

Infraestructures del Transport Aeri

IFR approaches

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May 2020 – Version 2.4

Introduction

Conventional Radionavigation

Departure
En-Route
Arrival
Approach



2D

VOR
DME SRE
NDB

Final Approach segment

Non Precision Approach (NPA)

2D

VOR (+DME) DF
NDB LOC SRE
L MLS azimuth

Precision Approach (PA)

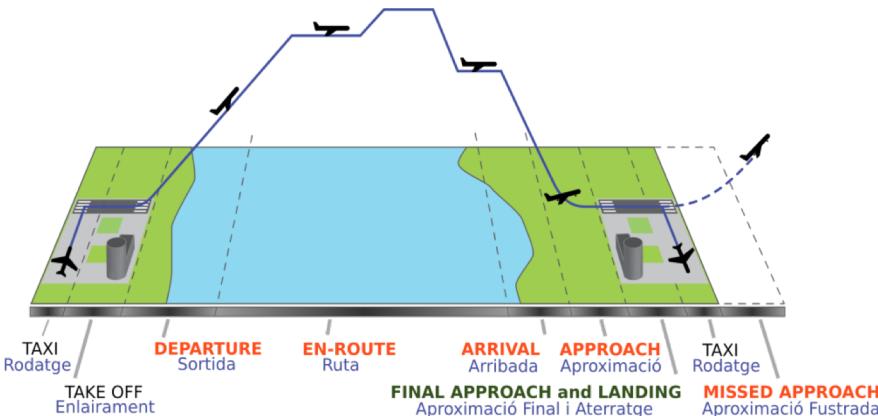
3D

ILS PAR
MLS

VOR: VHF Omnidirectional Range
DME: Distance Measurement Equipment
NDB: Non Directional Beacon
SRE: Secondary Radar Equipment

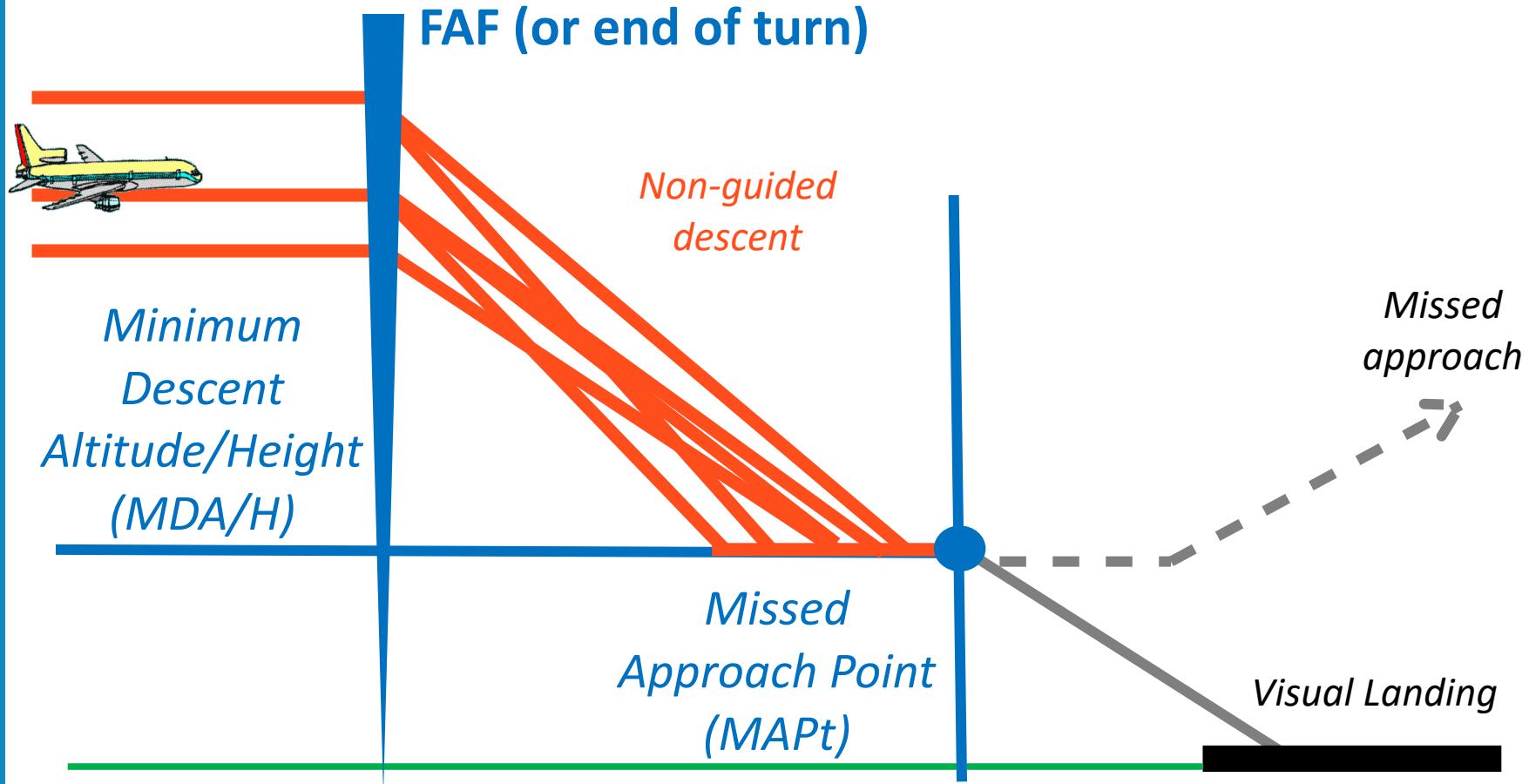
DF: Direction Finder
L: Locator
LOC (or LLZ): Localizer (ILS)
MLS: Microwave Landing System

ILS: Instrumental Landing System
PAR: Precision Approach Radar



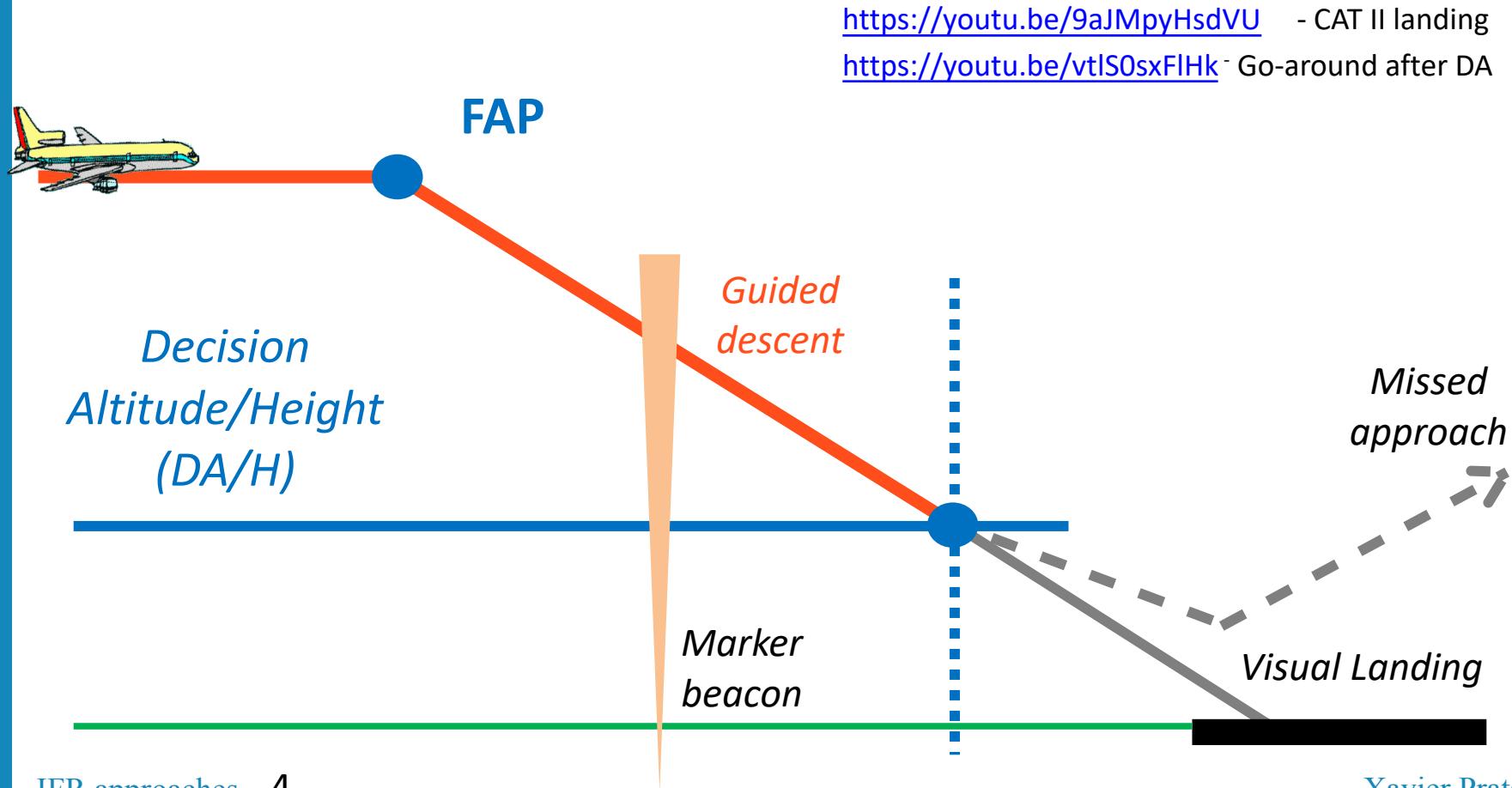
Approaches

Non Precision Approach (NPA)



Approaches

Precision Approach (PA) or Approach with Vertical Guidance (APV)



Approaches

Types of approaches

Depending on:
Final segment
guidance

Non Precision Approach (NPA)

- Lateral guidance
- MDA/H: Minimum Descent Altitude/Height
- MAPt: Missed Approach Point

Precision Approach (PA) & Approach with Vertical Guidance* (APV)

- Lateral **AND** Vertical Guidance
- DA/H: Decision Altitude/Height
- Altitude is cross-checked with marker beacons and/or DME range



Approaches

Types of approaches

Depending on:
Final segment alignment
and gradient

Straight-in approach

If final approach course is within a specified alignment* with the Runway centerline AND final descent gradient is within some specified minimum and maximum limits**

Circling approach (circle to land)

If not Straight-in approach:

- “free” visual manoeuvering (circling)
- visual manoeuvering using prescribed tracks

* 30° alignment for Cat A&B and 15° for other Cat

** See ICAO Doc. 8168 PANS-OPS Vol-II

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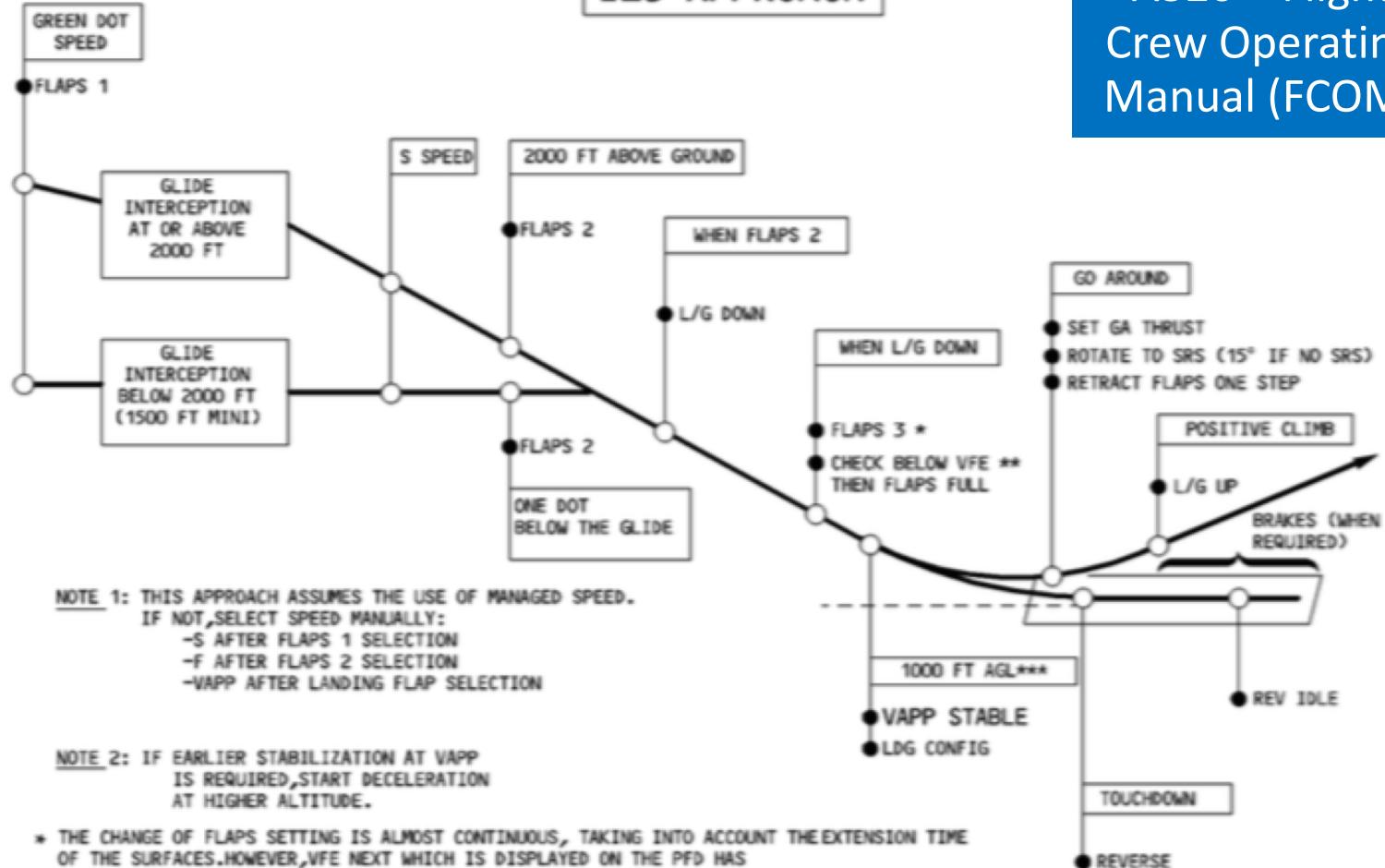
May 2020 – v2.4



