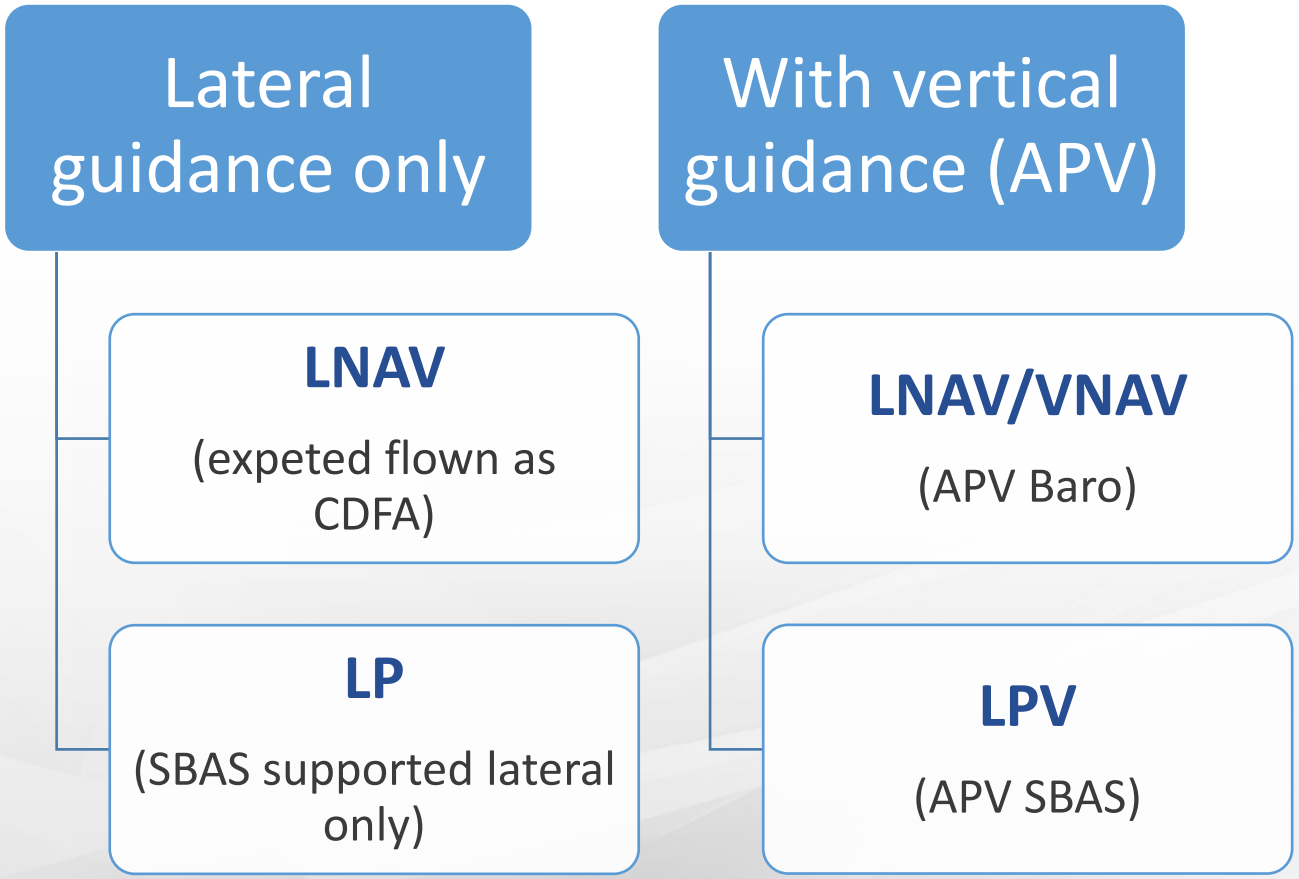
RNAV APPROACH MANAGEMENT OF DEGRADED NAVIGATION **A320**

