PERFORMANCE BASED NAVIGATION (PBN) IMPLEMENTATION PLAN NORWAY

Version 4.0
2016

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SYNOPSIS

In order to ensure a safe and efficient performance of the global Air Navigation System, ICAO has urged all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept stated in the PBN Manual (ICAO Doc 9613).

This will be done by developing a Performance Based Navigation (PBN) Implementation Plan to ensure the implementation of RNAV and RNP operations where required for en-route and terminal areas.

The implementation of instrument approach procedures (IAP) with vertical guidance (APV) including LNAV only minima for all APV capable instrument runway ends (IRE) is in progress and these procedures will serve as primary approaches or as a back-up for precision approaches.

The end of 2016 is a target date for APV in Norway. IRE that is not APV capable shall, as a minimum, have LNAV procedures. PBN Airspace is implemented in Bodø OCA (Part and NAT-region) with transition to the requirement for RNP10 or RNP4 certification for operating flights.

This plan covers PBN implementation in all phases of flight in Norway FIR and Bodø Oceanic FIR.

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CHAPTER 1: INTRODUCTION

Context and Issues

Resolution A37-11 *"Performance based navigational global goals"*, of which an excerpt is given below, was adopted by the ICAO 37th General Assembly.

The Assembly

1. Urges all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (Doc 9613);
2. Resolves that:
   a) States complete a PBN implementation plan as a matter of urgency to achieve:
      1. implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones;
      2. implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014; and
      3. implementation of straight-in LNAV-only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more;

   b) ICAO develops a coordinated action plan to assist States in the implementation of PBN and to ensure development and/or maintenance of globally harmonized SARPs, Procedures for Air Navigation Services (PANS) and guidance material including a global harmonized safety assessment methodology to keep pace with operational demands
2. Urges that States include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a maximum certificated take-off mass of 5 700 kg or more, according to established timelines and intermediate milestones;

This resolution applies to all ICAO member states. In accordance with Norway's international commitments, the Civil Aviation Norway (CAA Norway) has developed the PBN Implementation Plan Norway in accordance with ICAO resolution A37-11. Implementation of APV and LNAV procedures at all Instrument RWY ends (IRE) by end 2016 is enforced in the national regulation BSL G 4-1, para 7a (2).

European and National Context

PBN Implementation Roadmap and PBN regulation in the EUR region
The proposed amendment to ICAO EUR ANP (Doc 7754) Volume I, Basic ANP, Part IV contains the PBN Implementation Roadmap for the ICAO European Region as approved in June 2010. This includes the Navigation Application and Infrastructure Planning Strategy for the EUR. Given the requirement for interoperability, this Roadmap represents the parent source of the strategic regional planning context, and strong links are forged with the sub-regional programs, e.g. SESAR, ESSIP.

Furthermore, the European Commission has recently entrusted EASA with providing assistance in developing regulations related to specific requirements for the introduction of performancebased navigation applications in the European ATM Network (EATMN). This regulation aims to harmonise the implementation of PBN procedures in the EUR region. The rulemaking is still in process and the final Ruleset will be implemented under the Basic Regulation (EC 216/2008) as a separate Regulation covering Airspace usage requirements.

BSL G 1-2a implements regulation EU 716/2014 – the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan. The Annex to this regulation introduces specific PBN requirements in high density TMAs. In Norway this is applicable for Oslo TMA from 1st of January 2024

Performance and Safety Related Issues
European Union legislation relating to air traffic management performance requires improvements in performance, especially:

- in terms of capacity, in order to reduce the delays imposed in the form of traffic regulation,
- in terms of reduced environmental impact, through optimum flight profiles (continuous climb/descent) and reduction in distances covered (flight efficiency),
- in terms of economic efficiency, while guaranteeing the same safety level.

These requirements are stated in the Norwegian Performance Plan and in the NEFAB (Functional Airspace Block established between Norway, Finland, Estonia and Latvia) Performance Plan, which are mutually complementary.

The most important Issues by implementing PBN is to improve Safety and Airport regularity by offering more precise and reliable Instrument Approaches and Departure procedures. This is also in line with the core reason for ICAO urging States to do so.

In the en-route/terminal airspace, boosting capacity of the air traffic management system involves making routes with less lateral separation, together with reduced longitudinal spacing between aircraft especially in oceanic areas.