Approaches

NFCS-03-0318-009-ADD1AA

ILS APPROACH

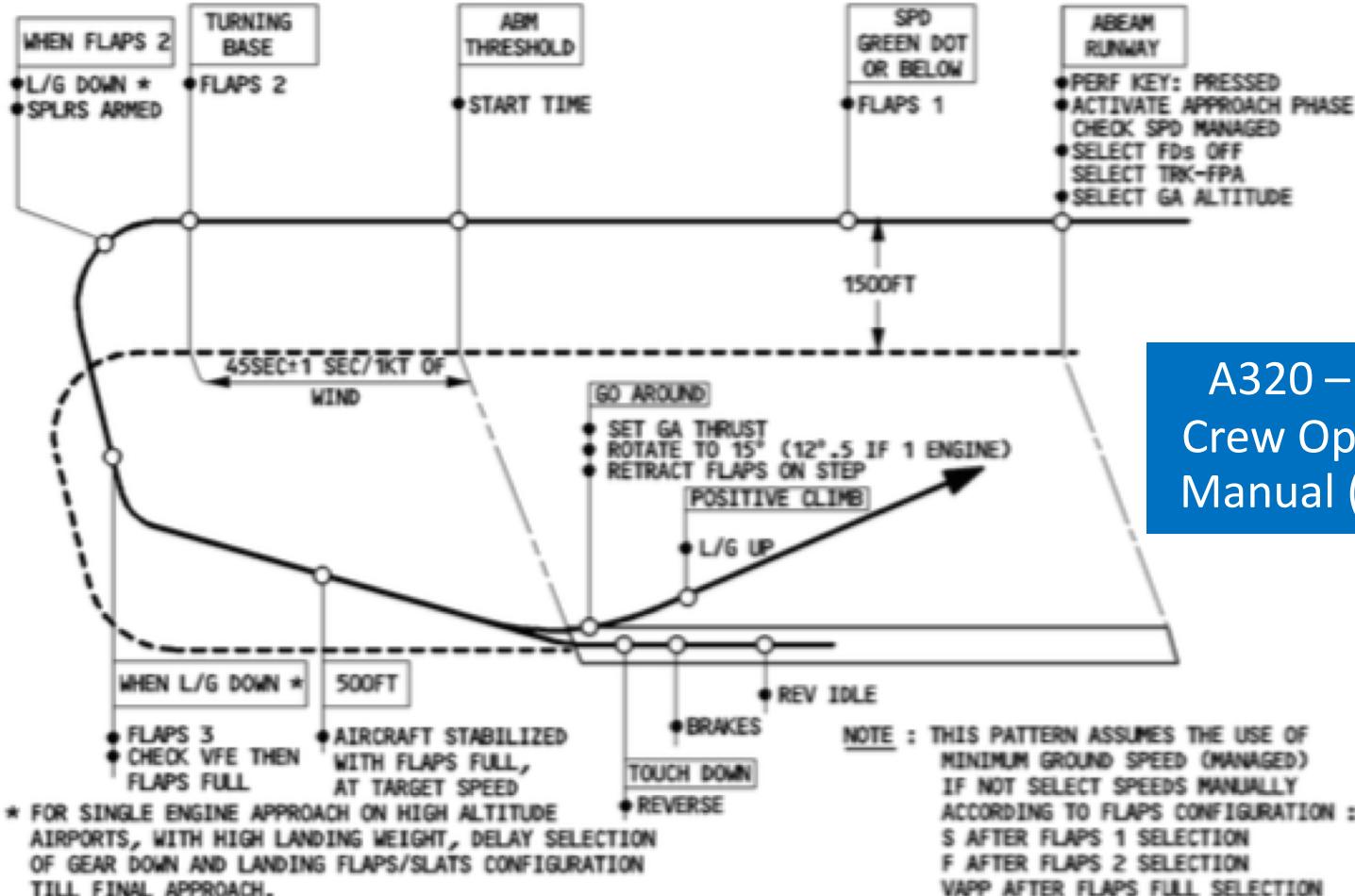


A320 – Flight
Crew Operating
Manual (FCOM)

Approaches

NFCS-05-0320-002-ADD1AA

VISUAL APPROACH (1 OR 2 ENGINES)



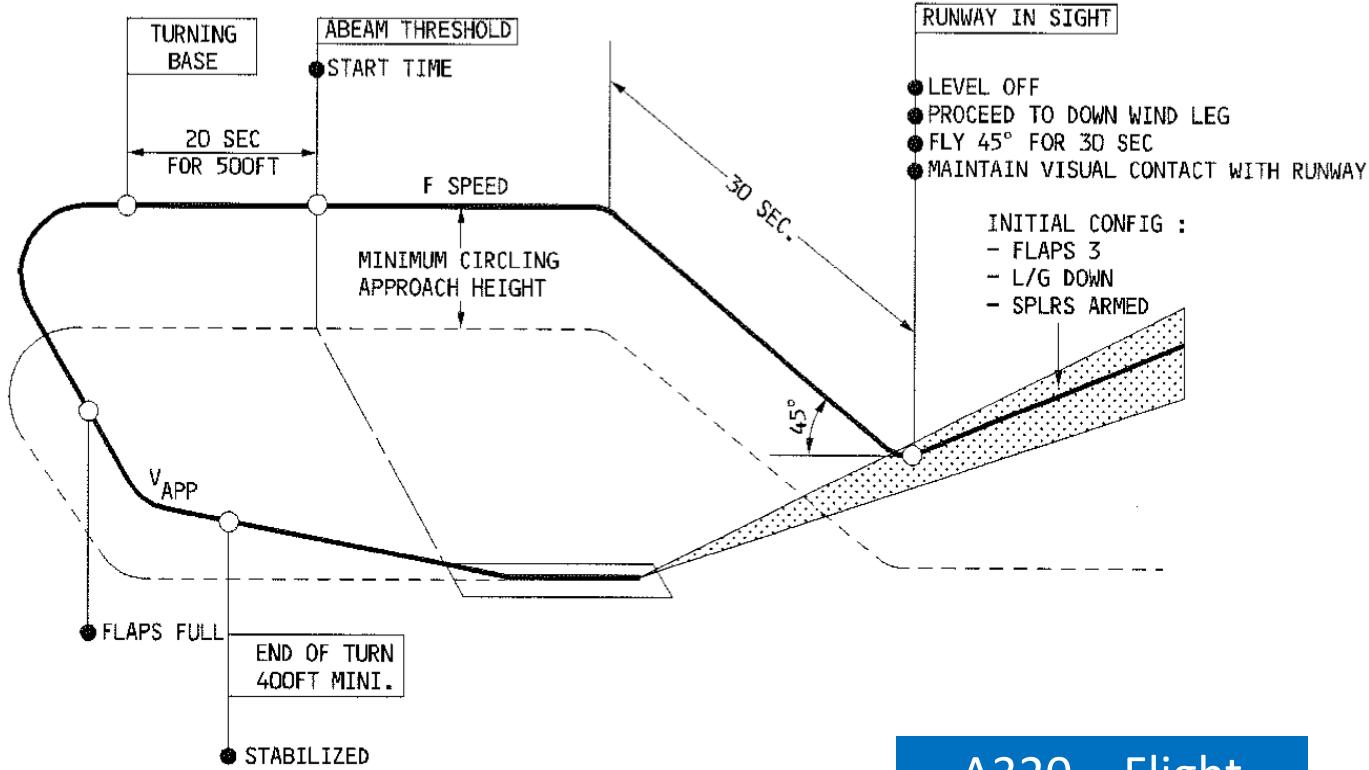
A320 – Flight
Crew Operating
Manual (FCOM)



Approaches

NFC5-03-0319-013-AD01AA

LOW VISIBILITY CIRCLING APPROACH



A320 – Flight
Crew Operating
Manual (FCOM)

AIRBUS TRAINING
SIMULATOR
FLIGHT CREW OPERATING MANUAL
A320

STANDARD OPERATING PROCEDURES

3.03.19 P 13

NON PRECISION APPROACH

SEQ 001 REV 36

SIMU F.P.S.3 UP

for training only

STD 1.3.1



Aircraft Categories

Approach procedures designed for different Aircraft Categories*

Indicated AirSpeed (IAS) at Threshold → $V_{at} = 1.3V_{s1g}$ at MLW

Category A: $V_{at} < 169\text{km/h}$

Category B: $169\text{km/h} < V_{at} < 224\text{km/h}$

Category C: $224\text{km/h} < V_{at} < 261\text{km/h}$

Category D: $261\text{km/h} < V_{at} < 307\text{km/h}$

Category E: $307\text{km/h} < V_{at} < 391\text{km/h}$

Category H: Helicopters

IAS: Indicated AirSpeed

MLW: Maximum Landing Weight

V_{s1g} : Stall speed at 1g

* ICAO Doc. 8168 PANS-OPS Vol-I

Aircraft Categories

Approach procedures designed for different Aircraft Categories*

Category A: Cessna 172, Piper PA28, Beech Baron,...

Category B: ATR72, Falcon 10,...

Category C: Airbus A320, Boeing 737, MD83,...

Category D: Airbus A340, Boeing 747, DC10,...

Category E: Concorde

Category H: Helicopters

* ICAO Doc. 8168 PANS-OPS Vol-I



Aircraft Categories

Approach procedures designed for different Aircraft Categories



Cat A
(Beechcraft 200)



Cat B (ATR 72)



Cat C (Airbus A320)



Cat D (Boeing B747)

Approach Procedure Segments

1- Initial Segment

Allows the aircraft to descend and align with the runway (RWY)

2- Intermediate Segment**

Allows aircraft to properly intercept the final segment
(and helps to transition to landing configuration: speed, flap/slats...)

3- Final Segment*

Allows a safe descend to the DA/H or MAPt for landing

4- Missed Approach Segment*

Allows a safe climb in case of aborted landing

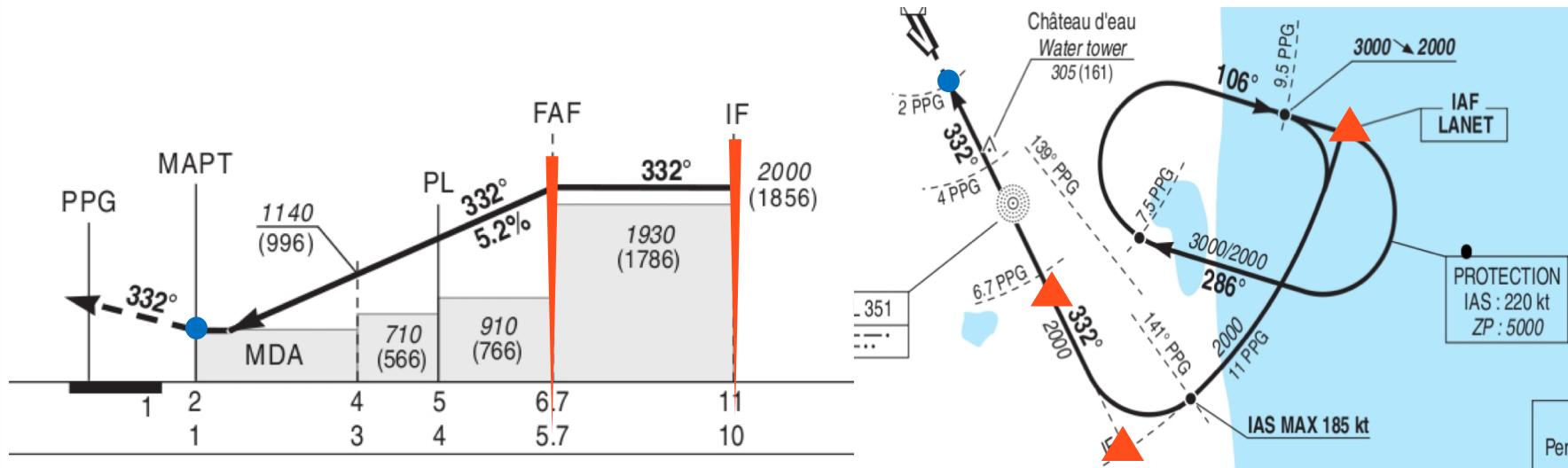
* Mandatory in ALL type of approaches

** Mandatory only in PA and APV approaches



Approach Procedure Segments

- IAF → Initial Approach Fix
- IF → Intermediate Fix
- FAF → Final Approach Fix
- FAP → Final Approach Point
- MAPt → Missed Approach Point



Examples: IAC headers

CARTA DE APROXIMACIÓN
POR INSTRUMENTOS-OACI

ELEV AD
24

APP	119.80
TWR	118.50
GMC	121.80
ATIS	117.80

IBIZA
ILS
RWY 24

001°20'E

001°30'E

001°40'E

ALTITUDES, ELEVACIONES Y ALTURAS EN PIES.

CARTA DE APROXIMACIÓN
POR INSTRUMENTOS-OACI

ELEV AD
15

APP	119.85
TWR	119.85
GMC	121.70

SAN SEBASTIÁN
VOR/DME A
(CAT A, B & C)
RWY 04

002°20'W

002°10'W

002°00'W

001°50'W

001°40'W

001°30'W

APPROCHE AUX INSTRUMENTS

Instrument approach

CAT A B C D

ALT AD : 616, THR : 616 (22 hPa)

PAU PYRENEES

BAKRO / L PO / L PU - ILS RWY 31

BAKRO / L PO / L PU - LLZ RWY 31

ANCHORAGE, ALASKA

AL-1500 (FAA)

LOC/DME I-TGN 109.9 Chan 36	APP CRS 069°	Rwy Idg TDZE Apt Elev 10600 128 152
--	------------------------	---

RVR predicated on Rwy 7R

ANCHORAGE/

TED STEVENS ANCHORAGE INTL (ANC) (PANC)

ILS or LOC/DME RWY 7L

MISSING APPROACH. Climb to 400 then climbing right turn to 2500 via



Example: Perpignan Rivesaltes

APPROCHE AUX INSTRUMENTS

Instrument approach

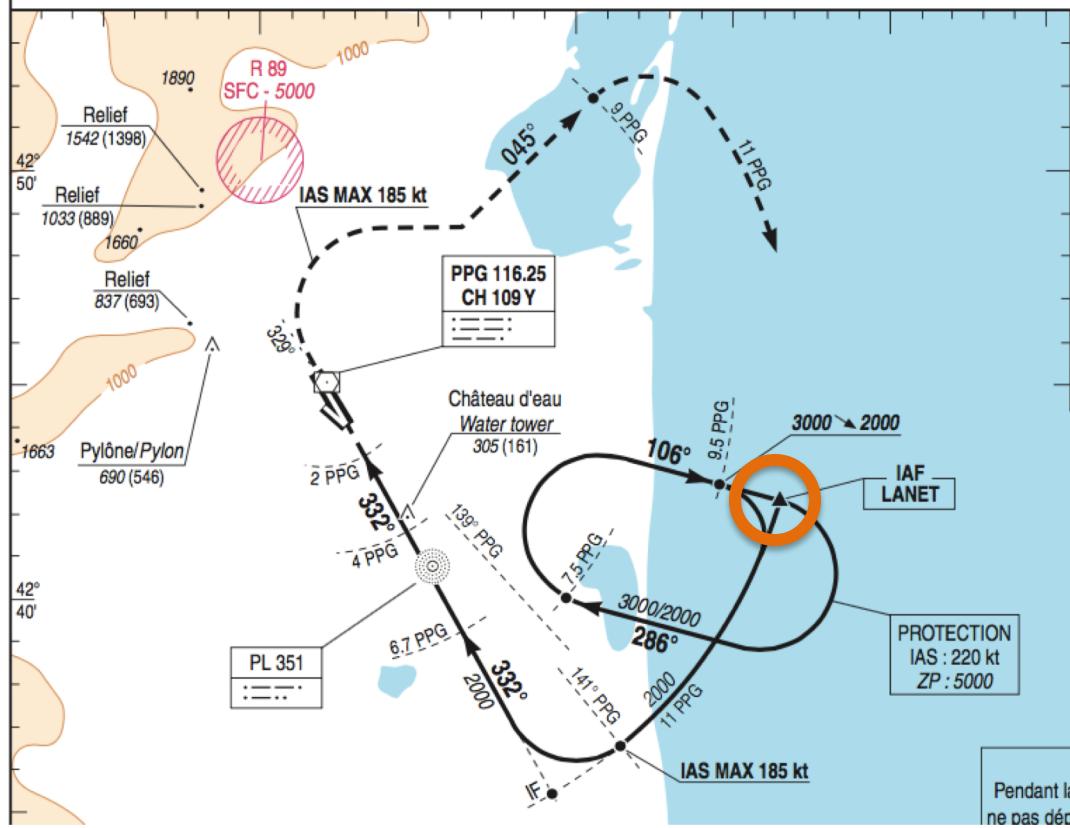
CAT A B C D

ALT AD : 144 (6 hPa), DTHR : 135

ATIS PERPIGNAN : 127.875

APP : PERPIGNAN Approche/Approach 120.750

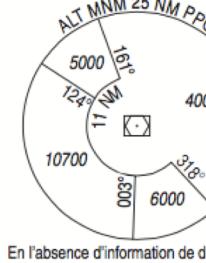
TWR : PERPIGNAN Tour/Tower 118.3



PERPIGNAN RIVESALTES

LANET - VOR/DME RWY 33

V.F.R.
1°W
(05)



En l'absence d'information de distance :
 ALT MNM 5000 entre QDM 161° et 124°
 ALT MNM 10700 entre QDM 124° et 003°
 ALT MNM 6000 entre QDM 003° et 318°
 Without distance information :
 ALT MNM 5000 between QDM 161° and 124°
 ALT MNM 10700 between QDM 124° and 003°
 ALT MNM 6000 between QDM 003° and 318°

NOTE :
 Pendant la branche d'éloignement
 ne pas dépasser le radial 139° PPG

Example: Perpignan Rivesaltes

TA : 5000

API : Monter sur RDL 152° PPG (RM 332°).

A PPG, tourner à droite pour rejoindre et suivre RDL 045° PPG (RM 045°) en montée vers 2000 (1856). A 9 NM PPG, tourner à droite pour suivre l'arc DME 11 NM PPG.

