



INTERNATIONAL CIVIL AVIATION ORGANIZATION
A United Nations Specialized Agency



PBN Procedure Design Course 2026

ICAO APAC FPP

Beijing, China

(7-25/Sep/2026)





INTERNATIONAL CIVIL AVIATION ORGANIZATION
A United Nations Specialized Agency

C O N T E N T S

PART ONE

**Basic Concepts of
GBAS**

PART TWO

**Basic Concepts of
SBAS**

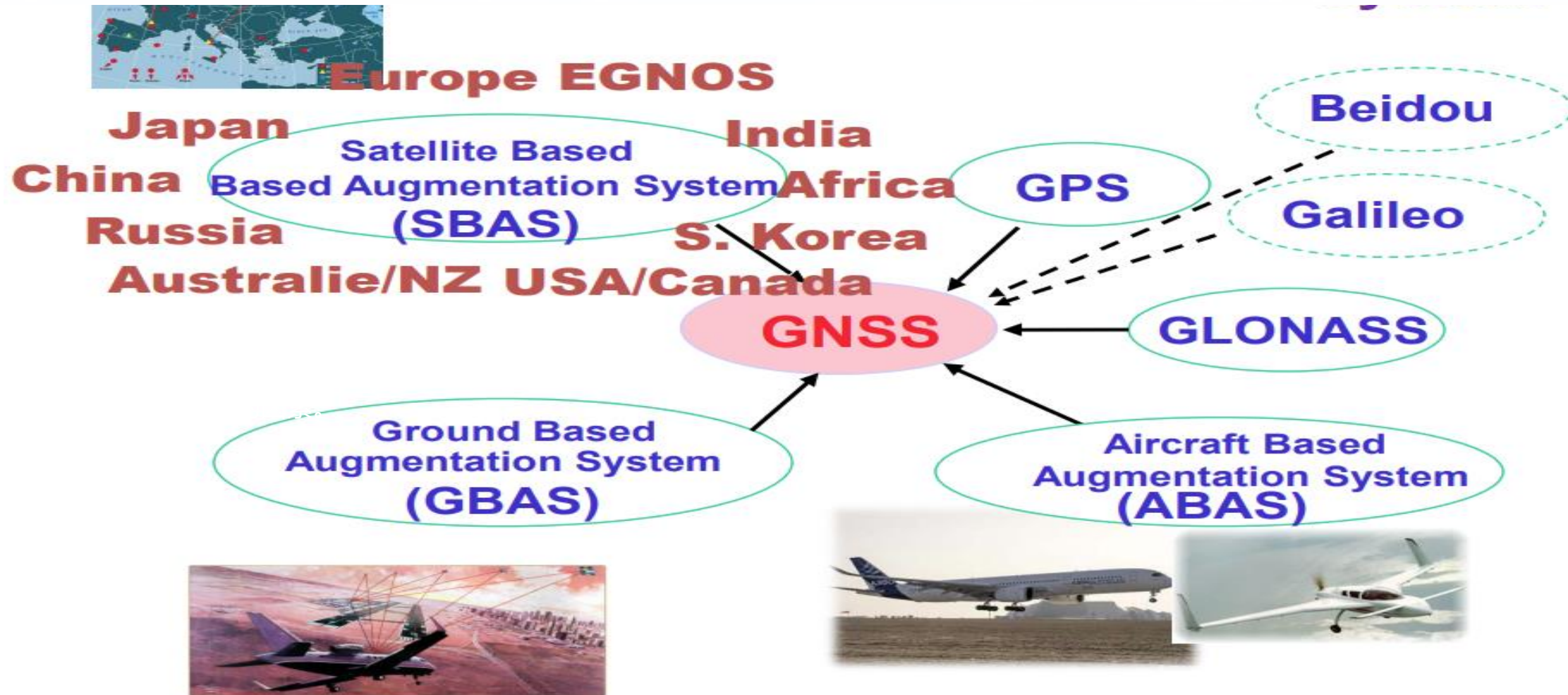
PART THREE

FAS Data Block

PART FOUR

Charts & Coding

Augmentation System



Augmentation System

Global Navigation Satellite System (GNSS)



