



PBN – an environmental tool

Solakonferansen 2017

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AVINOR AS

Society's mission and environmental aspects

- Within the commercial framework, the mission set out by the society shall be delivered through effective and secure operation of the business.
- **Environmental responsibility** is a central part of this, an environmental strategy is established to cement the environmental activities such that the concern's approved aims are achieved.
- Balance between
 - Noise
 - Emission
 - Capacity
 - Effectiveness
 -with flight safety as a foundation.

From Environmental Strategy to Environmental Factor

Aircraft and helicopter noise is defined as a significant environmental factor.



Facts about noise

- Noise is seen as pollution in accordance with the anti-pollution act.
- The Parliament has decided that noise annoyance shall be reduced by 10 % by 2020.
 - Noise annoyance (from air traffic) has actually been reduced 28 % since 1999.
- Aircraft noise has particular qualities:
 - The exposure time of each event is long
 - The noise level variation from event to event is large
 - Air traffic does not follow fixed paths
 - Noise incidence arrives from many angles and sets high requirements to sound insulation of facades and roofs.

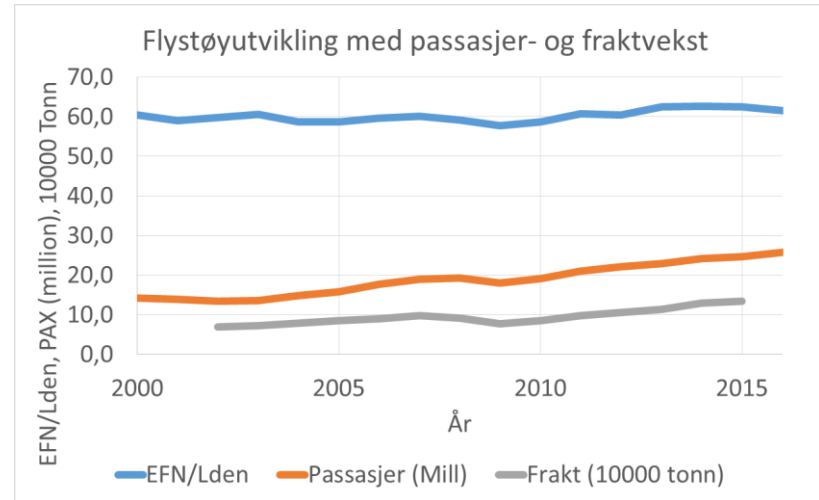
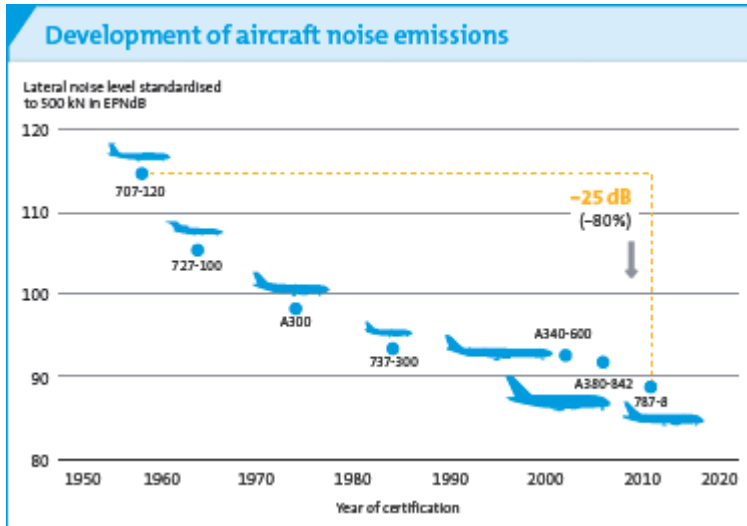
Facts about noise

- Noise is the environmental factor highest on the minds populations surrounding Avinor's airports.
- A doubling of the sound level is equal to an increase of 3dB.
- The human ear cannot discern a level difference until it is 3dB or more.
- An increase of 10dB is necessary to be perceived as a doubling of the noise level