A LANET intégrer l'attente à 2000 (1856).

Monter à 1500 (1356) avant d'accélérer en palier.

Missed APCH : Climb RDL 152° PPG (MAG track 332°).

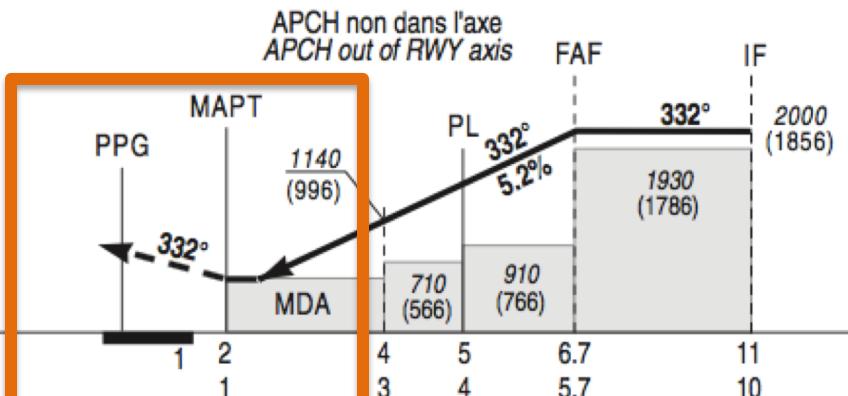
At PPG, turn right to join and follow RDL 045° PPG (MAG track 045°) climbing up to 2000 (1856). At 9 NM PPG, turn right to follow DME arc 11 NM PPG.

At LANET join holding at 2000 (1856).

Climb up to 1500 (1356) prior to level acceleration.

PPG ← (NM)

DTHR ← (NM)



REF HGT : ALT AD

MNM AD : distances verticales en pieds, RVR et VIS en mètres./Vertical distances in feet, RVR and VIS in metres.

CAT	VOR/DME		MVL (1)
	MDA (H)	RVR	
OCH : 407			
A	1200	990 (840)	1500
B	1300	1140 (990)	1600
C	1400	1430 (1290)	2400
D	1600	1940 (1800)	3600

STAP : paramètres disponibles : vent, base des nuages, T, DP, QNH, QFE.
STAP : available data : wind, cloud base, T, DP, QNH, QFE.

DME PPG				
NM	6	5	4	3
ALT (HGT)	1780 (1636)	1460 (1316)	1140 (996)	820 (676)

Indications to help the pilot with the (non-guided!!) descent

Observations/Remarks : (1) MVL CAT C et D : RWY 15/33 seulement et interdites à l'Ouest de la piste.

(1) Circling CAT C and D : RWY 15/33 only and prohibited West of RWY.

French nomenclature: MVL (Manoeuvre a Vue Libre) = Visual circling to land -
MVI (Manoeuvre a Vue Imposée) = Visual prescribed tracks

Example: Pau Pyrénées

APPROCHE AUX INSTRUMENTS

Instrument approach

CAT A B C D

ALT AD : 616, THR : 616 (22 hPa)

ATIS PAU 128.475

APP : PYRENEES Approche/Approach 121.175 - 128.8 (s)

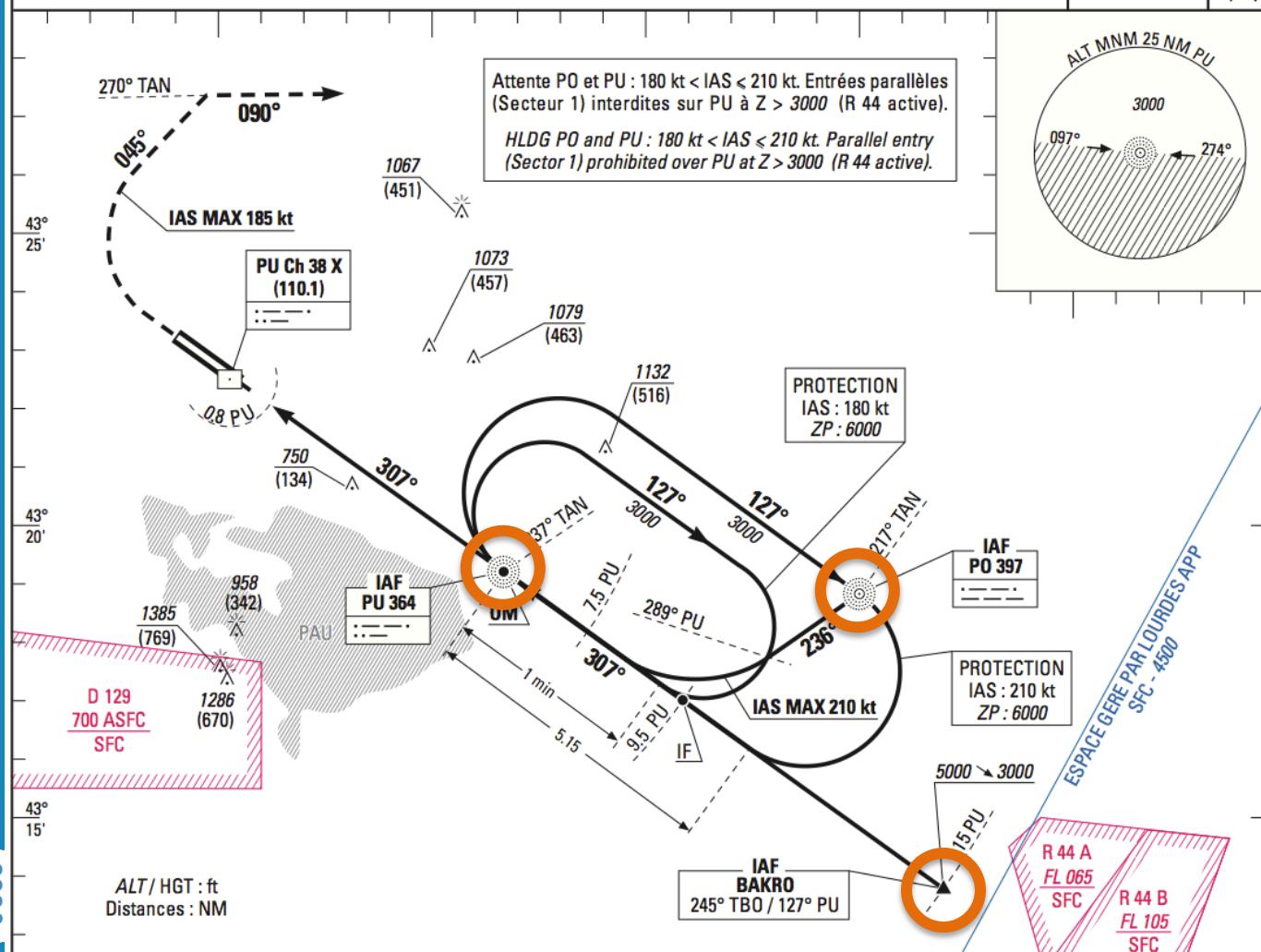
TWR : PAU Tour/Tower 124.15

PAU PYRENEES

BAKRO / L PO / L PU - ILS RWY 31

BAKRO / L PO / L PU - LLZ RWY 31

ILS - DME	VAR
PU 110.1	1°W
RDH : 50	(05)



Example: Pau Pyrénées

TA : 5000

API : Monter dans l'axe à 1200 (584). Sauf instructions contraires du CTL, tourner à droite RM 045° en montée vers 4000 (3384) pour intercepter et suivre RDL 270° TAN (RM 090°). Suivre ensuite les instructions du CTL pour rejoindre PO.

Ne pas tourner avant le MAPT.

Monter à 1800 (1184) avant d'accélérer en palier.

Missed APCH : Climb straight ahead up to 1200 (584). Except opposite ATC clearance, turn right MAG track 045° up to 4000 (3384) to intercept and follow RDL 270° TAN (MAG track 090°). Then, follow ATC clearance to join PO.

Do not turn before MAPT.

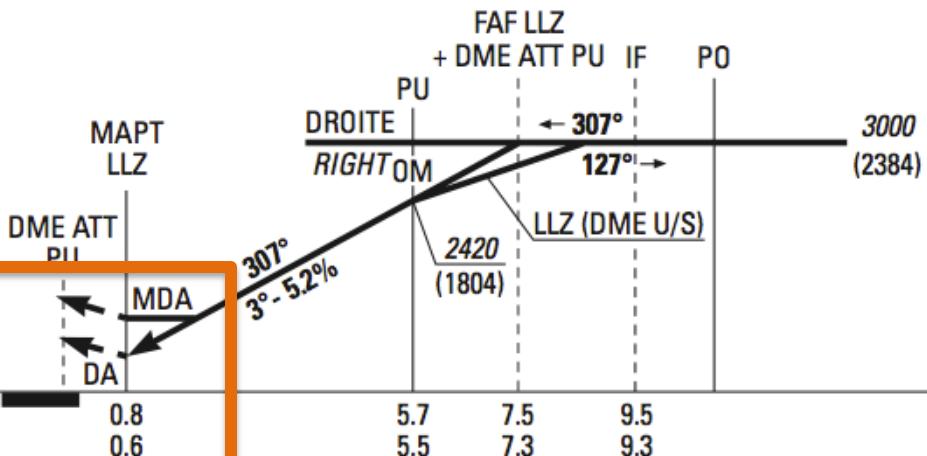
Climb up to 1800 (1184) prior to level acceleration.

DME PU ← (NM)

THR ← (NM)

MNM AD : distances verticales en pieds, RVR et VIS en mètres./Vertical distances in feet, RVR and VIS in metres.

REF HGT : ALT THR



APCH RWY 31 homologuée/homologated CAT 2 et/and 3 avec/with DA.

CAT	ILS		LLZ OCH : 383		OCH ILS CAT 1	OCH ILS CAT 2	CAT	MVL	
	DA (H)	RVR	MDA (H)	RVR				MVA (H)	VIS
A			900		130	56	A	1340 (720)	1500
B	820 (200)	550	1010 (390)	1000	142	65	B	1340 (720)	1600
C			1000		150	77	C	1480 (860)	2400
D			1400		161	90	D	1540 (920)	3600

Observations/Remarks : (1) MVL interdites au Sud de la piste. (2) Base OCH ILS CAT 2 : Plan sol.

(1) Circling prohibited South of RWY /2) OCH base ILS CAT 2 : Ground

DME PU	NM	6	5	4	3	2
ALT (HGT)	(19)	24	21	19	17	15

MAPt defined with timing (alternative to DME distance)

L/PU - THR	5.5 NM	70 kt	80 kt	90 kt	100 kt	115 kt	130 kt	145 kt	160 kt	175 kt	185 kt
L/PU - MAPT	4.9 NM	4 min 43	4 min 07	3 min 40	3 min 18	3 min 00	2 min 32	2 min 16	2 min 04	1 min 53	1 min 47
VSP (ft/min)		Non disponible/Not available									

French nomenclature: MVL (Manoeuvre a Vue Libre) = Visual circling to land -
MVI (Manoeuvre a Vue Imposée) = Visual prescribed tracks

Example: Pau Pyrénées

APPROCHE AUX INSTRUMENTS

Instrument approach

CAT A B C D

ALT AD : 616 (22 hPa), THR : 616

ATIS PAU 128.475

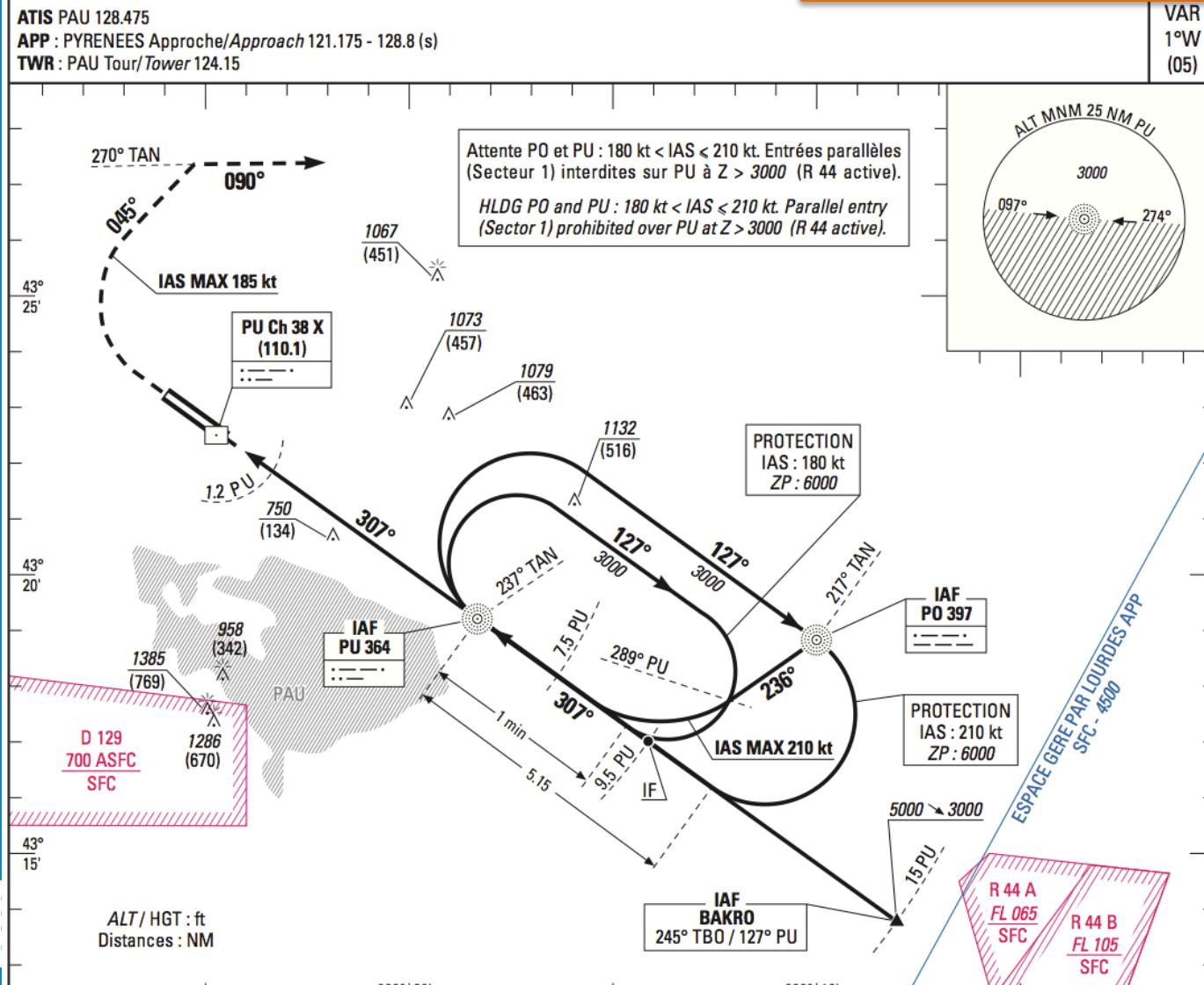
APP : PYRENEES Approche/Approach 121.175 - 128.8 (s)

TWR : PAU Tour/Tower 124.15

PAU PYRENEES

BAKRO / L PU / L PO RWY 31
BAKRO / L PU / L PO + DME RWY 31

VAR
1°W
(05)



Example: Pau Pyrénées

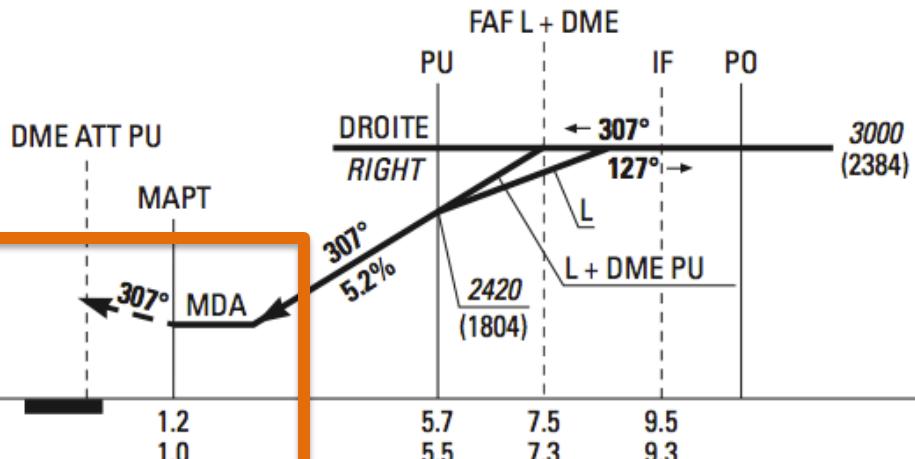
TA : 5000

API : Monter au QDR 307° de PU (RM 307°) jusqu'à 1200 (584). Sauf instructions contraires du CTL, tourner à droite RM 045° en montée vers 4000 (3384) pour intercepter et suivre RDL 270° TAN (RM 090°). Suivre ensuite les instructions du CTL pour rejoindre PO.