In regards to reduced environmental impact, the aim is to reduce the impact of civil aviation in terms of noise and emissions of CO2 and other greenhouse effect gases and thus diminish individual aircraft fuel consumption. This will also contribute to operational savings for the airlines.

The PBN Concept's Contribution to Improvements in Performance and Safety
To achieve the above-mentioned objectives, there is a need to fully use the navigation capacities already available with various airborne equipment, thus avoiding costly aircraft modifications in the near term. The PBN concept seems in this respect to offer the flexibility and level of requirements needed for this ambitious policy.

Some of the immediate benefits that can be expected are:

- An increasing number of routes allowing flight altitude, as well as climb and descent profiles to be optimized.
- Shorter low altitude flight paths.
- Vertical guidance in the final approach phase.
- Continuous climb and descent profiles.
- Reduction in operational minima.

This concept is based on high level research and development programmes, especially by the SESAR (Single European Sky ATM Research) programme.

As of today, Norwegian operators in general are certified for the following PBN operations; RNAV 5, RNAV 1 and LNAV. Major operators such as SAS and Norwegian also have aircraft certified for LNAV/VNAV procedures. They regard enhanced safety as the main benefit of PBN and want to achieve this through simplification of instrument procedures and, where there is no precision approach available, through establishing APV procedures.

Furthermore, the following elements are considered beneficial:

- PBN instrument procedures in all phases of flight facilitate the provision of correct data in the aircraft navigation databases thus eliminating the use of overlay procedures.
- Airports with non-precision runway ends will have the option to consider establishment of APV procedures instead of ILS thus considerably reducing investment costs.
- A-RNP and RNP AR procedures introduce the possibility for curved approaches which can increase safety and airport availability and also to meet environmental aspects (reduced IAP and avoid noise-sensitive areas) in the vicinity of the Airport.
- Implementing PBN instrument procedures facilitates the rationalisation of groundbased navigation aids and conventional instrument procedures, resulting in reducing investment/operating costs for ANSP/Airports.

The use of GNSS as Primary Means of Navigation

The components of GNSS are not subject to conformity assessment, so no certification of GNSS according to the SES regulations is necessary. Standards and recommended practices in ICAO Annex 10 do ensure interoperability between components of GNSS. In regards to this context, NCAA has approved GNSS as the primary means of navigation in Norway.

On behalf of the Norwegian Space Centre the Norwegian Mapping Authority is monitoring GNSS and EGNOS performance in Norwegian territory.

Radio Frequency Interference (RFI) on GNSS needs increased focus. The Norwegian Space Centre has recently initiated a working group, bringing together stakeholders from various sectors with the aim of developing a national plan for detection of GNSS interference and countermeasures.

The Scope of the PBN Implementation Plan Norway

The PBN Implementation Plan Norway describes the planned implementation of PBN applications in Norway FIR and Bodø Oceanic FIR. The concurrent decommissioning of groundbased navigation aids is not covered by the plan.

Furthermore, the plan only covers development of PBN applications in accordance with the navigation specifications in the PBN Manual (ICAO Doc 9613), and it will be in line with ICAO A37-11 and the new EC PBN regulation which is currently under development.

"Instrument runway end for APV" is defined as a runway end where an APV-procedure can be designed in accordance with current Pans-Ops criteria (ICAO Doc 8168 Vol II) and is situated within the EGNOS Service area (LPV procedures). Norway has a total of 107 runway ends including approximately 78 instrument runway ends that are APV capable based upon current Pans-Ops criteria.

The plan will ensure coherent navigation planning by providing proper guidance and direction to the air navigation service providers, airports, airspace operators and users, regulating agency (NCAA), as well as foreign operators who operate or plan to operate in the state. Operators can use the PBN roadmaps to plan future equipage, capability and investments. Similarly, air navigation service providers and airports can determine e.g. requirements for future automation systems, and plan for the rationalisation of conventional instrument procedures and the groundbased navigation infrastructure.

EGNOS Service Area and Galileo
EGNOS services are currently limited to 70° North by design configuration. Consequently, LPV procedures are not available at the following Norwegian airports north of 70° North: Hasvik (ENHK), Hammerfest (ENHF), Honningsvåg (ENHV), Mehamn (ENMH), Berlevåg (ENBV), Båtsfjord (ENBS), Vardø (ENSS), Vadsø (ENVD), Lakselv (ENNA), Svea (ENSV), Longyear (ENSB) og Ny Ålesund (ENAS).

