International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group

Thirteenth Meeting (CNS SG/13)
(Jeddah, Saudi Arabia, 20 – 23 October 2024)

Agenda Item 6: ASBU Threads/ Elements related to CNS

MON-NAV ATM OPERATIONAL INPUTS

(Presented by the Secretariat)

SUMMARY

This paper presents the new element of the ASBU Thead NAVS Element B0/4 related to "Navigation Minimal Operating Networks" (NAVS) has been classified as Priority 1 in the MID Region Air Navigation Strategy (MID Doc 002). This element allows the rationalization of the ground based conventional infrastructure through the definition of minimal networks of ground navaids defined in a specific Plan for minimal operating networks (MON). The aim of this paper is to present the Navigation Minimal Operating Networks Template for the review and update, as deemed necessary, by the meeting.

Action by the meeting is at paragraph 3.

REFERENCE(S)

- ICAO GANP 7th edition
- MID Region Air Navigation Strategy (MID Doc 002)
- MIDANPIRG/18 & RASG-MID/8 Meetings Report
- MIDANPIRG/20 & RASG-MID/10 Meetings Report
- MIDANPIRG/21 & RASG-MID/11 meeting report

1. INTRODUCTION

1.1 The GANP has the objective of a future harmonized global navigation capability based on area navigation (RNAV) and performance-based navigation (PBN) supported by the global navigation satellite system (GNSS).

1.2 The implementation of Performance-Based Navigation (PBN) on a wide scale in all phases of flight is well under way and may lead for navigation aids (NAVAIDS) rationalization, as it was enabled by GNSS as the primary navigation means. While some of the ground systems can also support PBN operations (e.g. DME station coverage), the role of the ground based navigation infrastructure will evolve towards providing a reversion capability for GNSS and supporting contingency operations in the case of GNSS outage. This offers the opportunity to rationalize some of the terrestrial infrastructure while retaining a Minimal Operational Network.

1.3 The wide advantages of PBN; the flexibility of the procedure design brings efficiency to the operations and airspace usage, and ground-based infrastructure can be reduced to a Minimum Operation Network (MON) as back up the infrastructure, which has a positive impact on the NAVAIDs associated costs.

1.4 Therefore, PBN planning should embrace the definition of the Minimum Operating Network (MON) of legacy Navaids to sustain the system in case of GNSS disruption or degraded operations and address the PBN contingency modes.

1.5 MIDANPIRG/21 tasked ATM SG/10 to provide the operational input in coordination with the relevant SGs to be reviewed by the CNS subgroup before presentation to the MIDANPIRG/22.

2. DISCUSSION

2.1 The ASBU element "Navigation Minimal Operating Networks" (NAVS B0/4) has been classified as Priority 1 in the revised MID Region Air Navigation Strategy (MID Doc 002). This element aims to:

- adjust conventional navaids networks through the increased deployment of satellite based navigation systems and procedures to ensure the necessary levels of resilience for navigation.
- provide a minimum level of capabilities to accommodate aircraft operations in mixed operation mode environments (aircraft equipage).
- make a more efficient use of the frequency spectrum.

2.2 The meeting may wish to recall that MIDANPIRG/18 meeting held virtually from 15 - 22 February 2021, through Decision 18/42, agreed on the need to develop a template for Navigation Minimal Operating Networks (NAV MON) plan in line with ICAO SARPs and Regional requirements and established NAV MON PLAN AD-HOC ACTION GROUP, to develop the template.

2.3 The NAV MON PLAN AD-HOC ACTION GROUP developed a template to serve as a standardized pre-designed format that can be used by MID States for their national NAV MON plan. The purpose of this template is to provide consistent structure, design, and organization, making it easier to develop national NAV MON plan with a uniform and harmonized manner. The template is at **Appendix A**.

2.4 Additionally, the MIDANPIRG/20 (Muscat, Oman, 14 – 17 May 2023); agreed through DECISION 20/46: NAV MON Plan Template that, the ATM SG, CNS SG and PBN SG be tasked to review and update, as deem necessary, the NAV MON Plan Template to be presented to MIDANPIRG/21 for further review and endorsement.