Ne pas tourner avant le MAPT.

Monter à 1800 (1184) avant d'accélérer en palier.

*Missed APCH : Climb QDR 307° PU (MAG track 307°) up to 1200 (584). Except opposite ATC clearance, turn right MAG track 045° up to 4000 (3384) to intercept and follow RDL 270° TAN (MAG track 090°). Then, follow ATC clearance to join PO.
Do not turn before MAPT.
Climb up to 1800 (1184) prior to level acceleration.*



DME PU ← (NM)
THR ← (NM)

MNM AD : distances verticales en pieds. RVR et VIS en mètres./Vertical distances in feet, RVR and VIS in metres.

REF HGT : ALT AD

CAT	L PU OCH : 413		MVL	
	MDA (H)	RVR	MDA (H)	VIS
A	900	1340 (720)	1500	
B	1040 (420)	1000	1340 (720)	1600
C		1000	1480 (860)	2400
D	1400	1580 (960)		3600

DME PU	MDA (H)						
	NM	7	6	5	4	3	2
ALT (HGT)	2850 (2234)	2530 (1914)	2210 (1594)	1900 (1284)	1580 (964)	12	64

MAPt defined with timing (alternative to DME distance)

(1) Circling prohibited South of RWY.

L - MAPT	4.5 NM	70 kt 3 min 51	80 kt 3 min 22	90 kt 3 min 00	100 kt 2 min 42	115 kt 2 min 21	130 kt 2 min 05	145 kt 1 min 52	160 kt 1 min 41	175 kt 1 min 33	185 kt 1 min 28
VSP (ft/min)		470	530	610	670	780	880	980	1080	1180	1250

French nomenclature: MVL (Manoeuvre a Vue Libre) = Visual circling to land -
MVI (Manoeuvre a Vue Imposée) = Visual prescribed tracks

Example: Pau Pyrénées

APPROCHE AUX INSTRUMENTS

Instrument approach

CAT A B C D

ALT AD : 616 (22 hPa), THR : 581

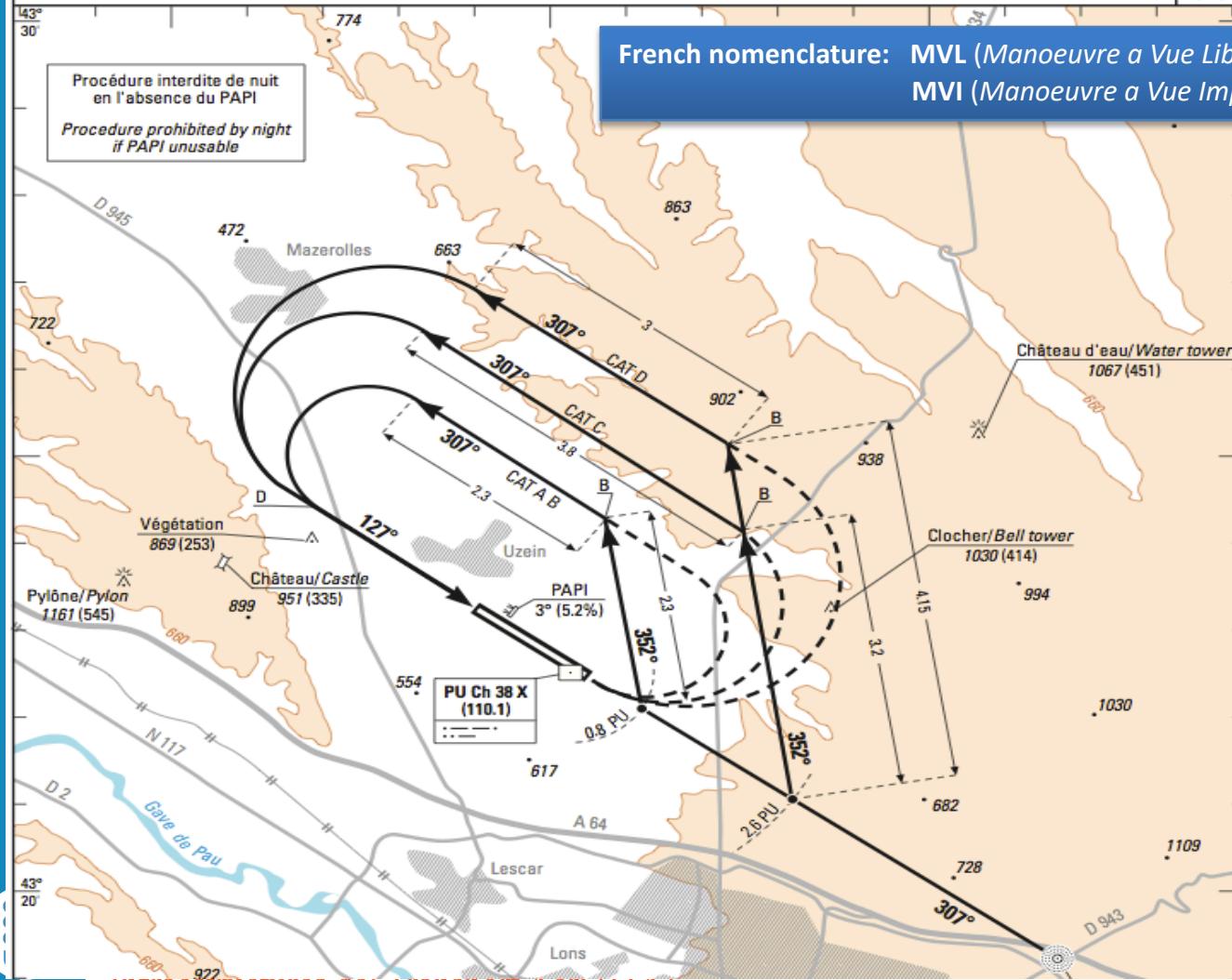
ATIS PAU 128.475

APP : PYRENEES Approche/Approach 121.175 - 128.8 (s)

TWR : PAU Tour/Tower 124.15

PAU PYRENEES

MVI RWY 13	VAR
1°W (05)	



French nomenclature: **MVL** (*Manoeuvre a Vue Libre*) = Visual circling to land -
MVI (*Manoeuvre a Vue Imposée*) = Visual prescribed tracks

CAT	MVI		MNM AD : distances verticales
	MDA (H)	VIS	
A	1180 (560)	1500	
B	1180 (560)	1600	
C	1440 (820)	2400	
D	1470 (850)	3600	

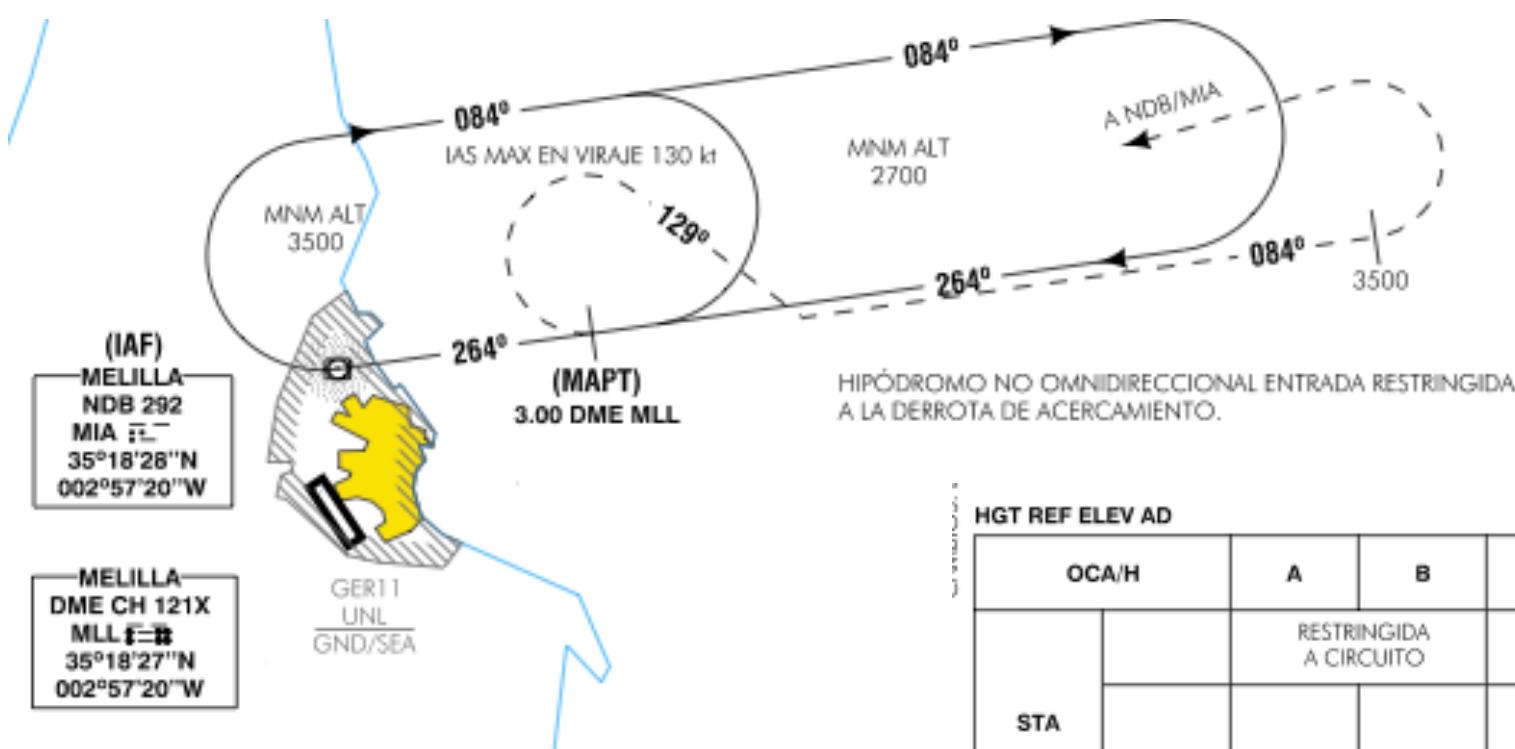
Example: Melilla

<https://youtu.be/47fjpw3AOU0> - Circling at Chambery

https://youtu.be/SE2P_J-vuuA - Circling at KLNS

https://youtu.be/ggapye_s8Ck - NDB + circling at Manado

MELILLA
NDB
RWY 15 (CAT A & B)



HGT REF ELEV AD		A	B	C	D
STA	OCA/H				
				RESTRINGIDA A CIRCUITO	
En circuito (H) sobre	1000 (850)				

WEE DA ALTO DE VIBRAC ALADT 00/001

Initial Segment

- Start: IAF
- End: IF, FAF or end of turn
- Free (for the procedure designer!) trajectories:
 - Straight with track guidance
 - Straight dead reckoning
 - Curved with track guidance (DME arc, RNAV RF leg)
- Pre-defined trajectories:

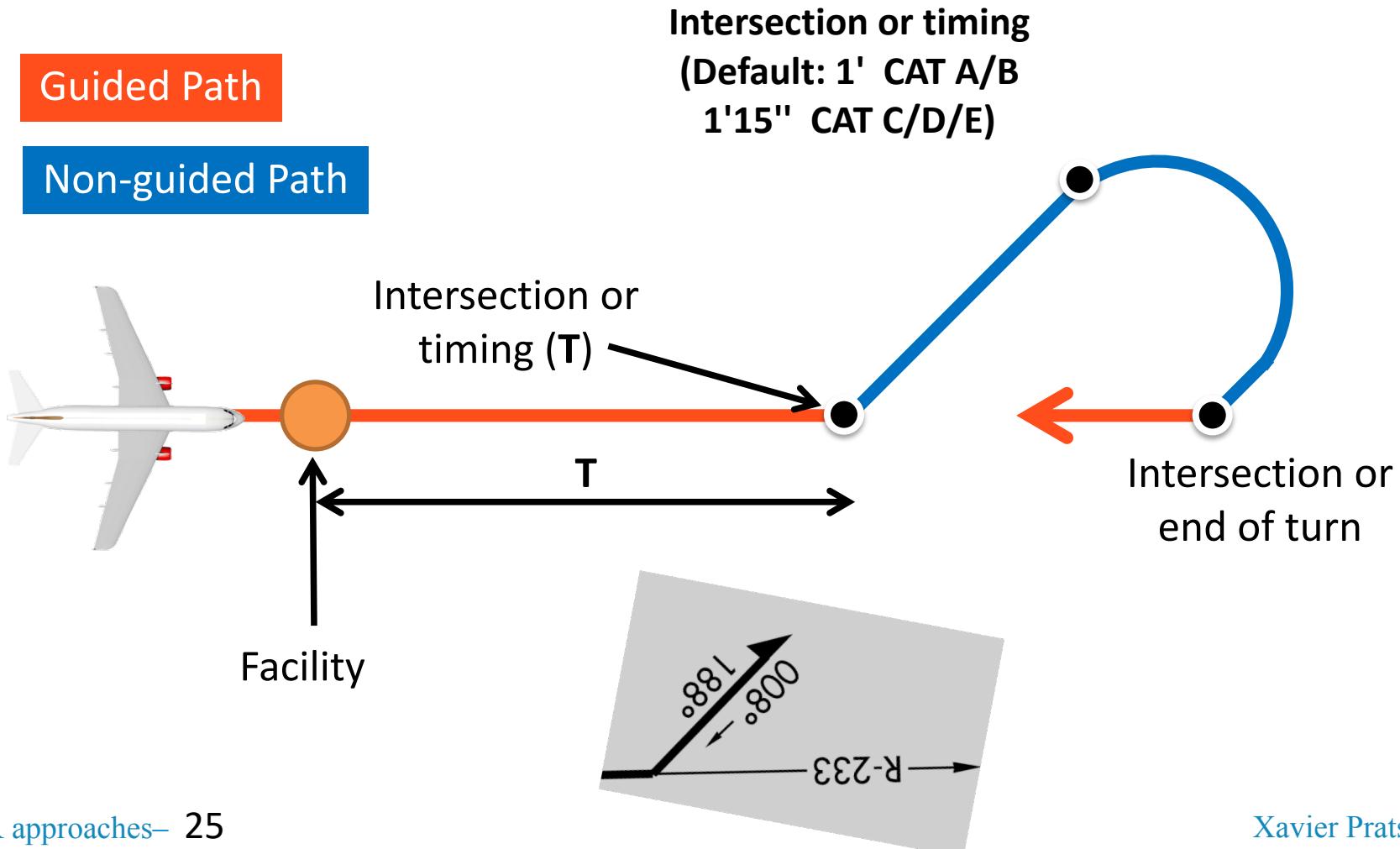
Used if initial turn exceeds 120° and/or to provide room for extra descent and/or to increase final segment length