Offshore activities and noise

- Noise has not traditionally been an issue for offshore helicopters, whereas it has for some of the small helicopter and aircraft segments
- The development of heavy helicopters has gone in the opposite direction to aircraft
 - They are based on military platforms
 - Operational pattern – no or limited requirements to the surroundings
 - Requirements for safety increase their weight
 - Low frequency noise gives the greatest challenge
- Technology/purchasing processes
 - All honours to the Norwegian oil and gas association operators, for influencing the suppliers to produce helicopters with upgraded navigation, certified with higher precision
 - «066 – Norwegian oil and gas associations guidelines for flights to petroleum installations»
- Avinor has together with the industry encouraged the authorities to set national requirements when approving new heavy helicopters

Development of noise (fixed wing)



Development of helicopter noise

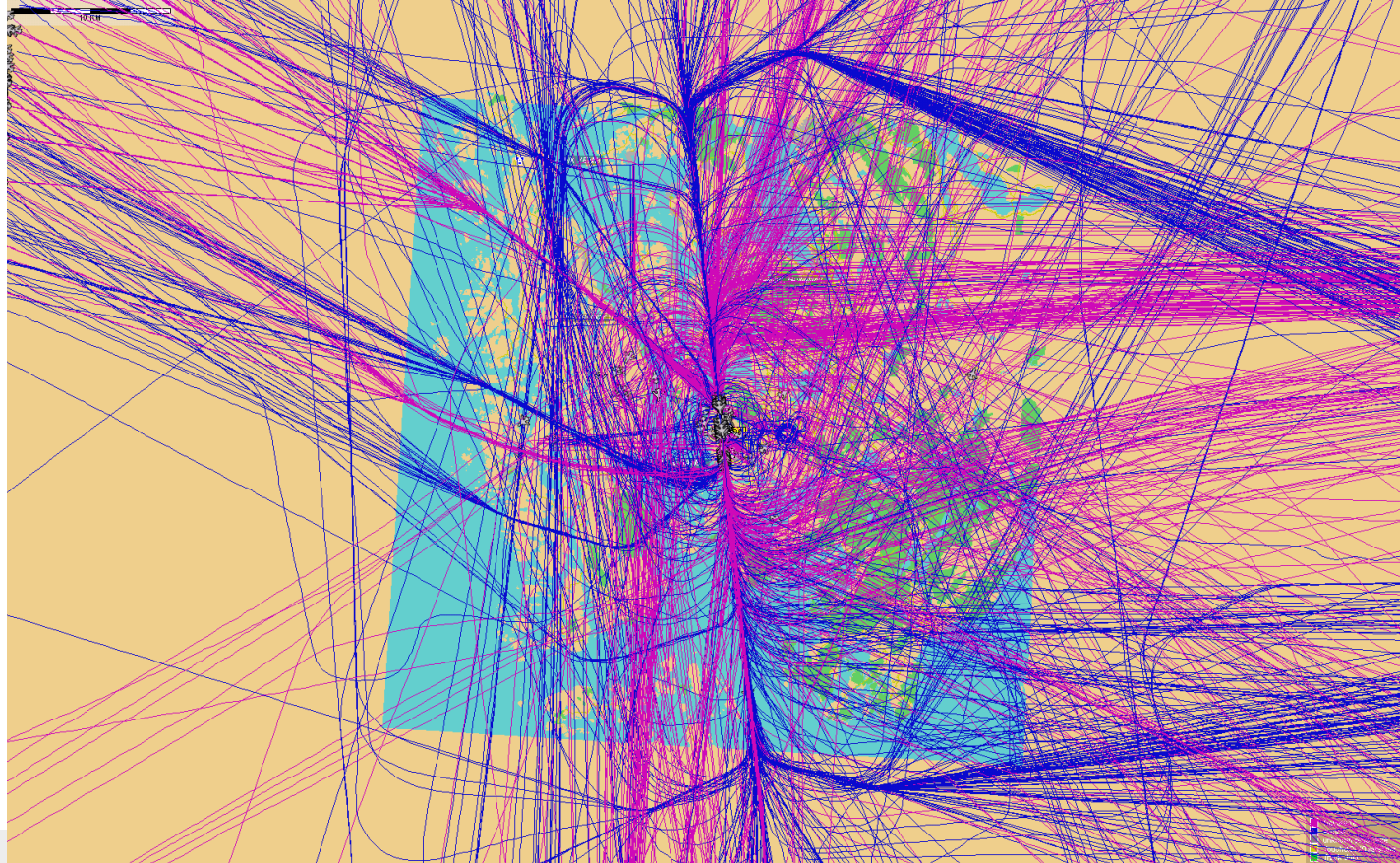
Helicopter type	Departure	Over flight	Landing	PAX
S92	94,6	97,2	97,5	19
EC225/H225	95,6	93,5	98,9	19
AW189	91,3	95,2	99,1	16
AW101	97,6 (101,5)	93,6 (100,5)	99,1 (102,5)	24*
S61	92,8	94,0	91,6	
AW169 (new police helicopter)	88,8 (93,6)	89,3 (91,6)	94,4 (96,6)	
H145 (alternative bidder for police helicopter)	86,5 (95,7)	84,7 (94,7)	90,3 (96,7)	
EC135 (present police helicopter)	88,3 (94,7)	85,7 (93,7)	94,9 (95,7)	