2.5 The MIDANPIRG/21 & RASG-MID/11 meeting (Abu Dhabi, UAE, 4 – 8 March 2024), discussed the increased number of GNSS vulnerability reports within the MID Region and agreed on the following Conclusion:

RASG-MID CONCLUSION 11/3: GNSS INTERFERENCE AND SPOOFING

That,

a) ICAO with the support of states and IATA to establish a regionally determined minimum operational network (MON) of conventional navigation aids for use in case of GNSS interference /Spoofing;

b) States be urged to develop mitigation measures to be used in case of GNSS interference;

c) States to maintain adequate infrastructure to enable aircraft operators use of conventional navigation aids as appropriate during GNSS RFI or Spoofing;

d) Original Equipment Manufacturers (OEMs) to provide further guidance and information on the effects and mitigations of GNSS RFI (including interference, jamming and spoofing) from the perspective of aircraft equipment;

e) States to foster Civil-military coordination and cooperation; and

f) ICAO with the support of States, ACAO, IATA and IFALPA to amend RASG-MID Safety Advisory – 14 including the update of the GNSS RFI statistics and to include GNSS spoofing effect and mitigation measures.

2.6 The CNS and PBN Subgroups reviewed the template, at **Appendix A**; and requested the ATM SG to review it before presenting it to the MIDANPIRG.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information within the paper; and

b) review and amend accordingly the MON NAV Template at **Appendix A**.

Navigation Minimal Operating Networks

(NAV MON) Template

Draft

State Name

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TBA

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Executive Summary

~~TBA~~

The shift from facility-referenced navigation to coordinate-based navigation enabled by performance-based navigation (PBN) provides significant benefits, in particular by supplying the flexibility required to design airspace and associated routes and procedures according to operational needs. The most suitable navigation infrastructure to support PBN is GNSS. Consequently, the role of conventional navigation aids is currently evolving towards that of a reversionary terrestrial infrastructure capable of maintaining safety and an adequate level of operations in case of unavailability of GNSS (for example due to outages). During this evolution, terrestrial aids may also enable PBN operations for users not yet equipped with GNSS.

Until a solution to ensure adequate GNSS resilience is available, it is essential that a terrestrial navigation infrastructure, suitably dimensioned to be capable of maintaining safety and continuity of aircraft operations, be provided.

In line with the ASBU elements NAVS-B0/4 element, this plan encompasses the definition of the Minimum Operating Network (MON) of legacy Navaids to sustain the system in case of PBN disruption or degraded operations and addresses the PBN contingency modes.

This plan, developed in partnership with the national authorities (ANSP, Operators and Airspace users), should be revisited with the introduction of new navigation capabilities and frequently updated and considered as a living document.

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1. ~~2.~~ Introduction

The implementation of Performance-Based Navigation (PBN) on a wide scale in all phases of flight is well under way and is itself a prerequisite for ground-based navigation aids (navaids) rationalization. This is because PBN procedures are enabled by GNSS as the primary navigation means. While some of the ground systems can also support PBN operations (e.g. DME), the role of the ground based navigation infrastructure will evolve towards providing a reversion capability for GNSS and supporting contingency operations in the case of GNSS becoming unusable. This offers the opportunity to rationalize some of the terrestrial infrastructure while retaining a Minimal Operational Network to maintain ATM operations using only ground-based Navaids.

This plan supports the evolution of PBN as the preferred means of navigation by sustaining and expanding the use of GNSS, providing a PBN-capable backup with the DME, and a minimum operational network of VORs to ensure aircraft can navigate safely during GNSS outages.

~~The GANP has the objective of a future harmonized global navigation capability based on area navigation (RNAV) and performance-based navigation (PBN) supported by the global navigation satellite system (GNSS)~~

~~The optimistic planning that was considered at the time of the Eleventh Air Navigation Conference for all aircraft to be equipped with GNSS capability and for other GNSS constellations to be available, together with dual frequency and multi-constellation avionics capability being carried by aircraft have not been realized~~

~~The shift from facility-referenced navigation to coordinate-based navigation enabled by performance-based navigation (PBN) provides significant benefits, in particular by supplying the flexibility required to design airspace and associated routes and procedures according to operational needs. The most suitable navigation infrastructure to support PBN is GNSS. Consequently, the role of conventional navigation aids is currently evolving towards that of a reversionary terrestrial infrastructure capable of maintaining safety and an adequate level of operations in case of unavailability of GNSS (for example due to outages). During this evolution, terrestrial aids may also enable PBN operations for users not yet equipped with GNSS.~~