 - Reversal procedure (or procedure turn)
 - Racetrack procedure



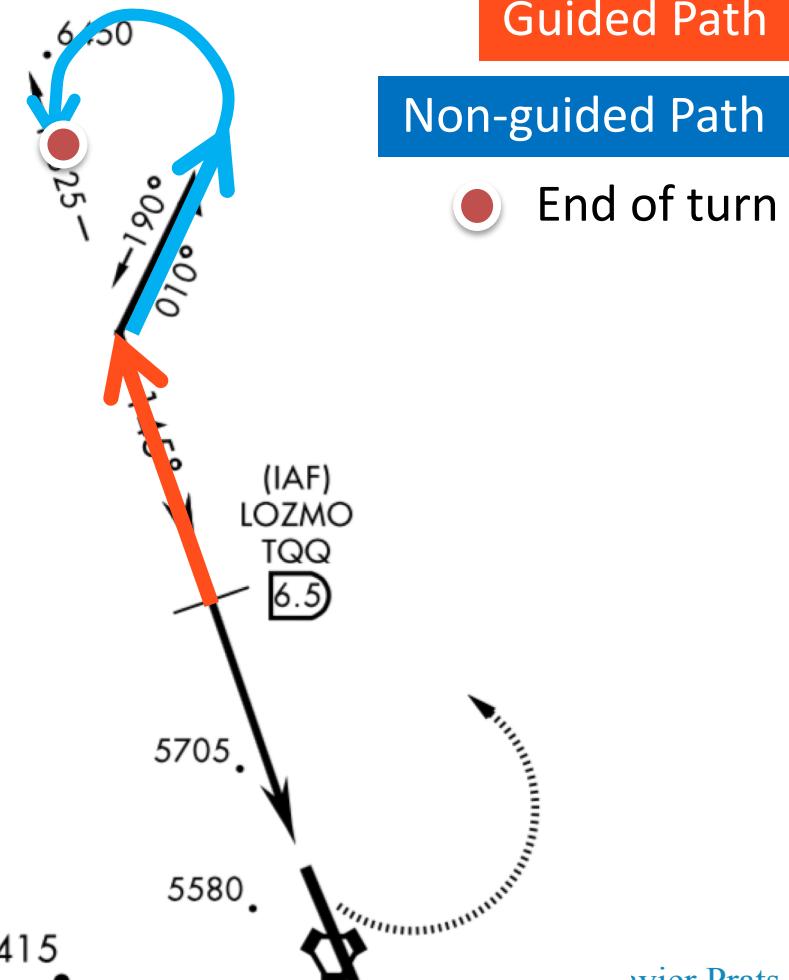
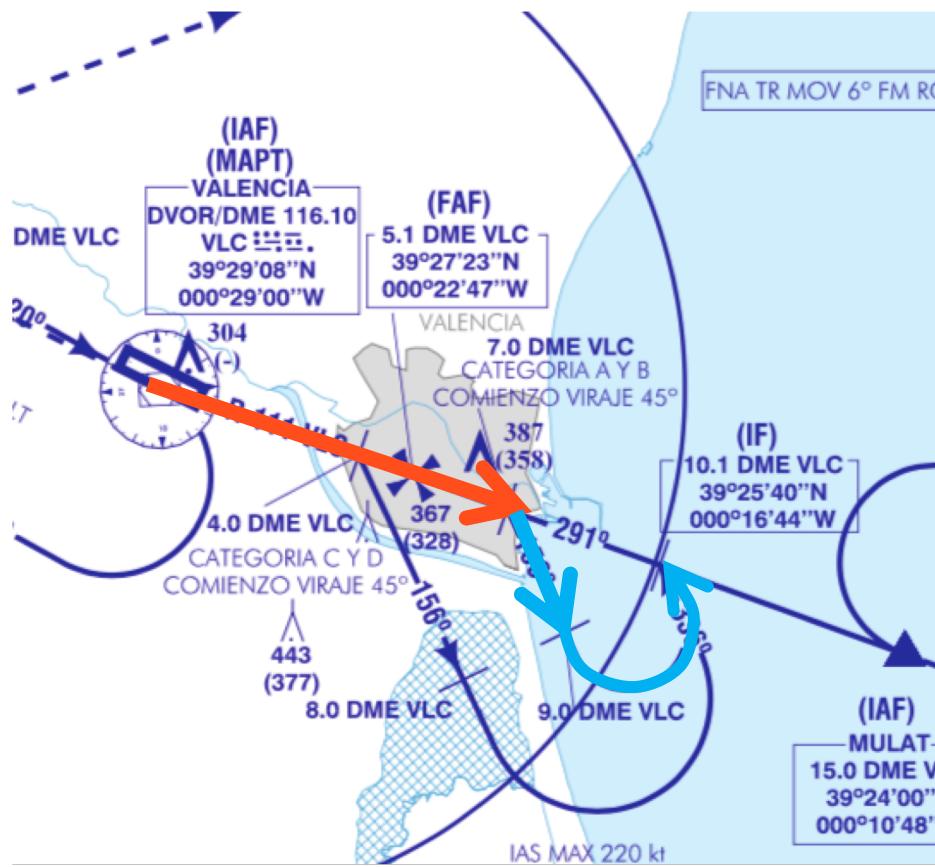
Initial Segment

Reversal Procedure: 45°/180° procedure turn



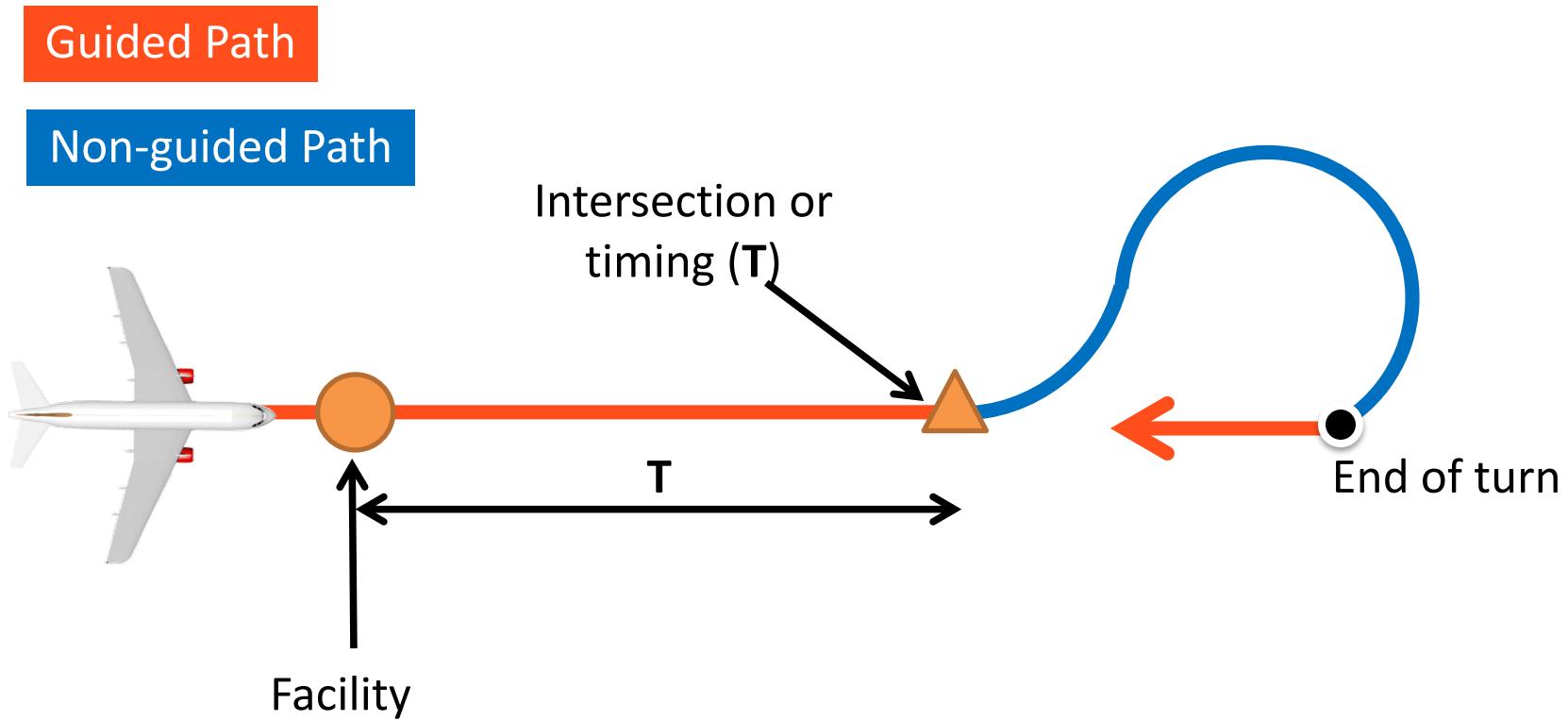
Initial Segment

Reversal Procedure: 45°/180° procedure turn



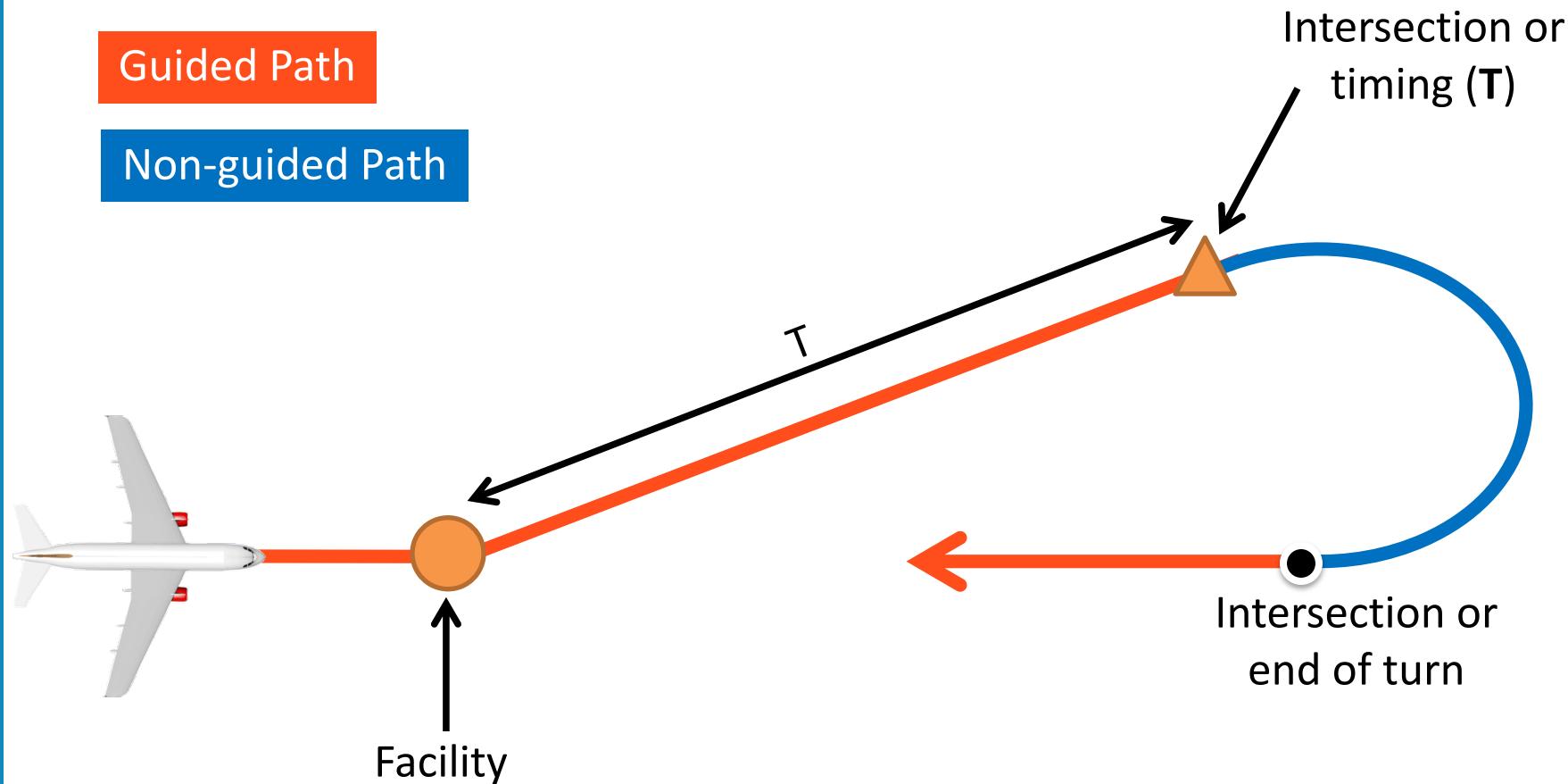
Initial Segment

Reversal Procedure: 80°/260° procedure turn



Initial Segment

Reversal Procedure: Base turn (tear drop)



Initial Segment

Reversal Procedures: Entry

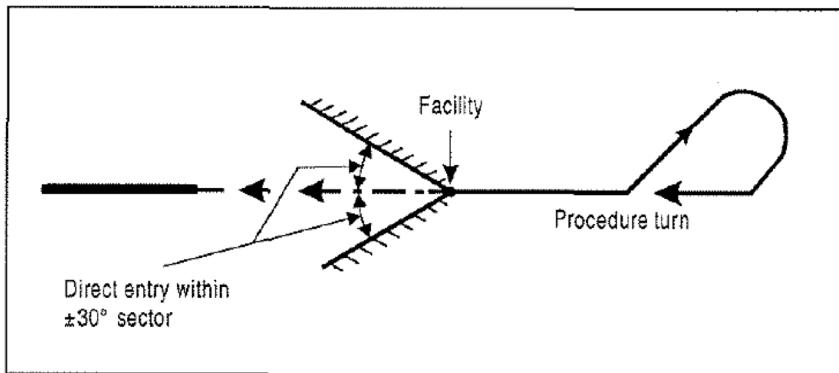


Figure I-4-3-2. Direct entry to procedure turn

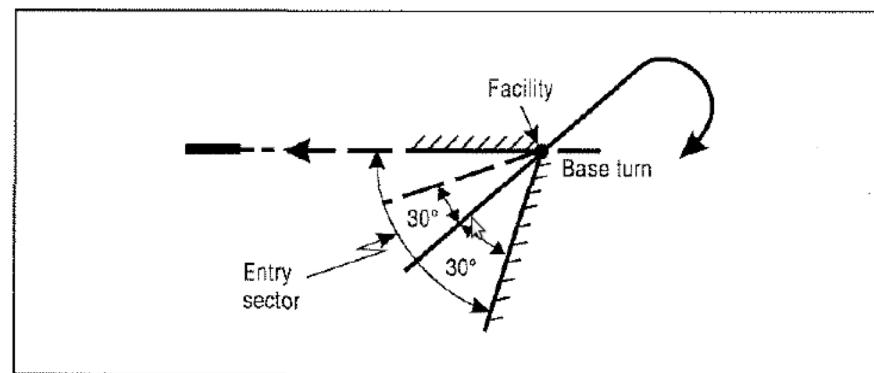


Figure I-4-3-3. Direct entry to base turn

Arrivals outbounds the direct entry sector must integrate a “virtual” hold (usually defined above the facility) prior to the reversal procedure

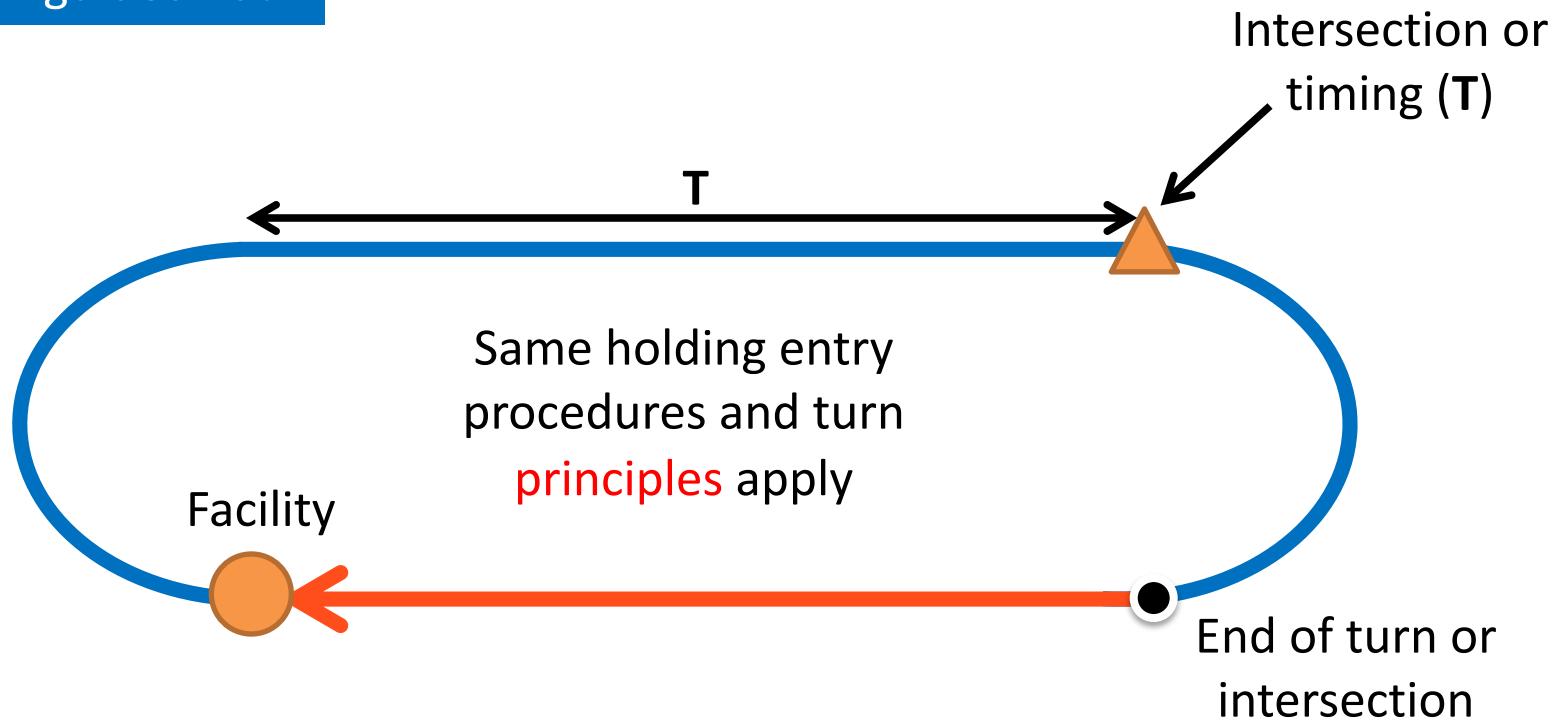
Initial Segment

Racetrack Procedure:

Guided Path

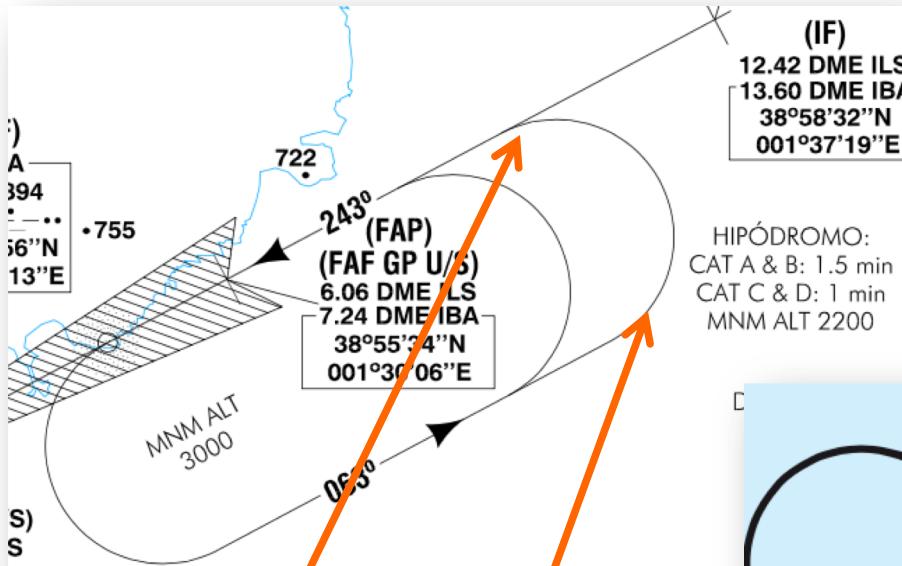
Non-guided Path

A Racetrack
IS NOT a holding
procedure!!

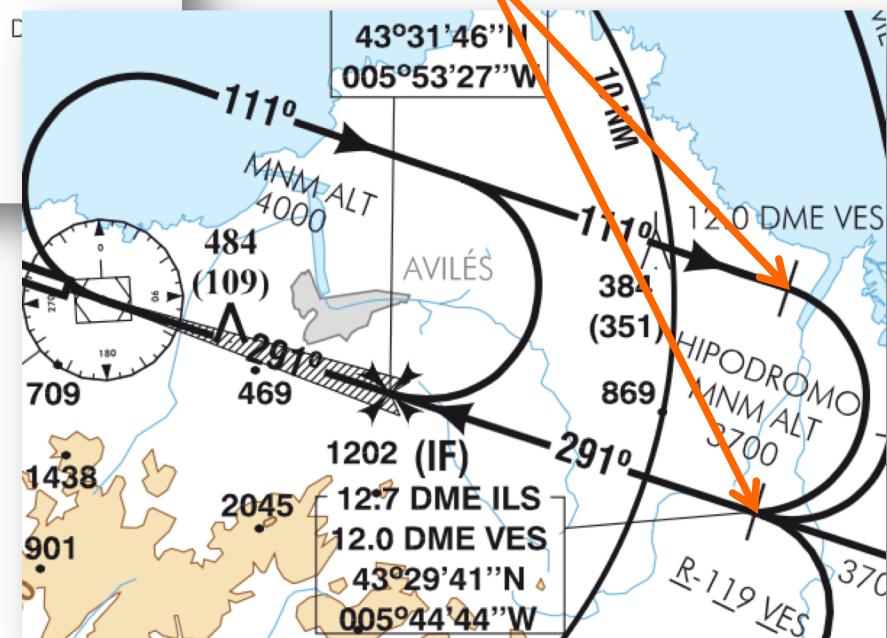


Initial Segment

Racetrack Procedure:



Intersection



Intermediate Segment

- Start: IF or end of turn
- End: Non Precision App: FAF
Precision App & APV: FAP
- Horizontal (constant altitude) and straight segment *
- Segment with track guidance
- Minimum length: 30" at initial segment speed
- Mandatory segment for Precision Approaches & APV

* Some exceptions might apply.
See ICAO Doc. 8168 PANS-OPS Vol-II



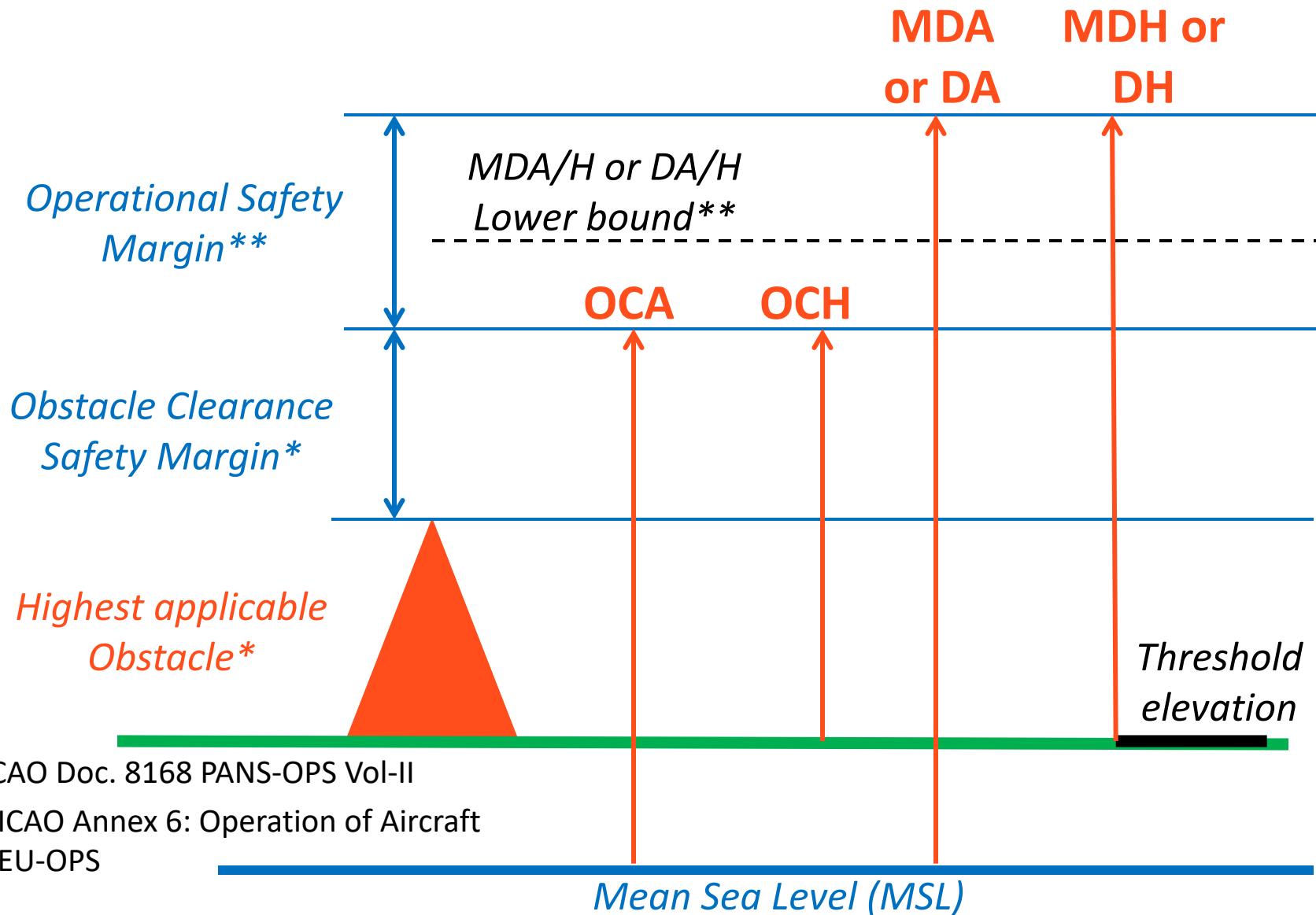
Final Segment

- Start:
 - Non Precision App: FAF or end of turn
 - Precision App & APV: FAP
- End:
 - Non Precision App: MAPt
 - Precision App & APV: when reaching DA/H while following the final approach track.
- MAPt definition:
 - Overflying a facility (VOR, NDB or L)
 - Intersection
 - DME distance or timing from a FIX/Facility

GS	kt	80	100	120	140	160	180
FAF-THR: 9.75 NM	min:s	7:19	5:51	4:53	4:11	3:39	
FAF-MAPT: 7.00 NM	min:s	5:15	4:12	3:30	3:00	2:38	
ROD: 5.81 %	ft/min	470	588	706	823	941	

Example of MAPt defined with timing

Final Segment



Final Segment

EU-OPS 1.430 :

In establishing the aerodrome operating minima, the operator must take full account of:

- The type, performance and handling qualities of the aeroplane
- The composition of the flight crew, their competence and experience
- The dimensions and characteristics of the runways selected to use
- The adequacy and performance of the available visual and non-visual ground aids
- The navigation and/or control equipment of the aeroplane available
- The obstacles in the approach, missed approach and the climb-out areas required for the execution of contingency procedures
- The obstacle clearance altitude/height published
- The means to determine and report meteorological conditions
- The flight technique to be used during the final approach



Final Segment

Obstacle Clearance Altitude/Height (OCA/H)

The lowest altitude/height used in establishing compliance with appropriate obstacle clearance criteria.

Minimum Descent Altitude/Height (MDA/H)

Specified altitude/height in a **non-precision approach or a circling approach** below which descent must not be made without the required visual reference.

Decision Altitude/Height (DA/H)

Specified altitude/height in a **precision approach or APV** at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.



Final Segment

Obstacle Clearance Altitude/Height (OCA/H)

National administrations **must** determine and publish it.

Minimum Descent Altitude/Height (MDA/H) & Decision Altitude/Height (DA/H)

National administrations **may** publish a **lower bound*** for the (M)DA/H **and/or** RVR. Operators **must** establish (M)DA/H **and** RVR or Visibility (**airport minima**) that **must** be approved by the corresponding national administration.

* Also known as the “minimum-minimum”

RVR: Runway Visual Range



Final Segment

Approach minima:

- **MDA/H:** Minimum Descent Altitude/Height for NPA
- OR**
- **DA/H:** Decision Altitude/Height for PA

AND

- **RVR:** Runway Visual Range

AND/OR

- **VIS:** Aerodrome Visibility

The operator must publish the approach minima for their fleet and crew and the competent authority (safety agency) must approve them



Final Segment

MNM AD : distances verticales en pieds, RVR et VIS en mètres./Vertical distance						
CAT	ILS	LLZ+DME PL OCH : 416	OCH ILS	MVL (1)		
	DA (H)	RVR	MDA (H)	RVR	MDA (H)	VIS
A	340 (200)	700	560 (420)	1200	138	990 (850)
B				1300	148	1140 (1000)
C				1400	160	1430 (1300)
D				1600	174	1940 (1810)

Altitude in feet Height in feet RVR or VIS in meters

Circling to approach

Perpinyà

ILS/LLZ RWY 33

French DGAC

HGT REF ELEV THR RWY 09					
	OCA/H	A	B	C	D
	CAT I 2.5%	2046 (204)	2203 (361)	2211 (369)	2222 (380)
STA	CAT I 3%	2034 (192)	2046 (204)	2054 (212)	2065 (223)
	CAT I 4%	2015 (173)	2027 (185)	2035 (193)	2046 (204)
	En circuito (H) sobre 1860	2660 (800)	3020 (1160)	4110 (2250)	