.... the 5 minutes review

REQUIRED RNAV 5* / APCH** EQUIPMENT
The minimum airspace navigation equipment

- One FMGC* / **
- One MCDU* / **
- One FD**
- One PFD* / PF side**
- One GPS* / ** or (1) VOR/DME or two DMEs to update FM position
- One* Two IRS**
- Two NDs* / ** (the temporary display of ND information via the PFD/ND** switch is permitted on one side).
- Two FCU channels**

Design of RNP Approaches

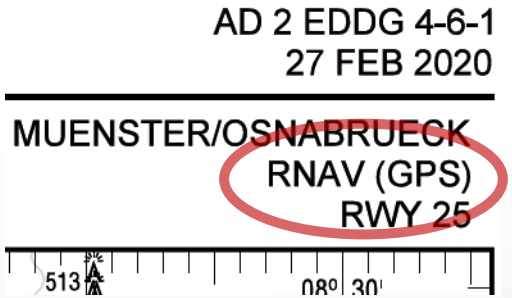


GPS-Approaches: RNAV, GPS, RNP

- ***Approaches***
  - **GPS**
  - **RNAV**
  - **RNP**
- ***Procedure lateral & vertical guidance***
  - LNAV
  - LNAV/VNAV
  - LP
  - LPV
  - APV

Approaches: RNAV, GPS, RNP

What are the differences?



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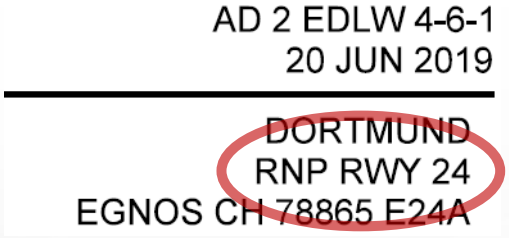
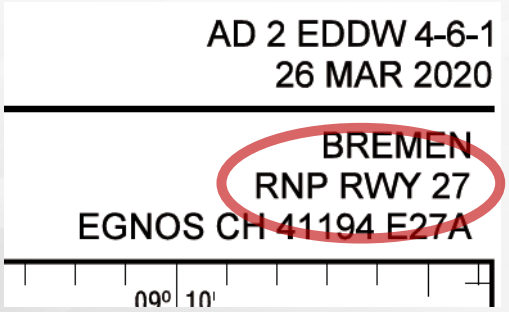




Approaches: LNAV, LNAV/VNAV, LPV

AD 2 EDDG 4-6-1
27 FEB 2020

MUENSTER/OSNABRUECK
RNAV (GPS)
RWY 25

513 08° 30'

OCA (OCH)	A	B
LNAV	600 (440)	600 (440)
LNAV / VNAV	470 (311)	480 (321)

AD 2 EDLW 4-6-1
20 JUN 2019

DORTMUND
RNP RWY 24
EGNOS CH 78865 E24A

OCA (OCH)	A	B
LNAV	790 (390)	800 (400)
LNAV / VNAV	700 (300)	700 (300)
LPV	702 (300)	702 (300)

AD 2 EDDW 4-6-1
26 MAR 2020

BREMEN
RNP RWY 27
EGNOS CH 41194 E27A

09° 10'

OCA (OCH)	A	B
LNAV	400 (380)	400 (380)
LNAV / VNAV	400 (380)	400 (380)
LPV	159 (145)	169 (155)

?