According to the Norwegian Space Centre the extension to 72N for EGNOS SoL-service will be implemented for testing in Q2 2017. Within Q4 2018 according to ESSP, the service description document will be updated following the test-period.

Through Avinor's engagement and contributions to SESAR and to the European GNSS Evolution Programme, the target service areas of 2020+ versions of Galileo and EGNOS will cover Northern ECAC up to 80°N. The end of deployment of the European constellation (Galileo) associated with version V3 of EGNOS (2020+) should allow the use of satellite resources alone for aircraft navigation to be consolidated and made thoroughly reliable.

Oceanic Operations in Bodø OFIR/OCA
Bodø OCA is a part of the NAT-region. Due to expected increase in traffic and capacity challenges related to traffic between the mainland and Svalbard/Longyear (ENSB), PBN applications in this area is required. Based upon "NAT MNPS to PBN Transition Plan" we have implemented RNP10 ARS-Routes.

Helicopter Operations
Helicopter operations between airports on the mainland and the oil rigs in the North Sea are challenging to the traffic regulation system (mixed operations helicopter/fixed wing). Furthermore, the environmental impact (noise) related to helicopter operations is a challenge, particularly the introduction of new helicopter types will probably trigger the demand for new noise abatement procedures for both approach and departure at affected airports. The introduction of tailored PBN procedures for helicopter operations is expected to mitigate these challenges. Avinor is presently together with the Air Ambulance Service (Luftambulansetjenesten) developing a concept of Low Level IFR-Routes for Helicopters. This is expected to be published in a separate manual for the relevant Operators. Safety and predictability for Operators and stakeholders are important constraints for these Routes.

Principles Applied in Development of the PBN Implementation Plan Norway
Planning and implementation of PBN will be based on the following principles:

a. Not to be in conflict with future EU regulation on PBN, the PBN Implementation Roadmaps for the European Region, and the ICAO NAT region.
b. Continued application of conventional instrument procedures during the transition period, to guarantee availability for non PBN-certified users. This includes the challenge of mixed operations, which must be solved at each location during the implementation planning phase.
c. Development of airspace concepts. One may apply airspace modelling tools as well as fasttime/real-time simulations, which identify the navigation applications that are compatible with the airspace concept when needed.
d. Cost-benefit analyses, if necessary, to justify the implementation of PBN concepts in each particular airspace.
e. Pre- and post-implementation safety assessments to ensure the application and-maintenance of the established target levels of safety.
f. Development of roadmaps in close consultation with airports and operators.
g. RNP APCH procedures at airports with ATC with runway ends without ILS and airports where the availability is dependent on conventional procedures based on non-redundant navaids. Plans exist for reinvestments in regards to old conventional navaids, and one may consider if this should be given higher priority.
h. Prioritize the coordination of the rationalization plans for conventional Navaids.
i. Prioritize the coordination of the considerations required for environmental impact (noise and emissions).

PBN Implementation and Monitoring Progress

NCAA monitors and ensures that the commitments described in the PBN plan Norway are carried out according to the established timeframes. Furthermore, NCAA ensures harmonized reporting of the PBN implementation progress to ICAO and Eurocontrol.

A national PBN Implementation Plan Working Group consisting of members from Avinor and NCAA is responsible for revising the PBN implementation Plan Norway in accordance with any applicable revisions to ICAO DOC 9613, relevant EASA documentation and/or national strategic policies. NCAA will ask stakeholders to contribute and take part in the review of the plan and in prioritizing PBN applications.

Alternate NAV Applications and NAVAID Infrastructure

GNSS signals are vulnerable to both intentional and unintentional sources of interference, as well as the effects of ionosphere and solar activity. Until a more robust mitigation of GNSS vulnerabilities has been developed (e.g. multi-constellation/ multi-frequency GNSS), there is a requirement for retaining some conventional instrument procedures and ground-based navigational infrastructure.