Altitude in feet Height in feet

Different Go-around climb gradients

Granada
ILS RWY 09

ENAIKE

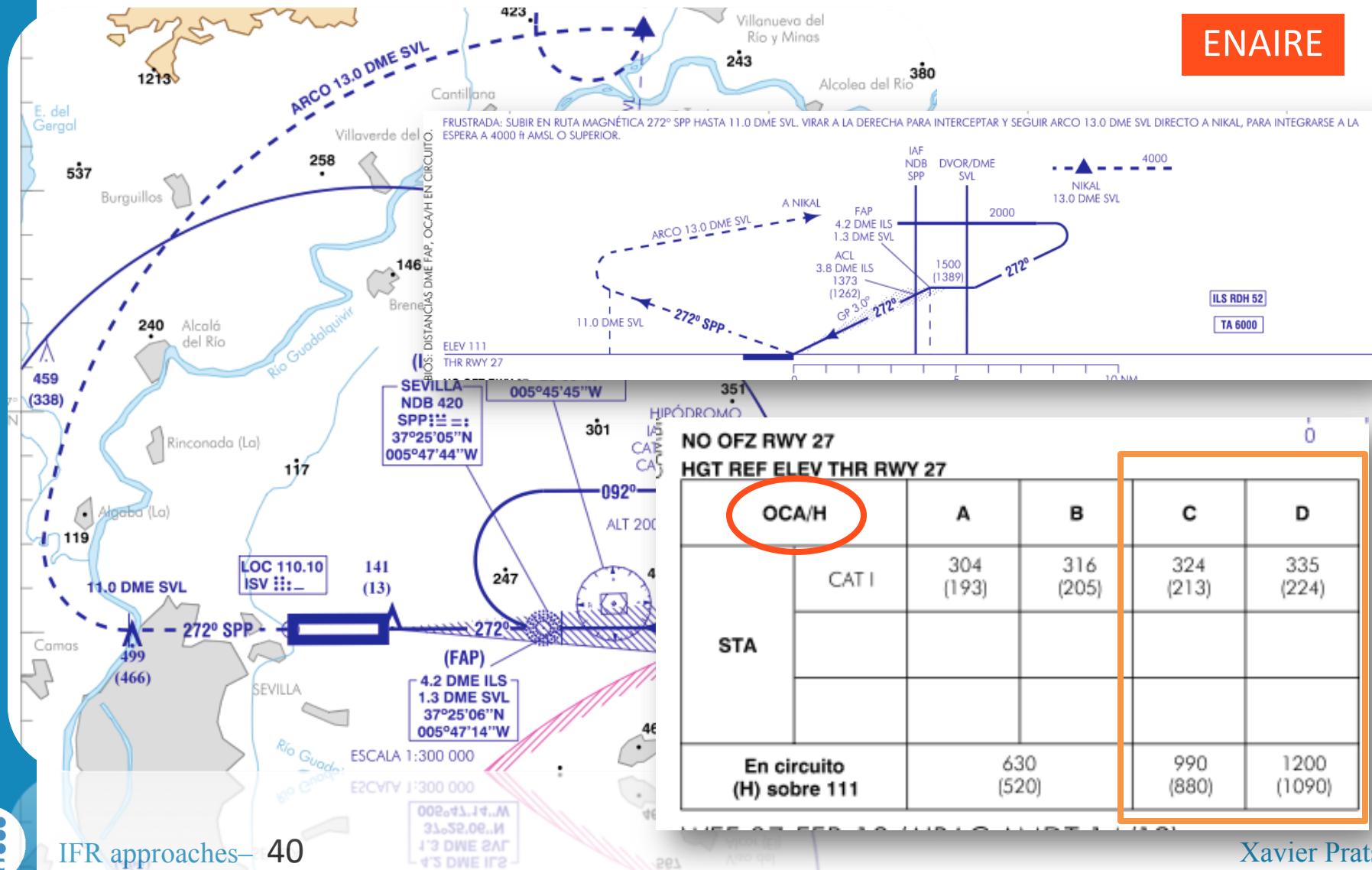
Straight-in approach

Circling to approach

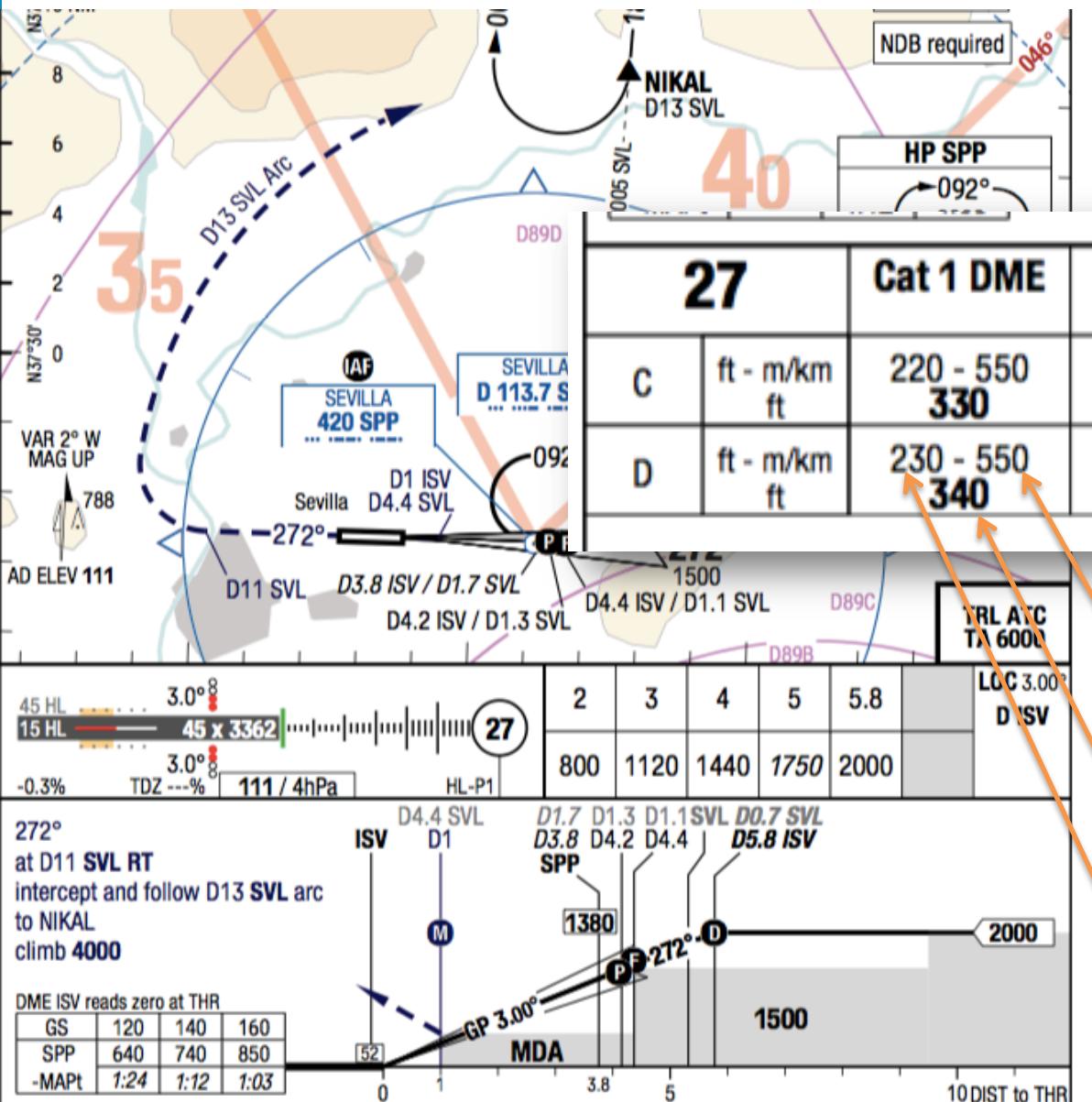
Final Segment

Sevilla ILS RWY 27

ENAIKE



Final Segment



Final Segment

Long Beach (CA) ILS/LOC RWY 30

FAA

Straight-in approach

Circling to approach

CATEGORY	MDA/RVR*				DH (in ft) (Military minima)
	A	B	C	D	
S-ILS 30		250/18	212 (200-½)		
S-LOC 30	520/24	482 (500-½)	520/40 482 (500-¾)	520/50 482 (500-1)	
CIRCLING	880-1 820 (900-1)	880-1¼ 820 (900-1¼)	880-2½ 820 (900-2½)	880-2¾ 820 (900-2¾)	

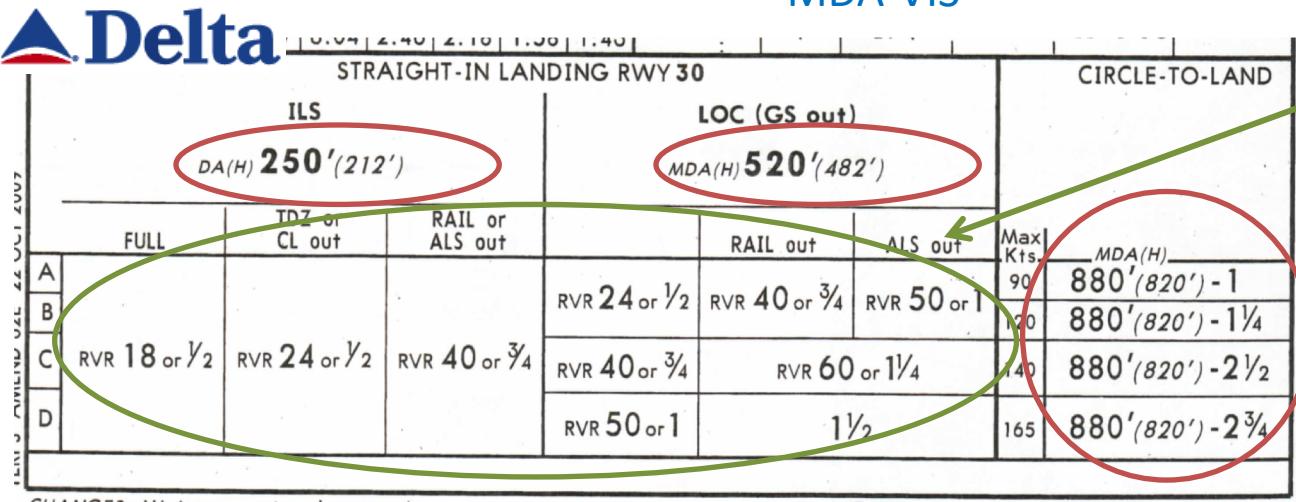
LONG BEACH, CALIFORNIA LONG BEACH

Lower-bounds for the operators

* In hundreds of feet (if RVR) or statute miles (if Visibility)

Different RVRs (or Visibility) as a function of the airport lighting system status

TDZ: touchdown zone
CL: centerline
RAIL: Runway Alignment Indicator Lights
ALS: Approach lighting system



Final Segment

Navigation system requirements

Accuracy: Difference between the measured position at any given time to the actual or true position.

Integrity: Ability of a system to provide timely warnings to users or to shut itself down when it should not be used for navigation.

Continuity: Ability of a system to perform its function without (unpredicted) interruptions during the intended operation.

Availability: Ability of a system to perform its function at initiation of intended operation. System availability is the percentage of time that accuracy, integrity and continuity requirements are met.



Final Segment

Navigation system requirements

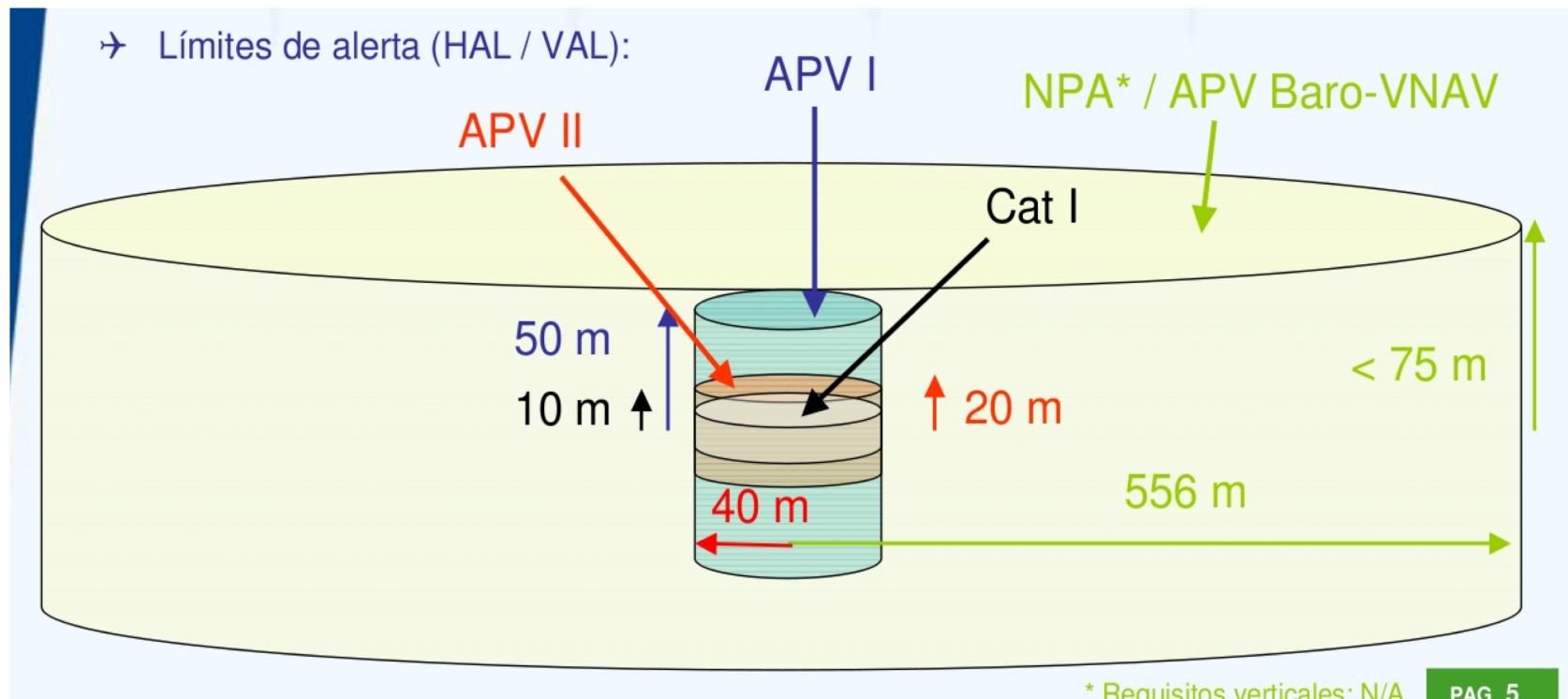
Example: GNSS SARPS (ICAO Annex 10 Vol 1)

	Accuracy (95%)		Integrity		Continuity	Availability	
	Horizontal	Vertical	Risk	Alert limits			
En-route	3,7 km	N/A	10^{-7} / h	HAL 7.4 km	5 min	10^{-4} / h to 10^{-8} / h	0,99 to 0,99999
En-route, terminal	0,74 km	N/A	10^{-7} / h	HAL 3.7 to HAL 1.85	15 s	10^{-4} / h to 10^{-8} / h	0,999 to 0,99999
Initial app., Intermediate app., Non-precision app., Departure	220 m	N/A	10^{-7} / h	HAL 556 m	10 s	10^{-4} / h to 10^{-8} / h	0,99 to 0,99999
APV-I	220 m	20 m	2×10^{-7} per approach	HAL 40 m VAL 50 m	10 s	8×10^{-6} in any 15 s	0,99 to 0,99999
APV-II	16 m	8 m	2×10^{-7} per approach	HAL 40 m VAL 20 m	6 s	8×10^{-6} in any 15 s	0,99 to 0,99999
CAT-I	16 m	6 to 4 m	2×10^{-7} per approach	HAL 40 m VAL 15 m to 10 m	6 s	8×10^{-6} in any 15 s	0,99 to 0,99999

Final Segment

Navigation system requirements

Example: GNSS Alarm limits

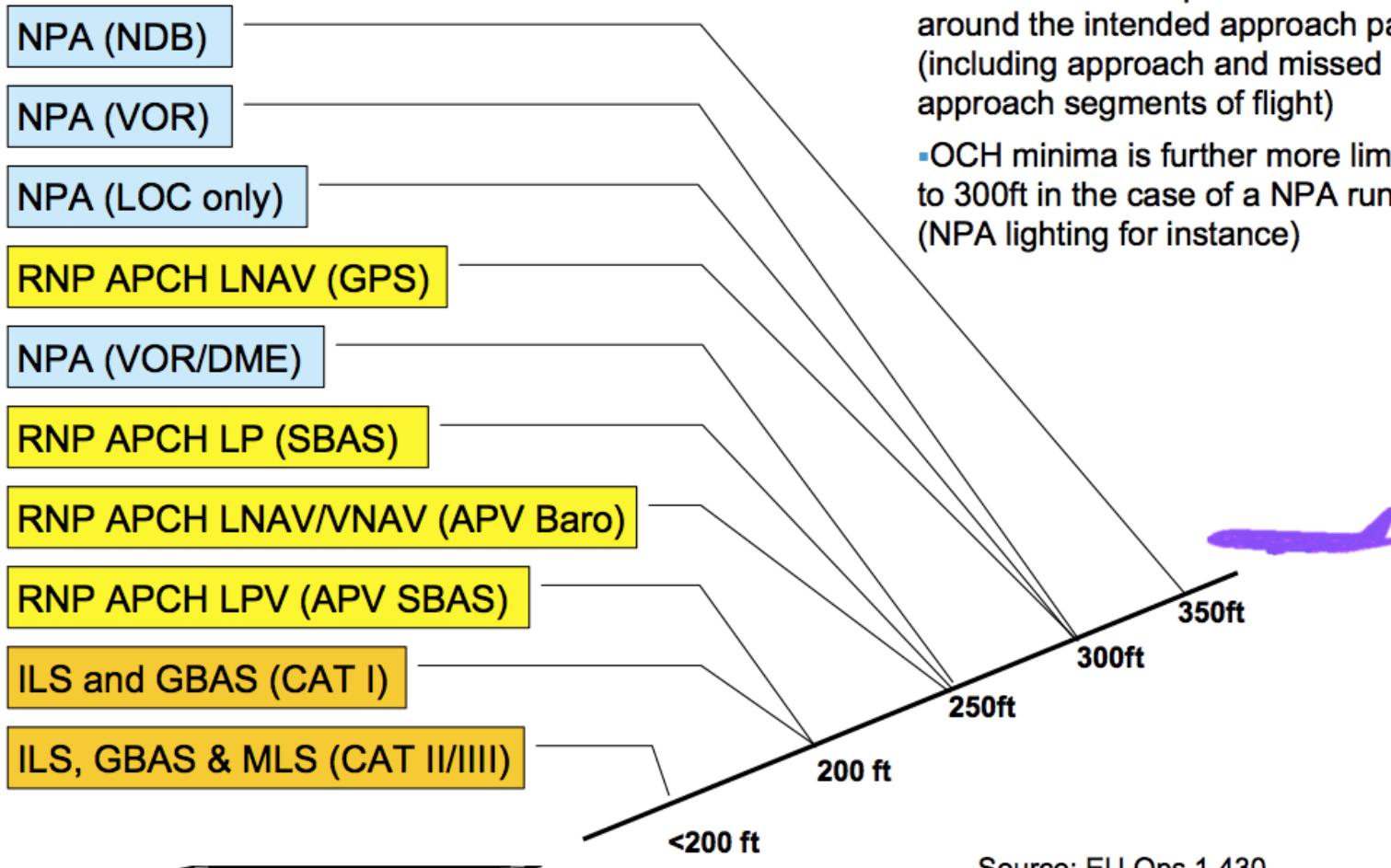


HAL: Horizontal Alert Limit. VAL: Vertical Alert Limit

Represents the containment of the uncertainty on aircraft position at 10^{-7} probability