Measured in EPNdB («Effective Perceived Noise in Decibels», max limit in brackets). A-weighted sound level (low frequency noise filtered out).

Industry and reputation

- Air transport is dependent on a good reputation
- Pro-active
 - Show that we take it seriously
 - Give the best solutions
- Collectively we have the competence (possibilities and limitations)
- We know where the pressure points are
- Regulations and controls don't necessarily give better results for the surroundings – together we contribute to the optimal result
-and we have excellent results from such cooperation to refer to

Potential for improvement - a random week at a random airport



Tools

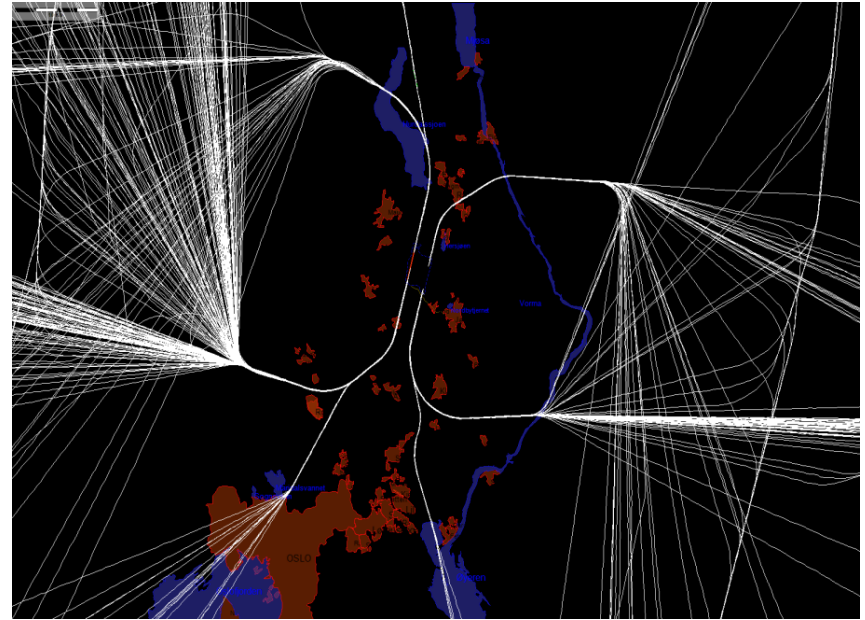
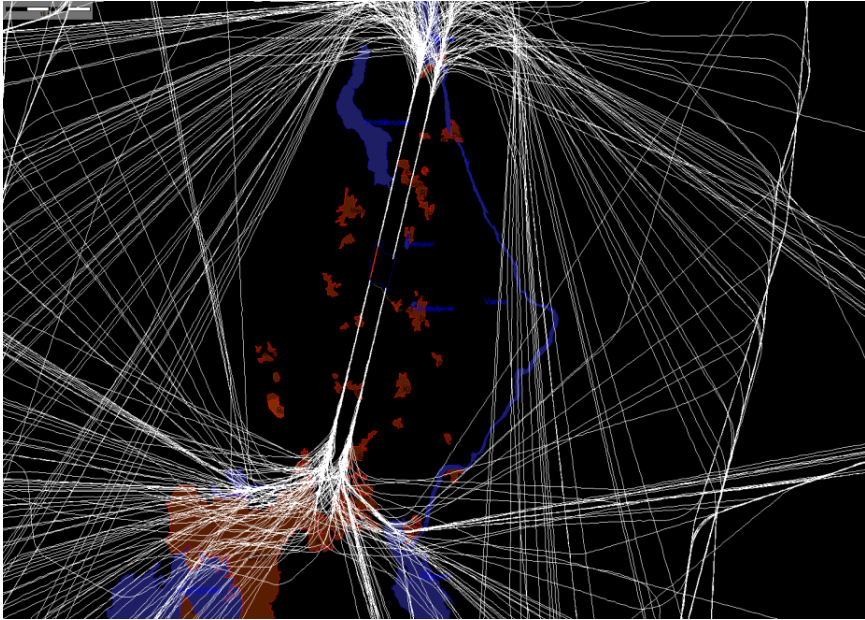
- Establishing "environmentally optimized" approach and takeoff procedures using PBN for helicopter and aircraft is an effective tool.
 - Reduces the number of noise exposed and/or the emissions (location dependent)
- *Special challenges* associated with offshore transport (S-92) has caused this part of the flight operations to be prioritized at Flesland and Sola.

