs from one or more Inertial Reference System (IRS) or any other sensor system complying with the MNPS requirement.
- b. Each LRNS must be capable of providing to the flight crew with a continuous indication of the aircraft position relative to desired track.
- c. It is highly desirable that the navigation system employed for the provision of steering guidance is capable of being coupled to the auto-pilot.

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

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

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

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

5.3. Application of Reduced Vertical Separation Minima (RVSM) in Shanwick OCA

RVSM applies in the MNPS Area of the Shanwick Oceanic Control Area from FL290 to FL410 inclusive. Aircraft using this Area are required to have a height keeping performance capability as defined in the appropriate ICAO Documents/JAA Temporary Guidance Leaflet. In order to ensure that the overall standard of required height keeping is being achieved within RVSM airspace a technical height keeping monitoring program has been established in accordance with ICAO guidance. In order to ensure that the required altimetry standards are being observed within RVSM airspace, a technical height keeping monitoring programme has been initiated. For the task of monitoring technical height keeping accuracy, a hybrid system comprising of a Height Monitoring Unit (HMU) and GPS Monitoring Systems (GMS) is employed.

5.4. Flight plan

If the flight is certified as being in compliance with Minimum Navigation Performance Specification (MNPS) and intends to operate in MNPS airspace, for any portion of the flight, the letter 'X' shall be inserted after the letter 'S' in Item 10 of the flight plan to indicate that the flight has been approved for operations within the Minimum Navigation Performance Specification Airspace (MNPSA). It is the Captain's responsibility to ensure that specific approval has been given for such operations by the State of Registry of either the aircraft or of the operator.

6. USE OF INSTRUMENT LANDING SYSTEM (ILS) FACILITIES IN IRELAND

6.1 Introduction

The purpose of this section is to provide guidance on the limitations of ILS and to advise pilots of precautions to be taken during operational use.

6.2 General

6.2.1 Instrument Landing System (ILS) facilities in Ireland conform to ICAO Annex 10 Standards appropriate to the promulgated facility performance category unless otherwise indicated by NOTAM or contained in AIP Ireland. They can therefore be relied upon to provide navigational information to the required accuracy providing:

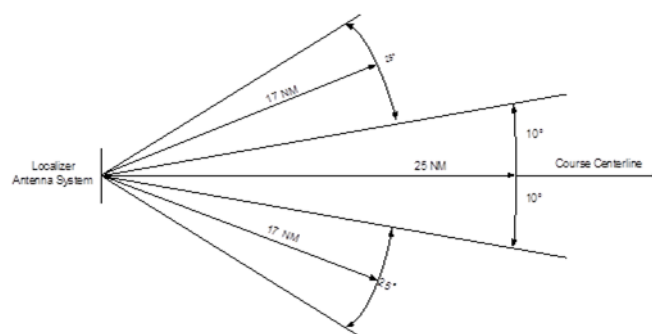
- a. they are only used inside specific coverage sectors;
- b. the signal-in-space is being adequately protected;
- c. due account is taken of any warnings or differences promulgated by NOTAM or contained in AIP Ireland.

6.2.2 An aerodrome's ILS facility should only be used when an Air Traffic Control Service is available for the airport. No attempt should be made to use the ILS outside the aerodrome's promulgated hours of operation, unless specific arrangements have been made with the aerodrome operating authority for this purpose which includes the provision of an Air Traffic Control Service.

6.3 Localizer

6.3.1 ICAO Annex 10 tolerances for ILS localizers provide for coverage from the centre of the antenna array;

- a. out to 25 NM within $\pm 10^\circ$ of the front course centreline;
- b. out to 17 NM within $\pm 35^\circ$ of the front course centreline;



6.3.2 The use of a localizer outside these areas can lead to false course and reverse sense indications being received and such use should not be attempted.

6.3.3 There is no provision for the use of localizer "back beam" in Ireland and any such indication should be ignored.

6.3.4 Certain combinations of localizer beam characteristics and modern receiver/autopilot combinations can cause premature localizer capture; flight crews should be alert to this possibility. Flight deck procedures should be designed to reduce the risk of premature capture by not allowing Flight Director/Autopilot capture modes to be armed too early. Flight crews are advised to confirm the validity of ILS capture by cross-checking with other sources of

navigational information where available.

6.4 Glidepath

6.4.1 The standard ILS Glide Path DOC provides coverage in the following areas:

- a. Coverage sectors of 8° in azimuth each side of the Localiser centre-line to a distance of at least 10 nm from threshold;
- b. Vertical Coverage is provided from 0.45Ø up to 1.75Ø above the horizontal where Ø is the promulgated Glide Path angle.

This equates to coverage from 1.35° to 5.25° above the horizontal for a 3° Glide Path.

6.4.2 Flight crews are warned that use of the Glide Path outside the coverage areas can lead to intermittent and incorrect indications being received.

6.4.3 Certain Glide Paths may not exhibit correct deflection sensitivity to one side of the Localiser course line. This effect is caused by terrain or other problems and can lead to inadequate 'Fly Up' indications being received. When this situation exists a warning will be notified in Irish AIP Part III – Aerodromes (AD), 2.19 RADIO NAVIGATION AND LANDING AIDS, specific to that facility or by NOTAM.

6.5 Protection of ILS guidance signals

6.5.1 The use of an ILS in its promulgated Category is subject to the signal in space being adequately protected from interference. Moving objects, particularly large ones like aircraft manoeuvring in close proximity to the runway, may disturb the ILS guidance signals. ATC will apply increased separation and such other methods considered necessary to prevent interference during Low Visibility Procedures (LVP).

6.5.2 Flight crews should be aware of the ILS interference effects that can occur while conducting auto-lands when LVP are not in force. The protection of ILS sensitive areas from intrusion by aircraft and vehicles is included within LVP.

6.5.3 In Category I conditions or better, LVP will not come into force unless specifically requested. Intrusion into the ILS critical and sensitive areas by taxiing aircraft, ground vehicles or overflight of the ILS localizer may cause interference to the ILS signal. This interference may result in deviations from the desired approach path and may be accompanied by a "LOC" warning flag appearing briefly.

6.5.4 When making auto-lands in conditions not necessitating the introduction of LVP, flight crews should closely monitor the flight path of their aircraft and be prepared to disconnect the autopilot immediately if excessive disturbances occur near to the ground.

6.6 ILS/DME

Distance Measuring Equipment (DME) is frequency paired with ILS channels to supplement or replace range information provided by ILS marker beacons. All range information from ILS/DME is zero referenced to the runway threshold but the use of such an ILS-paired DME outside of a promulgated procedure may result in erroneous distance information and/or corrupt or erroneous identification coding.

6.7 Maintenance

6.7.1 When an ILS is undergoing maintenance, or is radiating for test purposes only, the IDENTIFICATION coding will be removed completely or replaced with a continuous tone.

6.7.2 Under these conditions NO ATTEMPT should be made to use the ILS as erroneous indications may be received.

6.8 Further Information

Enquiries regarding the use of Instrument Landing Systems in Ireland should be addressed to:

Post: Aeronautical Services Department
Safety Regulation Division
Irish Aviation Authority
The Times Building
11-12 D'Olier St
Dublin 2
D02 T449

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