~~It had initially been expected that the rationalization of the legacy navigation infrastructure would have been a consequence of a top-down process where the implementation of PBN and GNSS within volumes of airspace would result in navigation aids being made totally redundant so they could be simply be switched off~~

~~NAVS ASBU Elements:~~

~~Element ID~~	~~Title~~
~~NAVS-B0/1~~	~~Ground Based Augmentation System (GBAS)~~
~~NAVS-B0/2~~	~~Satellite Based Augmentation System (SBAS)~~
~~NAVS-B0/3~~	~~Aircraft Based Augmentation System (ABAS)~~
~~NAVS-B0/4~~	~~Navigation Minimal Operating Networks (Nav.MON)~~
~~NAVS-B1/1~~	~~Extended GBAS~~

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NAVS-B2/1	Dual Frequency Multi Constellation (DF MC) GBAS
NAVS-B2/2	Dual Frequency Multi Constellation (DF MC) SBAS
NAVS-B2/3	Dual Frequency Multi Constellation (DF MC) ABAS

2. NAVS-B0/4 Navigation Minimal Operating Networks (Nav. MON):

The new element "Navigation Minimal Operating Networks" (NAVS B0/4) has been classified as priority 1 in the MID Region Air Navigation Strategy (MID Doc 002). The NAV MON element allows the rationalization of the ground based conventional infrastructure through the definition of minimal networks of ground navaids. Consultations and agreements from airspace users and aircraft operators including MIL are required to define this element. The MON should be revisited with the introduction of new navigation capabilities. The main purposes of the NAV MON Element (NAVS B0/4) are:

- To adjust conventional navaids networks through the increased deployment of satellite based navigation systems and procedures to ensure the necessary levels of resilience for navigation.
- To provide a minimum level of capabilities to accommodate State aircraft operations where there is a mismatch in terms of aircraft equipage.
- To make a more efficient use of the frequency spectrum

MIDANPIRG Conclusion related to NAV MON TBA and Link to MID AN Strategy

3. **3. Performance-based navigation impact on NAVAID infrastructure planning**
4. Infrastructure planning is complex, particularly with the increased integrated reliance on global navigation satellite system (GNSS) by communication, navigation and surveillance (CNS) and the increased pressure to decommission unnecessary terrestrial NAVAID infrastructure. Therefore, NAVAID infrastructure planners cannot look at the NAVAID infrastructure in isolation, but need to work closely with ATM system engineers, surveillance and communication infrastructure, operators and regulators when planning the infrastructure for both normal and contingency operations. The removal of conventional navigation aids and associated procedures constitutes an airspace change. In this respect, extensive consultation needs to take place with all impacted stakeholders.
5. PBN implementation will require infrastructure planners to consider:
6. a) the infrastructure requirements for normal operations;
7. b) the infrastructure required for contingency operations (a function of the objective of the contingency operations (such as safety only, required levels of service, compliance with regulatory requirements); and
8. c) how CNS supports both normal and contingency PBN operations (trade-offs between C-N-S can be made)
9. ICAO Twelfth Air Navigation Conference ANC 12 adopted the following Recommendations in this respect, published in ICAO Doc 10007:
10. *Recommendation 6/8* – Planning for mitigation of global navigation satellite system vulnerabilities That States: a) Assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods; …. f) where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of distance measuring equipment (DME) in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways.

~~11. *Recommendation 6/10* – Rationalization of terrestrial navigation aids That, in planning for the implementation of performance-based navigation, States should:~~
~~12. a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation;~~
~~13. b) ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and~~
~~14. c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.~~
~~15.~~
~~16. The overview of the ICAO Global context given above shows that in general,~~

3. ICAO Strategy

Tthe role of the ground-based Navaids will evolve towards providing a reversion for GNSS and supporting contingency operations in case of GNSS becoming unusable. This evolution offers the opportunity for the rationalization of some of the terrestrial infrastructure and retaining only a Minimum Operational Network (MON) which is designed to efficiently provide reversion service.

However, each Navaid can fulfil different operational roles irrespective of the availability of ATS Surveillance:

- During normal ATM operations, ground-based Navaids support

- PBN applications as a primary positioning source;
- PBN applications as a secondary positioning source to GNSS
- Conventional procedures (e.g. either in an environment where there are no PBN procedures; or to accommodate non-PBN capable aircraft.)