Environmentally optimized landing and departure procedures – from concept to publication - process

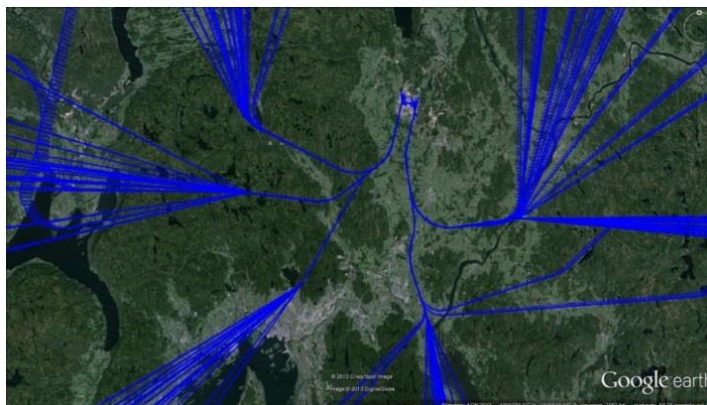
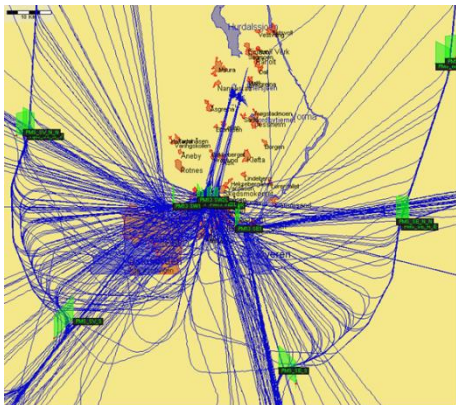
- Involve all parties
 - Neighbouring communities – operator
 - Extensive internal processes such as air space design, procedure design, environmental evaluations, capacity evaluations, risk analysis, test flights, regulation and verification flying from approved suppliers, before final approval from the Civil Aviation Authority.
 - Publication in AIP

= time consuming processes

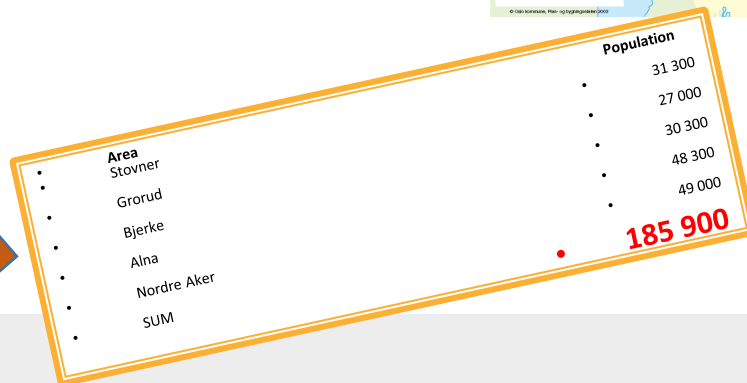
Experience with RNAV visual/RNP AR fixed-wing