The following table gives an overview of existing/planned PBN spesifications and back-up for PBN applications and GNSS infrastructure. Retaining some conventional instrument procedures and ground-based navigation infrastructure is also necessary to cater for

*DME/DME coverage in Norway is currently limited, primarily because of the challenging terrain. It's DME/DME coverage implemented in Oslo TMA and Farris TMA and planned for implementation in West Coast TMA. DME/DME coverage is subject to cost-benefit analyses and we do not expect this coverage to expand significantly in Norway.

** Conventional SID/STAR are very limited in number, and only implemented when airspace concept analysis shows the need.

Flight Phase	Nav Application	Nav Specification	Nav Infrastructure	Nav Infrastructure Back-Up	Nav Application Fall-Back Procedures
Oceanic	ATS-Routes	RNP 10 RNP 4 *(Mnps)*	GNSS	INS/IRU *(Required)*	
En-Route	ATS-Routes	RNAV 5	GNSS	VOR/DME *(Required)*	Vectoring
TMA	SID/STAR	RNAV 1 RNP 1	GNSS	DME/DME* *(As Required)*	Vectoring Conventional SID/STAR** *(As Required)*
APCH	IAP (LNAV, APV and RNP AR)	RNP APCH RNP AR APCH	GNSS	Conventional (ILS, LOC, VOR, NDB)	Conventional IAP *(As Required)*

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CHAPTER 2: POLICY FOR APPLICATION OF PBN IN AIRSPACE WHERE NORWAY IS PROVIDING ATS – AND RELATED PBN MASTER PLAN

The following PBN master plan for implementation of PBN operations in airspace where Norway is providing ATS is based upon prerequisites described in Chapter I and the related policies. This plan cover following periodes: 2016/2017, 2018/19 and 2020+. For the first two periods, the objectives and means considered to achieve them are specified for the various flight phases.

The period 2016/2017
constitutes a transition starting out from what already exists in terms of ground and airborne facilities. It is planned to implement APV to all APV capable IRE including LNAV minima. LNAV will be implemented at the remaining IRE.

The period 2018/2019
consolidates the choices and assumptions for the first period. The main objective is to reinforce the changes induced by the first phase and improve on the benefits due to PBN trajectories by implementation of more precise navigation specifications.

The period 2020+
will be characterised by the implementation of EC regulation on PBN. Furthermore, during this phase, the end of deployment of the European constellation (Galileo) associated with version V3 of EGNOS should allow the use of satellite resources alone for aircraft navigation to be consolidated and made thoroughly reliable.

Policy en-route operations

Aircraft flying IFR within controlled airspace above FL 95 within Norway FIR require compliance with the RNAV 5 navigation specification, except where a case can be made for application of a higher standard e.g. RNAV 1/ RNP 1 or Advanced-RNP.

Aircraft flying IFR in Bodø Oceanic Control Area (OCA) require compliance with the MNPS specification, RNAV 10 (RNP 10) specification or RNP 4 specification.

ATS-routes shall be developed within the scope of regional air navigation agreements with the other members of the ICAO regions and be integrated in the European ATM Network (EATMN).

2016/2017

En-route continental (Norway FIR)

All ATS-routes are based upon the RNAV 5 specification, and there are no plans to upgrade to a higher standard during this period. This is in line with PBN planning in the other NEFAB states.

Oceanic (Bodø OCA)

Bodø OCA is a part of "North Atlantic High Level Airspace" (NAT HLA) and has implemented PBN airspace according to Doc 7030. Operational approvals will be based on RNP 10 (RNAV 10) or RNP 4 specification.

2018/2019

En-route continental (Norway FIR)

Analyses based on national performance requirements and developments in NEFAB related to ATS-routes and Free Route Airspace (FRA) will be performed in order to clarify the benefits and appropriateness of implementing a compliance requirement to the RNP 1 and/or Advanced RNP specification. This will be done in order to reduce spacing between routes and between routes and TSA, thus improving traffic flows.

Oceanic (Bodø OCA)

Operations with aircraft approved for RNP 10 (RNAV 10) and/or RNP 4 operations are becoming more widespread. Operations with aircraft approved for MNPS are expected to cease at the end of this period

Note:
ADS-B coverage between the mainland and Svalbard will be operational.

Policy terminal airspace (TMA) operations

All airports with ATC or AFIS shall establish a SID/STAR system.

SIDs and STARs shall be based upon the RNAV 1 specification. RNP 1 specification shall be used when airspace concept analysis so requires. Conventional SID/STAR shall only be used when operational analysis so requires.