Final Segment

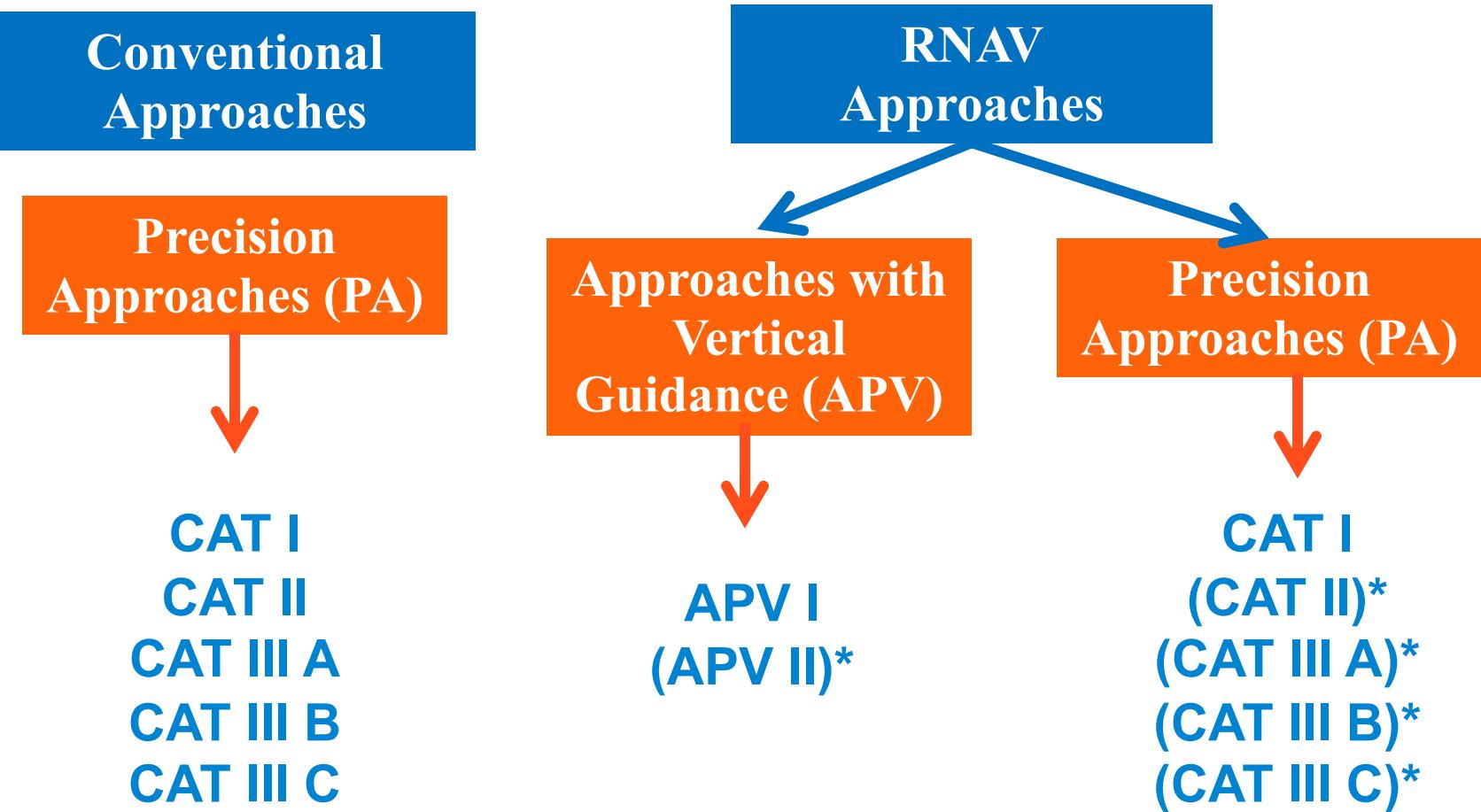
Approach Minima (EU-OPS)



Source: EU Ops 1.430

Final Segment

Vertical performance



* No criteria published (yet)

Final Segment

Approach “Minima-Minima” (ICAO Annex 6)

Precision Approaches (PA)	Decision Height (DH)	Visibility
CAT I:	DH \geq 200 ft	Visibility \geq 800m or RVR \geq 550m
CAT II*:	200 ft \geq DH \geq 100 ft	RVR \geq 350 m
CAT III-A*:	100 ft \geq DH \geq 0 ft	RVR \geq 200 m
CAT III-B*:	50 ft \geq DH \geq 0 ft	RVR \geq 50 m
CAT III-C*:	No DH limitation	No RVR limitation

* Subject to operations and airworthiness evaluation (aircraft equipment, crew training, maintenance procedures, airport infrastructure, ATC training...)

http://youtu.be/1d0clM_1vZ4

- CAT II landing

<http://youtu.be/giZLwpcmljw>

- CAT IIIA landing

<http://youtu.be/X4wAgk0pPC4>

- CAT IIIB landing

<http://youtu.be/9R425MDLByU>

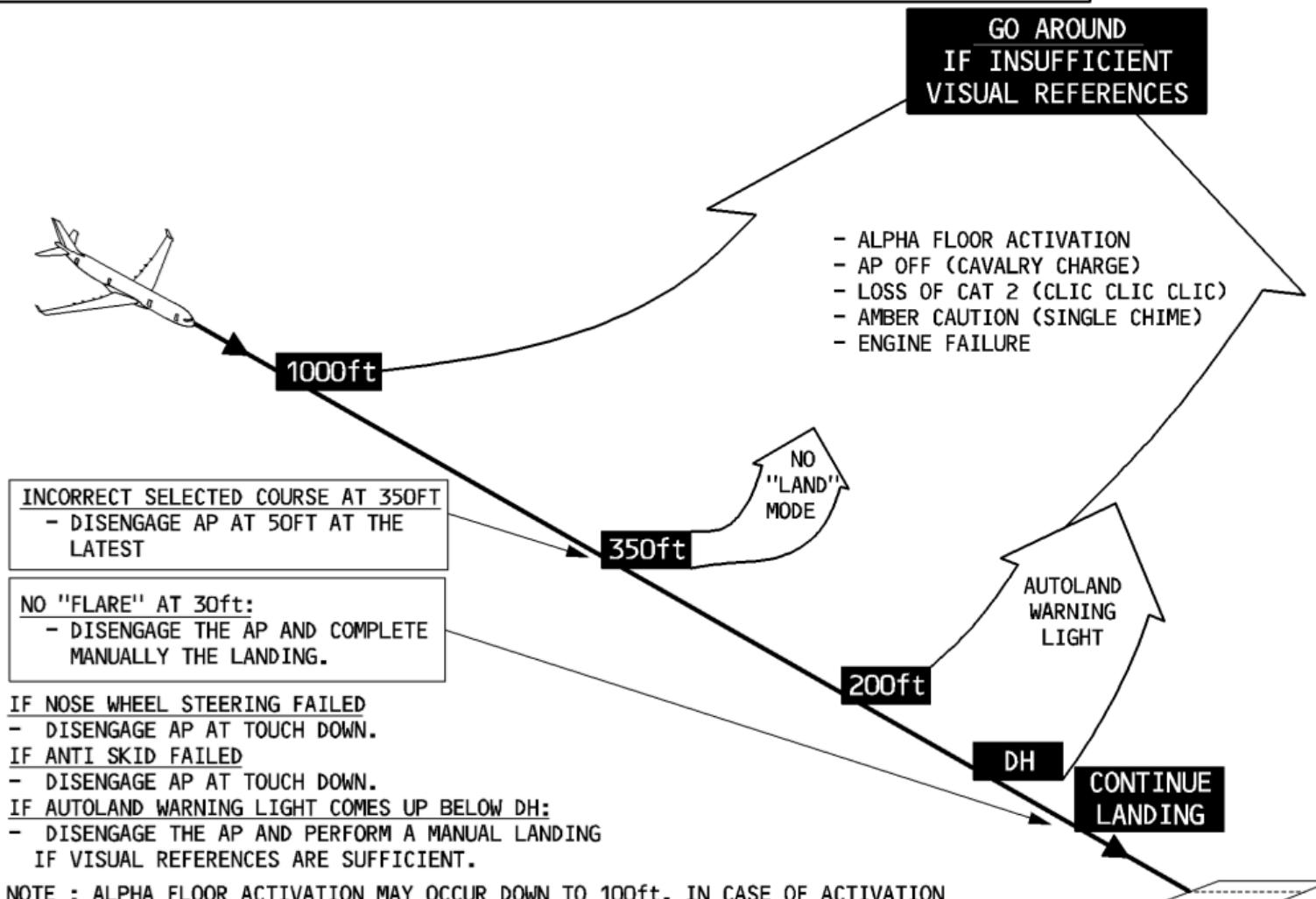
<https://youtu.be/d9WVcJUONa8> - Nice one (NPA)

RVR: Runway Visual Range

Final Segment

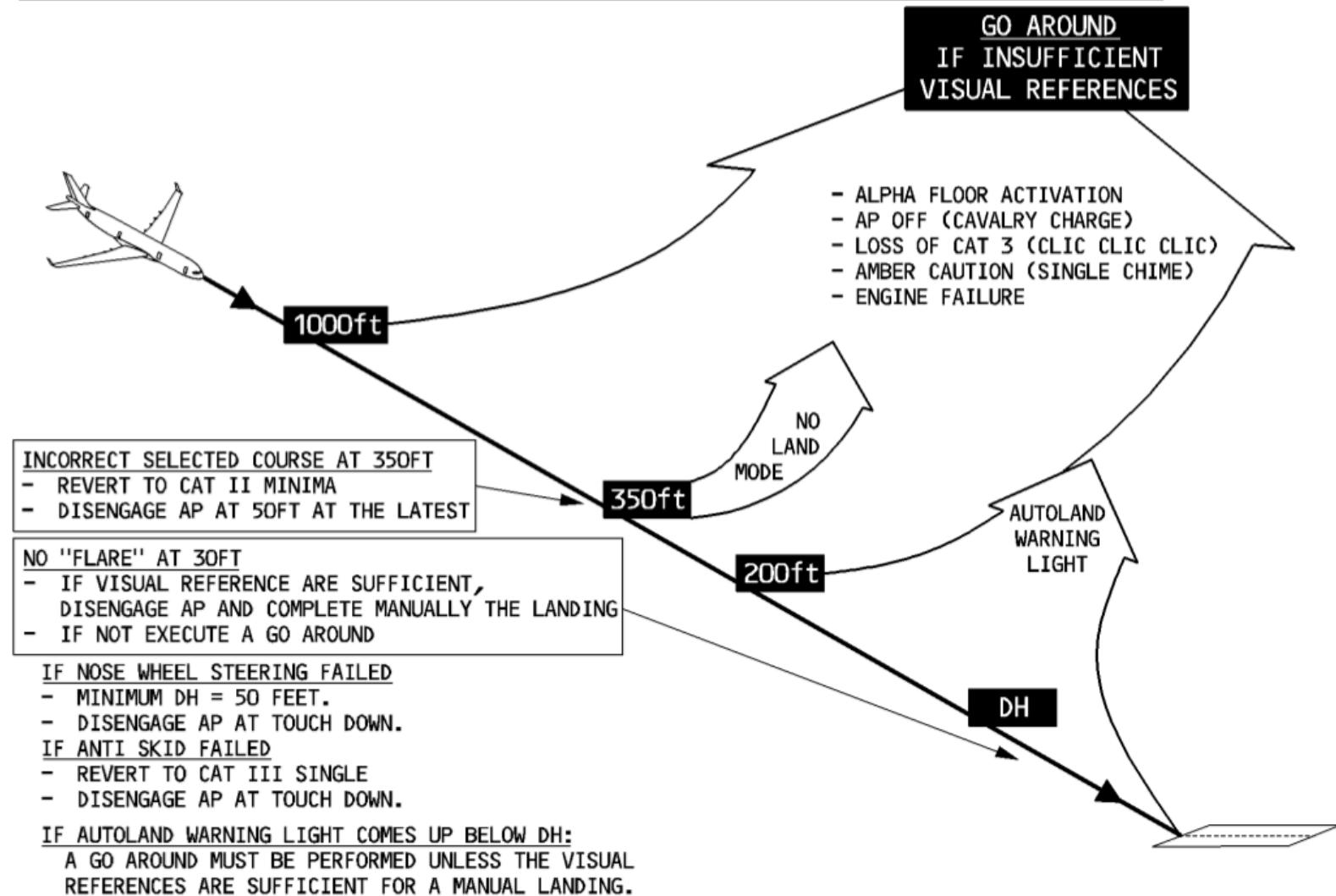
FFC5-04-0570-017-A001AA

FAILURES AND ASSOCIATED ACTIONS BELOW 1000FT DURING A CAT II APPROACH



Final Segment

FAILURES AND ASSOCIATED ACTIONS BELOW 1000FT FOR CAT III APPROACH WITH DH



Missed Approach Segment

- Start: Non Precision Approaches: MAPt
Precision Approaches & APV: when reaching DA/H
- End: When attaining the Minimum Obstacle Clearance (MOC) of the following segment
- After the Missed Approach, the aircraft will be able to:
 - Integrate into a holding pattern
 - Try the approach again
 - Resume navigation into the en-route airway structure

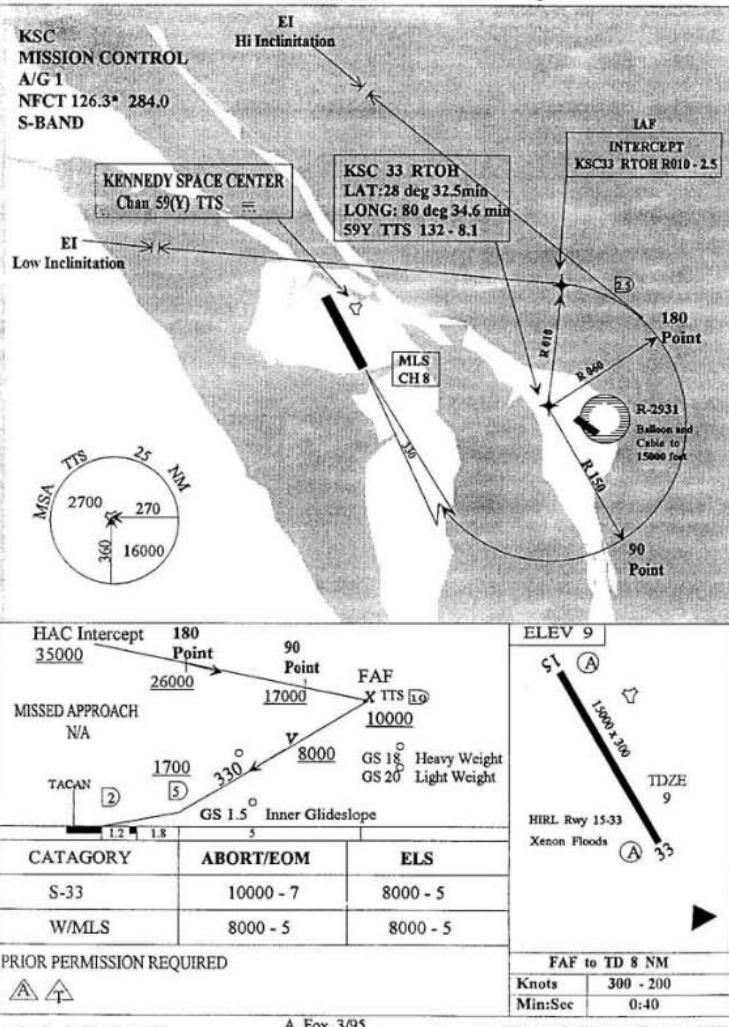


Missed Approach Segment

MLS RWY 33

A. Fox 3/95

Kennedy Space Center (KSC)
Cape Canaveral Fl.





Thank you!!

Gràcies!!