Test approach flights at Gardermoen



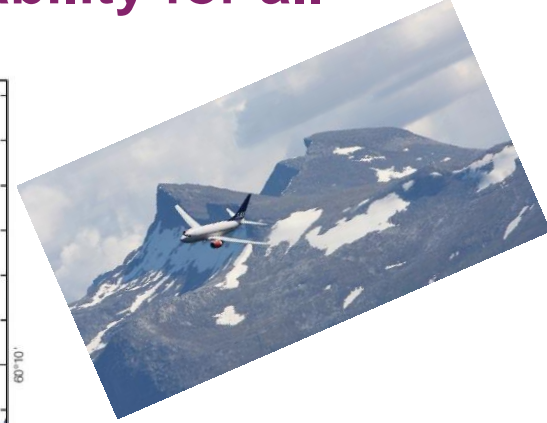
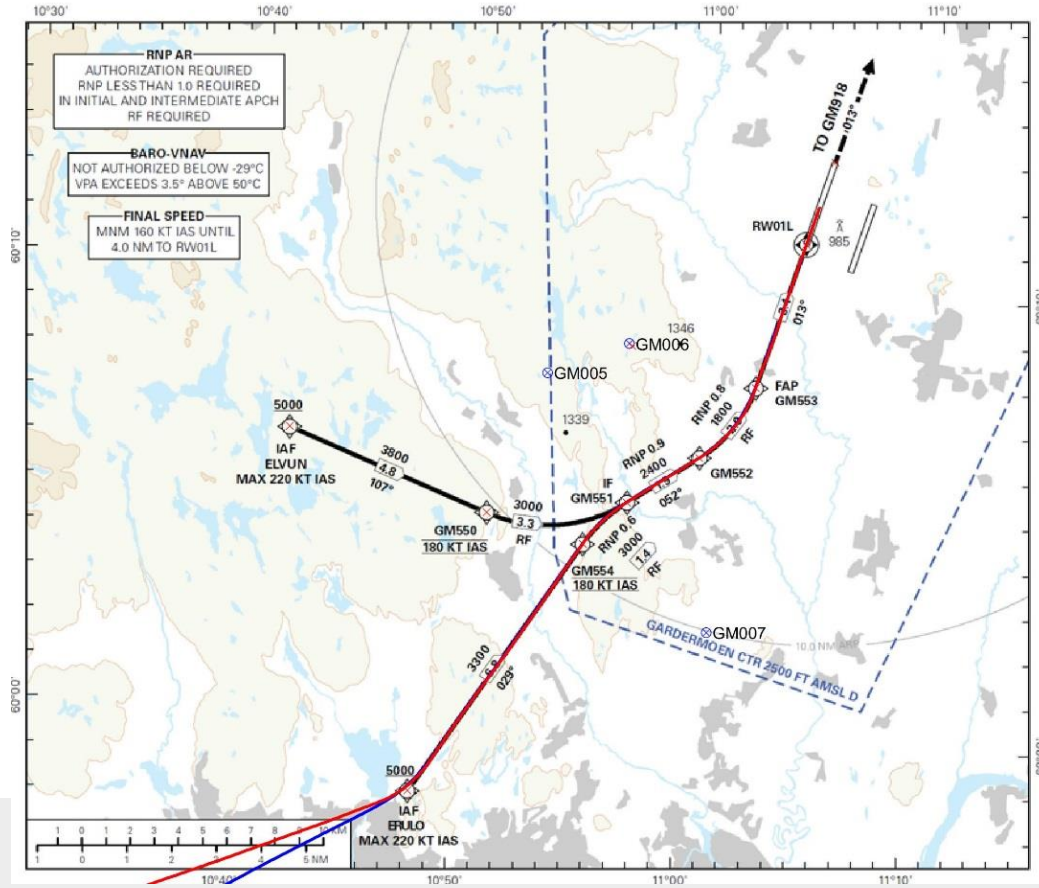
13700 approaches
1000 tonne fuel saved
 = **3200** tonne CO₂ +
 reduction in the number
 of noise exposed



Accuracy and repeatable pattern give predictability for all

LNAV/VNAV A/P
connected, give an
average lateral deviation
RF-segment = 5m.

From FAP the average deviation was 3.1 m from the centre line.



FDM B737 NG:

- 1200 parameters
- 30 used for positioning

15 FDM parameters for validation and procedure

- A/C position: lat, long. and alt.
 - Alt: baro. and radio-altimeter.
- Attitude: roll, pitch and heading.
- 4 parameters for the procedure; WPT distance to go, WPT Selected, Cross-track Deviation and Vertical deviation.
- 4 parameters for speed; Airspeed, Groundspeed, Wind speed/direction.