At AFIS airports with low traffic/complexity STARs may be replaced by using the Terminal Area Altitude (TAA) concept, and SIDs may be based upon Omnidirectional SIDs (Omni SID).

Note:
In this context TMA operations also include SID/STAR in uncontrolled airspace (RMZ) from/ to some airports with AFIS.

2016/2017

There is an on-going process of implementing RNAV 1 SID and STAR at Norwegian airports, including the sole use of TAA concept and Omni SID at AFIS airports with low traffic/ complexity.

2018/2019

Based upon national performance requirements and developments in NEFAB related to ATSroutes and terminal operations, analyses will be performed in order to clarify the benefits and the appropriateness of implementing a compliance requirement to the RNP 1 specification and RF functionality and/ or Advanced RNP specification in order to meet expected performance requirements and dependency of vectoring service.

Policy approach (APCH) operations

Establish instrument approach procedures (IAP) with vertical guidance (APV) including LNAV only minima for all APV suitable instrument runway ends (IRE), either as primary approaches or as a back-up for precision approaches by 2016. IRE that is not APV suitable shall as a minimum have LNAV procedures.

Consider establishment of RNP AR approaches@at instrument RWY ends where relevant operators are fitted and where APV procedures are not possible and/or environmentally beneficial.

RNAV Visual Approach Procedures (RVFP) based upon approved operational concept (e.g. RVFP designed according to RNP AR APCH criteria) may be the initial step to gain experience in such operations.

Airports shall maintain conventional IAP as deemed necessary based upon business case in order to ensure airport availability for non-PBN aircraft and in case of loss of GNSS signals.

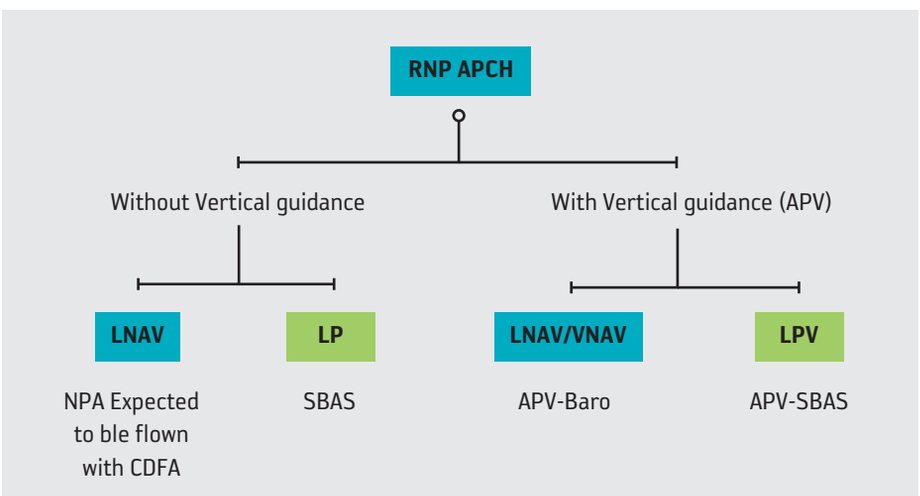
LNAV/VNAV procedures with VPA 3,9 degrees will be assessed at airports where RWY length so require. At these airports landing distance available is the limiting factor, while terrain might allow lower VPA.

Note 1:
North of 70 N the national SCAT-I procedures are the only procedures available with vertical guidance on most Instrument Runway Ends. These procedures are not according to any NAV spec in ICAO Doc 9613 and are expected to be supported by procedures according to ICAO NAV specifications (LNAV/VNAV with 3,9 degrees VPA and/or LPV when EGNOS coverage-area allow it).

Note 2:
EC regulation on PBN, now under development, may affect policy statements.

Note:
LP procedures are currently not considered an option at Norwegian airports.

Figure: RNP APCH definitions.



RNAV Visual Approach Procedures (RVFP)

A common initiative between Avinor and NCAA has led to ongoing work with developing a Norwegian plan for national Criteria and Policy for RNAV Visual Approach procedures. The Present ICAO "Concept of operations for RNAV Visual approaches" as described in the excerpt from WP 19 of ICAO OPS/WG-WHL/16:

CONCEPT OF OPERATIONS

There is a need to have a common understanding of how RNAV visual approaches will be designed and utilized.