Approaches: RNAV, GPS, RNP

- RNAV (GPS)
- RNP

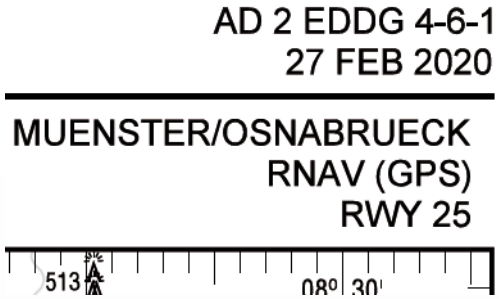
} *Exactly the same. Name dependents on the time of appointment*

- LNAV — *Only lateral guidance (cylindrical)*
- LNAV/VNAV — *Lateral guidance (cylindrical) plus vertical guidance barometric **
- LP — *Lateral guidance (conical) SBAS*
- LPV — *Lateral guidance (conical) SBAS plus vertical guidance SBAS*
- APV — *Generic term for LNAV/VNAV und LPV*

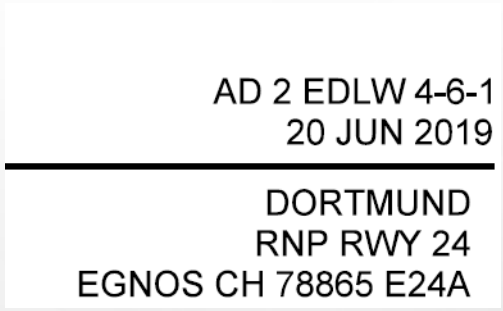
RNP – Vertical descent procedures

– LNAV	*Descent according to altimeter and VSI*
– LNAV/VNAV	*Descent to HSI but no existing FAS DB*
– LP	*Descent according to altimeter and VSI*
– LPV	*Descent to HSI with existing FAS DB*
– APV i. e. S.	*Descent to HSI with existing FAS DB*

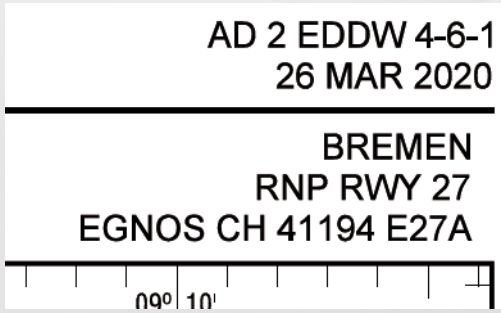
Minima LNAV/VNAV and LPV



OCA (OCH)	A	B
LNAV	600 (440)	600 (440)
LNAV / VNAV	470 (311)	480 (321)



OCA (OCH)	A	B
LNAV	790 (390)	800 (400)
LNAV / VNAV	700 (300)	700 (300)
LPV	702 (300)	702 (300)



OCA (OCH)	A	B
LNAV	400 (380)	400 (380)
LNAV / VNAV	400 (380)	400 (380)
LPV	169 (145)	169 (155)

?

Differences Minima LPV?

DORTMUND
RNP RWY 24
EGNOS CH 78865 E24A

OCA (OCH)	A	B	C	D
LNAV	790 (390)	800 (400)	800 (400)	810 (400)
LNAV / VNAV	700 (300)	700 (300)	740 (340)	740 (340)
LPV	702 (300)	702 (300)	702 (300)	702 (300)

BREMEN
RNP RWY 27
EGNOS CH 41194 E27A

OCA (OCH)	A	B	C	D
LNAV	400 (380)	400 (380)	400 (380)	400 (380)
LNAV / VNAV	400 (380)	400 (380)	400 (380)	400 (380)
LPV	159 (145)	169 (155)	179 (165)	189 (175)

BREMEN
ILS CAT II & III or LOC
RWY 27

OCA (OCH)	A	B	C	D
ILS CAT I	159 (145)	169 (155)	179 (165)	189 (175)
ILS CAT II	71 (57)	87 (73)	100 (86)	113 (99)
LOC-DME	410 (390)	410 (390)	410 (390)	410 (390)

Why different minimums?