Tools for Avinor and local councils

- Used as the basis to calculate the red and yellow noise zones
 - Accuracy is high
- Predictability prepares for better area usage planning

Noise reduction measures heli. SVG RWY29

RNAV visual 082/046

ENZV
SOLA

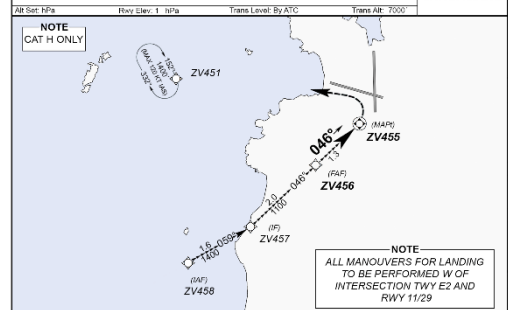
AVINOR
07 JAN 2016

STAVANGER, NORWAY
RNAV VISUAL 046

ATIS	APP (Area Control)	TWR	GND	VDF
126.000	119.600 119.400 118.500 122.100	118.350 122.100	121.750	ALL FREQ
RNP APCH (RNAV VISUAL) MISSED APCH	Final Appch Crs 046°	Procedure Alt ZV456 1100'	OC/NV Visual procedure RWY	Appch Crs 29

TURN LEFT DCT ZV451 CLIMBING TO 1400. ENTER ZV451 HOLDING.
MAX 90 KT IAS DURING MISSED APCH TURN.

MSA 25 NM ZOL



RNAV visual procedures are visual procedures where the FMS coding provides a nominal path intended solely for track repeatability and predictability for the unit providing air traffic services.

Pilot in command is responsible for obstacle avoidance during all phases of flight.

- Field in sight required before reaching IAF. If field not in sight request radar vectors for approach
- Autopilot and LNAV/VNAV mode required
- Transitions are not to be requested, as ATS will offer procedures in low density periods
- Vertical path angle (VPA) for the procedure is 3.3°
- Monitor RNP/ANP

CHANGES: NEW PROCEDURE

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ZV Procedures tested in the simulator for fly-ability

- Define MAPt
 - Secure that missed approach does not come in conflict with the main runway
 - Define wind limitations (speed and direction)
- Many thanks to THALES and CHC/Bristow
 - Minimize time usage



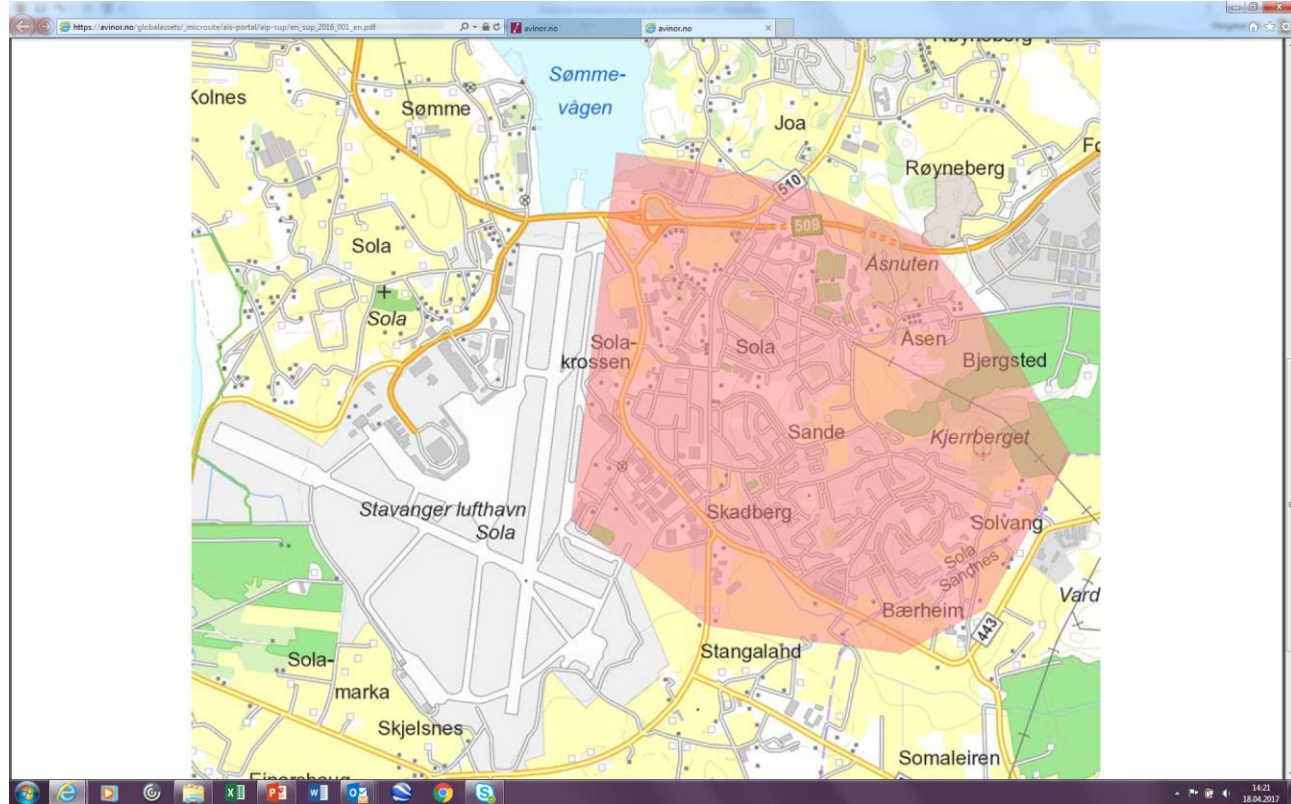
Further work.....