Therefore, for RNAV visual approaches, the following concept of operations is proposed:

a. an RNAV visual approach will be developed where there is an identifiable operational benefit and it has been requested by a stakeholder* (ANSP, air operator, airport authority or ATC);
b. the chart identification of the RNAV visual approach procedure will be consistent with and comply withexisting naming conventions of PANS-OPS, Volume II. However, it will be differentiable from an instrument approach procedure;
c. RNAV visual approach procedure chart will indicate the minimum navigation specification required to fly the procedure (RNAV 1, RNP 1, RNP APCH, etc) including any functional requirements;
d. all RNAV visual approaches will be designed and charted to a standard criteria;
e. the RNAV navigation guidance is subordinate to the visual navigation. The aircraft navigates through the RNAV system, but the position is monitored by visual reference to the ground, obstacles and other traffic;
f. prior to publication, the fly-ability of the procedure shall be tested in a full flight simulator and if deemed necessary in actual conditions when critical obstacles are involved; and
g. ATC and pilot responsibilities remain the same as per published visual approaches.

Note*:
In Norway RVFP will be based on request from either operator or airport manager.

RVFP CONOPS for each RWY end at Norwegian airports, developed by the service provider, shall be approved by NCAA.

2016

Implement APV procedures including LNAV at remaining APV capable IRE.

LNAV procedures are planned at remaining IRE that are not APV capable. We also expect LNAV procedures to replace circling procedures based on conventional VOR procedures to circling minima.

RNP AR procedures are in process to be implemented at three Norwegian airports:

- ENGM, Oslo/ Gardermoen airport
- ENHD,Haugesund/ Karmøy airport
- ENEV, Harstad/Narvik/Evenes airport

Implementation of RNP AR APCH procedures will be considered at other instrument RWY ends where APV procedures are not possible and/or it is operational or environmentally beneficial. See Chapter III "Status and planned implementation of RNP APCH and RNP AR APCH" for more details.

2017/2019

RNP APCH and RNP AR APCH procedures will be developed based upon operational requirements, the EC regulation on PBN, valid EGNOS service area and valid PANS-OPS criteria.

Foto: Colourbox.com

Helicopter Operations

Helicopter operations between the mainland and the offshore oilrigs challenge the traffic regulation system, especially when this slow moving traffic has to be integrated with fast moving traffic at the airports. Furthermore, the safe medical transportation by helicopter to hospitals is an issue. As of today a number RNAV PinS procedures to hospitals in Norway exists as *"company procedures".*

APV SBAS procedures in this context are beneficial for operations where a steep slope is required. Such procedures, requiring no ground infrastructure, can be established in to hospitals or oilrigs. However, the main limitation concerning these approaches is the number of Helicopters equipped for these operations.

There are also Airspace issues that need to be clearified.

Note: Permanent installations with helideck are stated in AIP Norway ENR 2.2, para 3.2.

2016

The main traffic flows between Stavanger/Sola (ENZV), Bergen/Flesland (ENBR) and the Ekofisk/ Statfjord oil rig area are operating on ATS-routes based upon RNAV 5 specification. The helicopter traffic flows are integrated in the airport TFC via a helicopter STAR system based on RNAV 1 specification, and they are established on dedicated arrival routes to the IAP. This system is also basis for offshore helicopter operations to/from Florø (ENFL), Kristiansund/Kvernberget (ENKB) and Brønnøysund (ENBN), and the implementation at Hammerfest (ENHF) is planned for this period.

RNAV approach procedures based on the Point In Space (PinS) concept are expected to be further implemented at airports and hospital heliports. It`s also ongoing work with low level routes based on PBN to support specific needs of helicopter operations in constraining environments.

2017/2019

Further implementation of tailored PBN procedures for helicopter operations.

PBN in long time planning

This period will be characterised by the implementation of the EC regulation on PBN.

Advanced applications such as 4-D and curved paths are in the development phase. As of today, GBAS is expected to be the only solution to meet future demands in all-weather navigational performance (CAT II/III), and be an enabler for reduced environmental impact. However, the technology is under development, and international standards are not yet in place. Combined with the fact that only a limited number of Aircrafts have the necessary equipment, the cost – benefit of such an investment has to be further assessed. GBAS is not expected to be implemented in Norway until 2020+ (except maybe earlier at Oslo/Gardermoen).