- ***EDDG Münster***
  - **RNP** without **EGNOS** (no FAS DB)
- ***EDLW Dortmund***
  - **RNP** with **EGNOS mit APV-I** (EGNOS APV-I since 2011)
  - In Chart as **LPV**
  - **Non-precision approach**
- ***EDDW Bremen***
  - RNP with EGNOS with LPV-200 (= ILS CAT I) (LPV200 since 2015)
  - **Precision approach**

Requirements for LPV as a precision approach

LPV-200

- ***EGNOS***
  - The system is designed to improve accuracy to 1-2 m horizontally and 3-5 m vertically
  - Integrity and safety are improved by alerting users within **6 seconds** if a GPS malfunction occurs (up to 3 hrs GPS alone)
- ***Runway and approach design***
  - Especially obstacle clearance

DA(H), MDA(H), OCA(H), MAPt

Standard — STRAIGHT-IN LANDING RWY **25**

	LNAV/VNAV		LNAV CDFA	
	DA(H) A: 470′(311′) C: 489′(330′) B: 480′(321′) D: 499′(340′)		DA/MDA(H) 600′(441′)	
		ALS out		ALS out
A	RVR 750m [1]	RVR 1400m	RVR 1400m	RVR 1500m
B	RVR 800m	RVR 1500m		
C				RVR 2100m
D				

Standard — STRAIGHT-IN LANDING RWY **24**

	LPV		LNAV/VNAV		LNAV CDFA	
	DA(H) 70′(300′)		DA(H) AB: 791′(300′) CD: 741′(340′)		DA/MDA(H) A: 790′(389′)	BC: 800′(399′) D: 810′(409′)
		ALS out		ALS out		ALS out
A	RVR 750m [1]	RVR 1400m	RVR 750m [1]	RVR 1400m	RVR 1100m	RVR 1500m
B						
C			RVR 800m	RVR 1500m		RVR 1800m
D					RVR 1200m	RVR 1900m

OCA (OCH)	A	B	C	D
LNAV	400 (380)	400 (380)	400 (380)	400 (380)
LNAV / VNAV	400 (380)	400 (380)	400 (380)	400 (380)
LPV	159 (145)	169 (155)	179 (165)	189 (175)

Approach-Minima-Terms

✈ *OCA/H*

The lowest altitude or the lowest **height** above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance **with appropriate obstacle clearance criteria**.

In a precision approach procedure (or APV), the OCA/H is defined as **the lowest altitude/height at which a missed approach must be initiated** to ensure compliance with the appropriate obstacle clearance design criteria.

Approach - Minima - Terms

- ***MDA(H)***

  Minimum descent altitude (MDA) or minimum descent height (MDH). A specified altitude or height **in a nonprecision approach** or circling approach, below which, descent should not be made without the required visual reference.

- ***DA(H)***

  Decision altitude (DA) or Decision height (DH). A specified altitude or height **in the precision approach** or **approach with vertical guidance** at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

Decision making

Event	Action
FINAL APP not engage	Discontinue approach
Dual loss of FINAL APP mode	Discontinue approach
GPS primary lost (on both NDs)	Discontinue approach
GPS primary lost (on one ND)	Continue the approach by engaging AP on not affected side
Dual NAV ACCURACY DOWNGRAD	Discontinue approach
FM/GPS POSITION DISAGREE	Discontinue approach
FMS1/FMS2 POS DIFF	Discontinue approach
One FMGS only	Continue the approach by engaging AP on not affected side
Dual loss of FMGS	Discontinue approach
Loss of GPWS TERRAIN function (in case of inconsistencies affecting obstacles or terrain computation)	Discontinue approach
NAV ALT DISCREPANCY	Discontinue approach
Dual FCU channel fault	Discontinue approach
One EFIS ND only	Continue the approach by engaging AP on not affected side
Dual EFIS ND fault	Discontinue approach
One MCDU only	Continue the approach by engaging AP on not affected side
Dual MCDU fault	Discontinue approach
One GPS (MMR) only	Continue the approach by engaging AP on not affected side
Dual GPS fault	Discontinue approach
One FD only	Continue the approach by engaging AP on not affected side
Dual FD fault	Discontinue approach