- Continue testing RNAV visual procedures
- Publication as LNAV/LPV and RNAV visual

Alternative measures to reduce noise annoyance

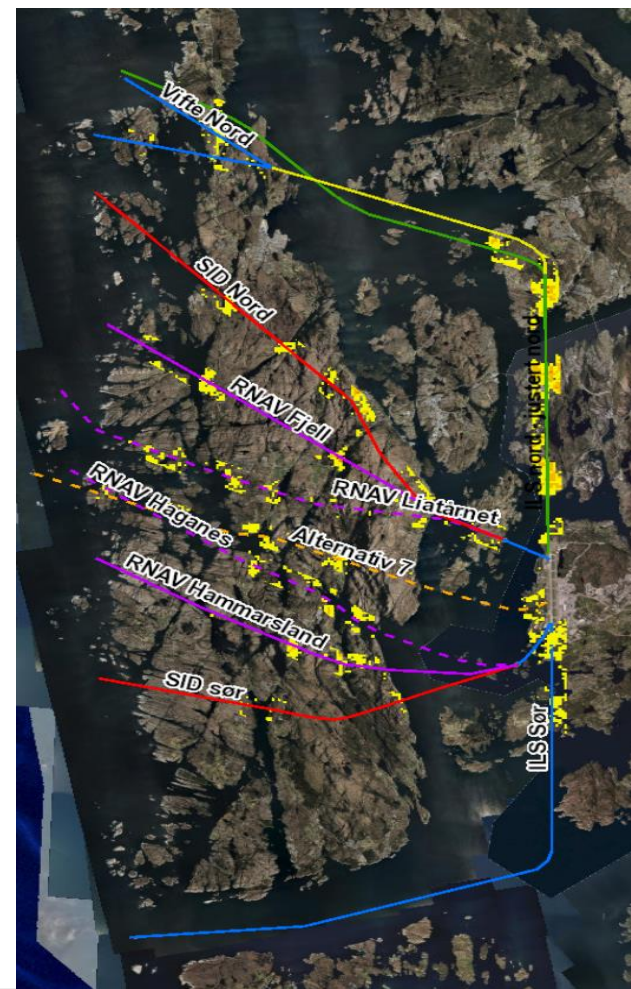
ENZV AD 2.21 Noise abatement procedures

Arriving and departing helicopters shall avoid overflying the area inside ZOL VOR/DME radial 360 - 090 radius 1.5 NM.



Noise reduction measures BGO

- ❑ Number of noise exposed today = 23212
- 2 conventional approaches
- 4 satellite based noise reduction approaches
 - increase height from 2000-3000 feet
 - 120 knop
- 2 departure procedures
- ❑ Number of noise exposed for the concept = 13898



RNAV visual/RNP-AR/LNAV/LPV status and further work

✓ RNP AR OSL - approved

✓ RNP AR HAU/EVE – application sent

RNP-AR / RNAV Visual

TRD:

- Fixed → AUG 2018
- Heli [RNAV(LPV)] → N/A

BGO:

- Heli [RNAV(LPV)] → AUG 2018
- Fixed → AUG 2018

SVG:

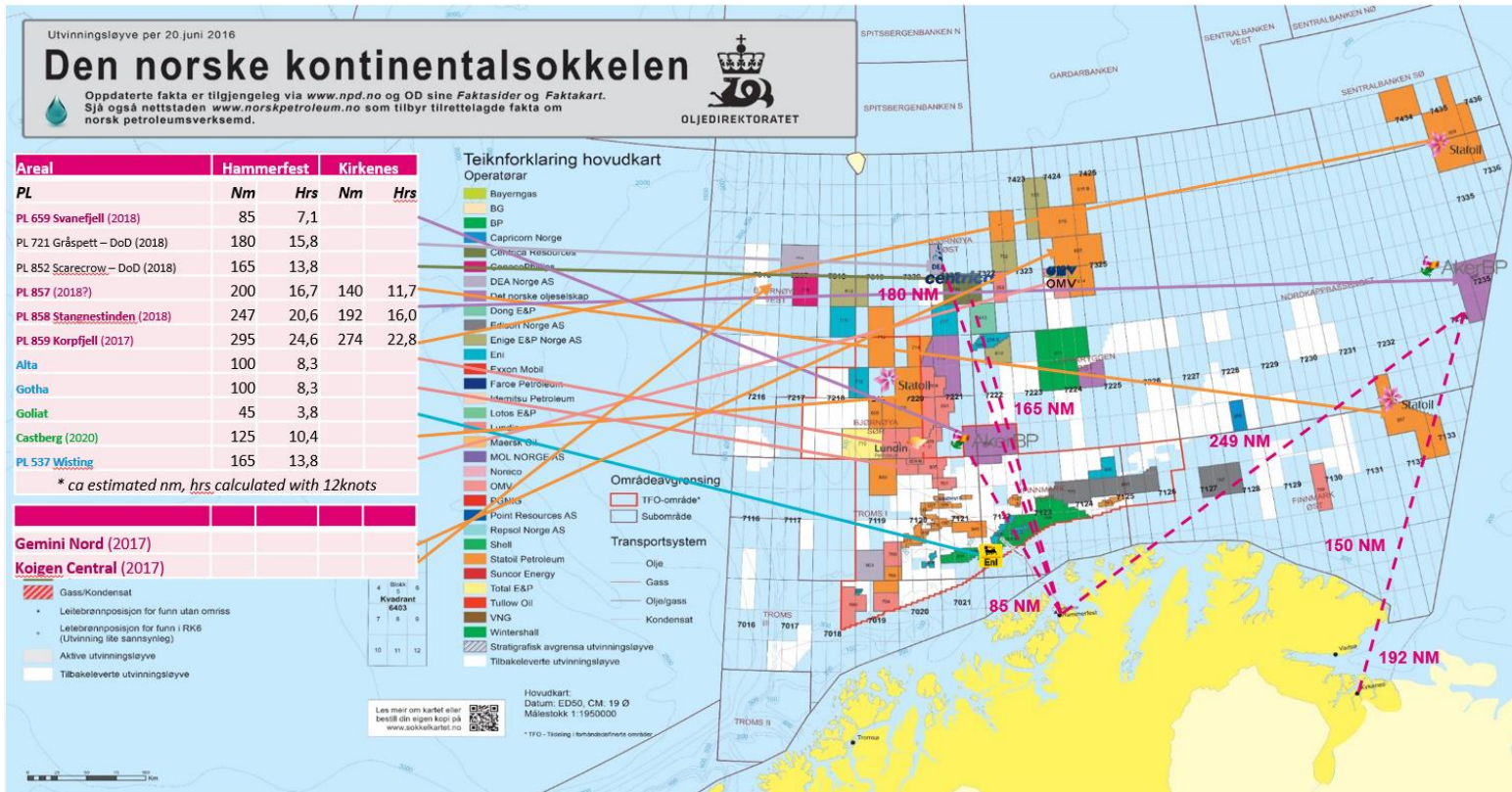
- Heli [RNAV(LPV)] → AUG 2018
- Fixed → AUG 2018

DRL

<i>Prioriterte</i>	<i>Pri. 2</i>
BOO - ENBO	MOL - ENML
LYR - ENSB	LKL - ENNA
TOS - ENTC	KSU - ENKB
KKN - ENKR	FRO - ENFL
AES - ENAL	
KRS - ENCN	

RNAV visual/LPV/LNAV/VNAV/RNP AR = same path (no visuals)
SID – Replace turn to right with point. RNP1 m/RF-leg (criteria from 2020)
STAR – Connect STAR & RNP-AR

Northern area activities?





Thank you for your
attention