GLS as a required tool is expected to provide CAT II/III minima, and ILS is therefore the only solution to secure high capacity in the near future. Therefore, it is assumed that ILS will remain the most viable option in regards to precision approach and landing application at those airports equipped with ILS in the foreseeable future.

Furthermore, during this phase, the end of deployment of the European constellation (Galileo) associated with version V3 of EGNOS should allow for the use of satellite resources alone for aircraft navigation to be consolidated and made thoroughly reliable.

Implementation of instrument approach procedures based on APV and LNAV has already started a rationalization of conventional navigation infrastructure at airports in Norway.

With further possibilities available (RNP AR, Advanced RNP, GBAS etc.) we expect a further rationalization of conventional navigation aids.

All airspace users are strongly recommended to become PBN-compliant as soon as possible, to utilize the best available navigation infrastructure.

CHAPTER 3: STATUS AND PLANNED IMPLEMENTATION OF RNP APCH AND RNP AR APCH

Airports with ATC

ICAO code	Airport name	IFR RWY	LNAV	LNAV/VNAV	LPV	RNP AR	Notes:
ENAL	Ålesund, Vigra	7	Implemented	Unable	Implemented		Terrain issues
		25	Implemented	Implemented	Implemented		
ENAN	Andøya, Andenes	3	Not planned	Not planned	Not planned		No published procedures to RWY 03
		21	Not planned	Not planned	Not planned		
		14	Implemented	Implemented	Implemented		
		32	Implemented	Implemented	Implemented		
ENAT	Alta	11	Implemented	Implemented	Unable		EGNOS coverage limited to 70°N
		29	Implemented	Unable	Unable		Terrain issue
ENBO	Bodø	7	Planned 2017	Planned 2017	Planned 2017		
		25	Planned 2017	Analysis required	Planned 2017		Offset issue LNAV/VNAV
ENBR	Bergen, Flesland	17	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		35	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
ENCN	Kristiansand, Kjevik	4	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		22	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
ENDU	Bardufoss	10	Planned 2017	Planned 2017	Planned 2017		
		28	Planned 2017	Unable	Planned 2017		VPA issue LNAV/VNAV

ICAO code	Airport name	IFR RWY	LNAV	LNAV/VNAV	LPV	RNP AR	Notes:
ENTO	Sandefjord, Torp	18	Implemented	Implemented	Implemented		Terrain issues
		36	Implemented	Implemented	Implemented		
ENVA	Trondheim, Værnes	9	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		27	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
ENZV	Stavanger, Sola	18	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		36	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		11	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
		29	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)

ICAO code	Airport name	IFR RWY	LNAV	LNAV/VNAV	LPV	RNP AR	Notes:
ENEV	Harstad/Narvik, Evenes	17	Implemented	Unable	Implemented		VPA issue LNAV/VNAV
		35	Implemented	Unable	Unable	Planned	APV not possible due to offset angle
ENGM	Oslo, Gardermoen	01R	Implemented	Implemented	Implemented	Implemented	
		01L	Implemented	Implemented	Implemented	Implemented	
		19R	Implemented	Implemented	Implemented	Implemented	
		19L	Implemented	Implemented	Implemented	Implemented	
ENHD	Haugesund, Karmøy	14	Implemented	Implemented	No date	Planned	LPV planned next revision (at latest 2018)
		32	Implemented	Implemented	No date		LPV planned next revision (at latest 2018)
ENKB	Kristiansund, Kvernberget	7	Implemented	Implemented	Implemented		
		25	Implemented	Unable	Implemented		Offset issue LNAV/VNAV. LPV planned next revision (at latest 2018)
ENKR	Kirkenes, Høybuktmoen	6	Implemented	Unable	Implemented		VPA issue LNAV/VNAV. Dependent on steep angle assessment.
		24	Implemented	Implemented	Implemented		
ENNA	Lakselv, Banak	17	Implemented	Implemented	Unable		EGNOS coverage limited to 70°N
		35	Implemented	Implemented	Unable		EGNOS coverage limited to 70°N
ENOL	Ørlandet	15	Implemented	Implemented	Not planned		
		33	Implemented	Implemented	Not planned		
ENRO	Røros	13	Not planned	Not planned	Not planned		No published procedures to RWY 14
		31	Implemented	Unable	Unable		APV not possible due to offset angle
ENRY	Moss, Rygge	12	Implemented	Implemented	Implemented		
		30	Implemented	Implemented	Implemented		
ENTC	Tromsø, Langnes	1	Implemented	Analysis required	Analysis required		LNAV/VNAV: Dependent on steep angle assessment. EGNOS coverage issue
		19	Implemented	Analysis required	Analysis required		LNAV/VNAV: Dependent on steep angle assessment. EGNOS coverage issue