- During ATM contingency operations, ground-based Navaids support

- PBN applications as a back up positioning source due to GNSS outage;
- Conventional procedures as a means of reversion during a GNSS outage;

In order to plan the evolution of the navigation infrastructure in MID Region, it is important to have a thorough picture of the type of operations that can be supported by each type of terrestrial Navaid as per MID PBN Implementation Plan. This understanding will enable States to develop both an optimization and decommissioning plan of Navaids as well as a coordinated evolution to a reversionary terrestrial infrastructure. Table below identifies which ground-based Navaid support which PBN specification.

MID Navigation Specifications and (**R**equired or **O**ptional) Navaid Infrastructure

	GNSS	IRU	DME/DME	DME/DME/ IRU	VOR/DME
RNAV 10[1]	O	O			

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RNAV 5[1]	O	O	O	O	O
RNAV 1[1]	O		O	O	
RNP 1	R		TBD[2]	TBD[2]	
RNP APCH	R				
RNP AR	R	O			

Note 1: For this navigation specification without required navaid infrastructure at least one navaid is requested for the associated navigation application.

Note 2: the use of DME/DME for this navigation specification requires a specific State authorization.

Note 3: IRU may be integrated with the GNSS sensor to improve performance and continuity of the operation.

3.1 ICAO reversion strategy

Annex 10 Attachment H defines a global "Strategy for rationalization of conventional radio navigation aids and evolution toward supporting performance based navigation". The objective of Attachment H is to provide guidance to the States for both the rationalization and reversion of the terrestrial Navaid infrastructure. The recommendations included in this high-level strategy are based on the residual roles foreseen for each type of Navaid to support PBN operations and/or conventional procedures.

Furthermore, consideration of this strategy should be given when deciding investments into new facilities or on facility renewals. As this strategy is highly relevant to the objectives of this plan, key points of this strategy are included below, customized for the MID region.

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Operational Considerations for terrestrial Navaids and reversion strategy

		Operational Roles	Navigation Performance	Specific Limitations	Opportunities And Solutions (Residual roles – PBN/conventional)
NDB	PBN	Exceptionally, can be used for extraction on the missed approach for RNP APCH. This operation is not encouraged.	None	N/A	Rationalize NDB and associated conventional procedures and if NDBs are used to define PBN ATS Routes they should be replaced by RNAV waypoints. Non—Precision Approaches based on NDB should be replaced by RNP APCH. Similarly, if NDBs are used as ILS locators associated with an RNAV procedure intercept, RNAV Waypoints should replace these.
	CONV	Can support en route operations and ATS Routes, SIDS/STARs and NPAs. This is not encouraged. NDB may be paired with a DME.	Can enable homing to a beacon. When co-located with a DME, ranging information is also available.	Ref Annex 10, Chapter3	
VOR	PBN	Can be used in the en-route phase of flight and arrival segment of an IFP. On the missed approach it can be used for extraction of an RNP APCH.	Can support a position estimation for RNAV 5. This enables operations in FRA and on RNAV 5 ATS Routes.	(*) Maximum range of conventional VOR typically 60 NM; Doppler VOR, typically 75 NM.	The opportunity arises to rationalize some VORs providing cost savings. Introduction of new VORs is not encouraged, but existing ones may be needed to support reversion operations; enhance situational; provide limited inertial updating if DME/DME not available; exceptionally to be used for NPAs if no other option is available; to support aircraft only able to navigate conventionally (this may include state aircraft) and support procedural separation. The use of VOR(/DME) to support RNAV 5 should be considered only in exceptional cases:
	CONV	Paired (or not) with a DME can support en route operations and SIDS/STARs and NPA	Can provide bearing information and enable homing to a beacon. When co-located with a DME,	Ref Annex 10, Chapter3	

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		and intercept to the ILS or missed approach.	range and bearing information is available.		• in areas where DME/DME coverage is not possible (e.g. islands environment) • in areas where DME/DME coverage is achievable only with high investment and operational cost (e.g. near the bottom of enroute airspace in terrain rich environment)
DME	**PBN**	Can be used in all phases of flight except final approach. On the missed approach it can be used for extraction.	Can support a position estimation for RNAV 5 and RNAV 1 operations. This enables operations in FRA, RNAV 5 ATS Routes and RNAV 1 SIDS/STARs.	Minimum range of 3NM and maximum range of 160 NM for RNAV 1; Below 40° above the horizon as viewed from the DME facility; geometric limitations between DME pairs of 30° to 150°;	DME/DME provides a fully redundant capability to GNSS for RNAV applications, and a suitable reversionary capability to RNAV 1 for RNP applications requiring a lateral accuracy performance of ±1 NM (95%), providing there is an adequate DME infrastructure. Many DMEs are co-located with VORs which creates certain limitations. When VORs are decommissioned, this can be an opportunity to optimise the DME network. In such instances, to save costs or to improve DME/DME performance, DME's can be re-located (ideally with other CNS assets) if a co-located VOR is withdrawn. To be operationally robust, efficient DME network design should fill gaps and provide DME/DME coverage as low as possible without requiring more investment unless needed for safety reasons. (Other solutions such as requiring on-board IRU, reliance on ATS surveillance and/or military TACANS may be viable alternatives). Cross-border use of DME facilities is encouraged supported by the necessary authorisations and/or agreements. Deployment of new DME stations should avoid that part of the
	CONV	Paired with a VOR, ILS or NDB, it can support conventional operations. Stand-alone it can enable the flying of DME arcs.	Can provide range when co-located with a VOR, NDB or ILS.	Ref Annex 10, Chapter3	

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					frequency spectrum close to the GNSS L5/E5 band (1164 – 1 215 MHz). CONCLUSION: The application of the above principles should enable uniformity of DME deployment across the MID region; It is recognized that in some areas, the provision of D/D navigation is not possible or practical, such as at very low altitudes, in terrain-constrained environments, or on small islands, remote areas and airspace over the water. Finally, it is possible that in some countries there could be an increase in the number of DMEs to support A-PNT. Note: Some FMS may exclude the use of ILS-associated DMEs. Consequently, it is not possible to ensure consistent D/D service is available to all D/D-equipped users based on ILS-associated DMEs. Therefore, those facilities should not be planned in the provision of such D/D service (regardless of whether they are published in the en-route section of the AIP), without an appropriate fleet assessment.

(*) If a State wished to use a VOR in excess of the typical ranges stated, then an implementation safety assessment based on a flight inspection demonstration may enable such non-standard use, subject to approval by the competent authority.

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3.2 Evolution Strategy

There is a need to consult aircraft operators and international organizations, and to ensure safety, efficiency and cost-effectiveness of the proposed infrastructure solutions. Based on the above, the global strategy is to:
a) Rationalize NDB and VOR and associated conventional procedures;
b) Align rationalization planning with equipment life cycles and PBN implementation planning;
c) Replace conventional approaches without vertical guidance with vertically guided approaches;
d) Where a terrestrial navigation reversion capability is required, evolve the existing DME infrastructure
towards providing a PBN infrastructure complementary to GNSS; and
e) Provide a residual capability based on VOR (or VOR/DME, if possible) to cater to airspace users not
equipped with suitable DME/DME avionics, where required.

~~Operational considerations~~

~~*NDB-related considerations* : NDBs serve no role in PBN operations except as a means for position cross-checking and general situational awareness. These minor roles should not lead to the requirement to retain NDB facilities.~~

~~Add MIDANPIRG Conclusion regarding decommissioning of NDB~~

~~*VOR related considerations* : The only PBN navigation specification enabled by VOR, provided a co-located DME is present, is RNAV 5. Provision of RNAV 5 based on VOR/DME is subject to significant limitations, since integrated multi-sensor navigation makes very little use of VOR/DME, in some cases limiting the range of use to 25 NM. Also, only very few aircraft operators have a certified RNAV 5 capability which is based only on VOR/DME. Consequently, the use of VOR/DME to provide PBN services is discouraged. The only exception to this could be to support RNAV 5 routes at or near the bottom of en-route airspace (above minimum sector altitude, MSA) where achieving DME/DME coverage is challenging. In principle, to enable cost savings, VOR facilities should be withdrawn in the context of an overall PBN plan. No new stand-alone VOR facilities (e.g. at new locations) should be implemented. However, VORs may be retained to serve the following residual operational purposes such as as a reversionary navigation capability.~~