Airports with AFIS

ICAO code	Airport name	IFR RWY	LNAV	LNAV/VNAV	LPV	RNP AR	Notes:
ENBL	Førde, Bringeland	7	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
		25	Implemented	Unable	Implemented		
ENBN	Brønnøysund	4	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
		22	Not planned	Not planned	Not planned		No published procedures to RWY 22
ENBS	Båtsfjord	03	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		21	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENBV	Berlevåg	06	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		24	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENFG	Fagernes	15	Not planned	Not planned	Not planned		No scheduled passenger flights
		33	Not planned	Not planned	Not planned		No scheduled passenger flights
ENFL	Florø	7	Implemented	Implemented	Implemented		
		25	Implemented	Unable	Unable		APV not possible due to offset angle
ENHF	Hammerfest	5	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		23	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENHK	Hasvik	11	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		29	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENHV	Honningsvåg, Valan	8	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
		26	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
ENLK	Leknes	2	Planned	Unable	Unable		APV not possible due to offset angle
		20	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle.
ENMH	Mehamn	17	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		35	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENML	Molde, Årø	7	Implemented	Implemented	Implemented		
		25	Implemented	Implemented	Implemented		
ENMS	Mosjøen, Kjærstad	16	Unable	Unable	Unable		No published procedures to RWY 16
		34	Implemented	Analysis required	Implemented		LNAV/VNAV: Further Analyses required
ENNM	Namsos	7	Implemented	Implemented	Implemented		
		25	Implemented	Implemented	Implemented		

ENNO	Notodden, Tjuven	12	Implemented	Unable	Unable		Terrain issue. Only LNAV due to need of Step down fix.
		30	Not planned	Not planned	Not planned		No published procedures to RWY 30
ICAO code	**Airport name**	**IFR RWY**	**LNAV**	**LNAV/VNAV**	**LPV**	**RNP AR**	**Notes:**
ENOV	Ørsta-Volda	6	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
		24	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
ENRA	Mo i Rana, Røssvoll	14	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
		32	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
ENRM	Rørvik, Ryum	4	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle.
		22	Implemented	Analysis required	Implemented		LNAV/VNAV: Offset issue.
ENRS	Røst	3	Implemented	Implemented	Implemented		
		21	Implemented	Implemented	Implemented		
ENSB	Svalbard, Longyearbyen	10	Implemented	Implemented	Unable		EGNOS coverage limited to 70°N
		28	Implemented	Unable	Unable		LNAV/VNAV: Offset issue. EGNOS coverage limited to 70°N
ENSD	Sandane	8	Implemented	Unable	Unable		APV not possible due to offset angle
		26	Implemented	Analysis required	Unable		LPV: Offset issue. LNAV/VNAV: Offset Issue.
ENSG	Sogndal, Haukåsen	6	Implemented	Unable	Planned		RNP APCH to circling (LNAV)
		24	Implemented	Unable	Implemented		
ENSH	Svolvær, Helle	1	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
		19	Unable	Unable	Unable		No published procedures to RWY 19.
ENSK	Skagen, Stokmarknes	9	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
		27	Planned	Unable	Unable		APV not possible due to offset angle
ENSO	Stord, Sørstokken	14	Implemented	Implemented	Not planned		
		32	Implemented	Implemented	Not planned		
ENSR	Sørkjosen	15	Implemented	Unable	Unable		RNP APCH to circling (LNAV)
		33	Unable	Unable	Unable		
ENSS	Vardø, Svartnes	15	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		33	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
ENST	Sandnessjøen, Stokka	2	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
		20	Implemented	Implemented	Implemented		LNAV/VNAV: Steep angle
ENVD	Vadsø	7	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N
		25	Implemented	Implemented	Unable		LNAV/VNAV: Steep angle. EGNOS coverage limited to 70°N

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