~~The analysis concerning VOR's operational role should consider all the other potential residual roles described in ICAO Annex 10 Attachment H. The following minimum set of considerations is recommended.~~

~~En route & TMA~~

~~Identify where VOR (/DME) is needed to support:~~

- ~~RNAV 5 operations in FRA or on ATS routes;~~
- ~~Conventional ATS routes defined by VOR/DME which are required to be maintained;~~
- ~~the operations of State aircraft or aircraft of lower capabilities on ATS Routes;~~

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- the provision of:
  - Navigation, cross-checking and situational awareness (e.g. during contingency operations, in support of radar vectoring or to avoid airspace infringements) within an airspace volume.
  - procedural separation within an airspace volume;

Approach and landing Identify where VOR(/DME) is required to support:

- Conventional instrument approach procedures that will be maintained or potentially redesigned. The analysis should consider the aerodromes which are designated as alternates for major aerodromes and/or for aerodromes where only RNP APCH procedures are foreseen;
- ILS IAP (LOC intercept and; avoid premature automatic flight control system arming for ILS intercept);
- Missed Approach Operations;

DME related considerations : DME/DME fully supports PBN operations based on the RNAV 1, RNAV 2 and RNAV 5 navigation specifications. Consequently, DME/DME (for equipped aircraft) is the most suitable current terrestrial PBN capability. DME/DME provides a fully redundant capability to GNSS for RNAV applications, and a suitable reversionary capability for RNP applications requiring an accuracy performance of ±1 NM (95 per cent) laterally, where supported by an adequate DME infrastructure.

Consequently, the following to be considered when identifying the future operational roles of the DME network:

En route & TMA

Identify where DME/DME is needed to support:

- RNAV 5 operations in FRA or ATS routes, in ENR airspace volumes;
- RNAV 1 operations (SIDs/STARs) in terminal airspace volumes;
- RNP 1 reversion operations (actually RNAV 1, SIDs/STARs) terminal airspace volumes;

What type of operation requires DME or DME/DME and where is this coverage needed?

What is the required performance of the DME (DME/DME) signal-in-space?

- Conventional ATS Routes incl. SIDS/STARS in en route or terminal airspace volumes, where DMEs are co-located with VORs;

Approach and landing

Identify where DME is required, as a co-located facility, to support:

- The intercept, approach or missed approach of conventionaNol approach procedures.

~~Add para decommissioning plan including lifetime, spare parts,…etc~~

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4. National Navigation Minimal Operating Networks

4.1 Main operations supported by VORs in the GNSS contingency concept

VOR ID	Location	Main operations supported in the GNSS contingency concept								
		IAP	TMA			EN-ROUTE				
		IAP - intercept - Final - Missed	Conventional SIDs/STARs	cross-checking and situational awareness	Conventional Holding	RNAV 5 and FRA	Conventional Routes and procedural separation	Situational Awareness & Reach Alternate A/D	RNAV Holding	Conventional Holding

~~4.1 Ground based Navigation Aids~~

Description to be ~~added~~

~~4.2 Space based operation~~

~~Description to be added~~

~~Add para about coverage analysis tool~~

~~Phase of flight (enroute, terminal, approach)~~	~~Area of operation~~	~~NAV Facility(ies)~~			
		~~Normal operation~~	~~Augmentation~~	~~Contingency operation~~	~~Facility ID~~
~~RNAV5~~	~~Enroute~~	~~GNSS~~	~~ABAS~~	~~VOR/DME~~	

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Type of NAV facility	**Location**	**ID**	**Facility life cycle**		**Rationalization plan**		**relocation of existing facilities or installation of new facilities**
			Start	**End**	Decommissioning	Replacement	

4.2 Evolution of the ground infrastructure towards MON configuration

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~~4.1~~4.3 ~~4.3~~ Future components of the National Navigation Minimal Operating Networks

~~Type of NAV facility~~	~~Location~~	~~ID~~	~~Range~~	~~Decommissioning Plan~~		
				~~Date~~	~~Replacing facility type~~	

Description to be added

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Type of NAV facility	Location	ID	Phase of flight (enroute, terminal, approach)	Range	Purpose of operation	
					Normal operation	Contingency operation

- END -

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