GPS

Glonass

Galileo

Beidou

Three types of
augmentations



ABAS



Aircraft Based Augmentation System

GBAS



Ground Based Augmentation System

SBAS

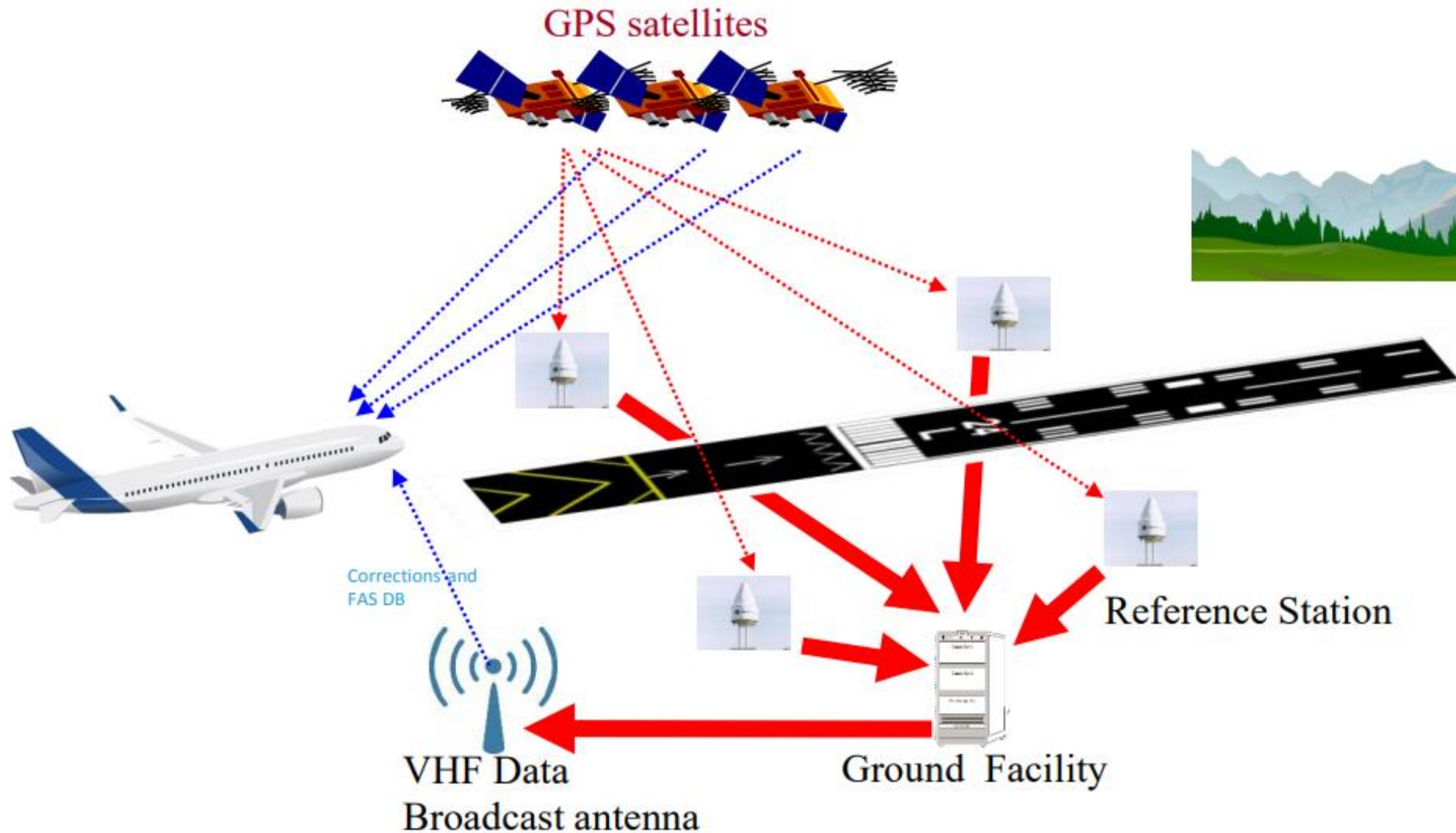


Satellite Based Augmentation System

Augmentation System

- **Satellite-Based Augmentation System (SBAS).** A **wide coverage** augmentation system in which the user receives augmentation information from a **satellite-based** transmitter.
- **Ground-Based Augmentation System (GBAS).** An augmentation system in which the user receives augmentation information directly from a **ground-based** transmitter.
- **GLS**-GBAS Landing System

GBAS-Benefits



GBAS-Benefits

Improve Efficiency



- ☐ Eliminate sensitive area of ILS
- ☐ Flexible digital approach
- ☐ Save time
- ☐ All weather operation

Reduce Cost



- ☐ Provide 48 approaches
- ☐ Low initial procurement price for large airport
- ☐ Save fuel

Improve Safety



- ☐ Improve signal stability
- ☐ Provide precision approach

Shorten Track



- ☐ Curved approaches
- ☐ Support CDO

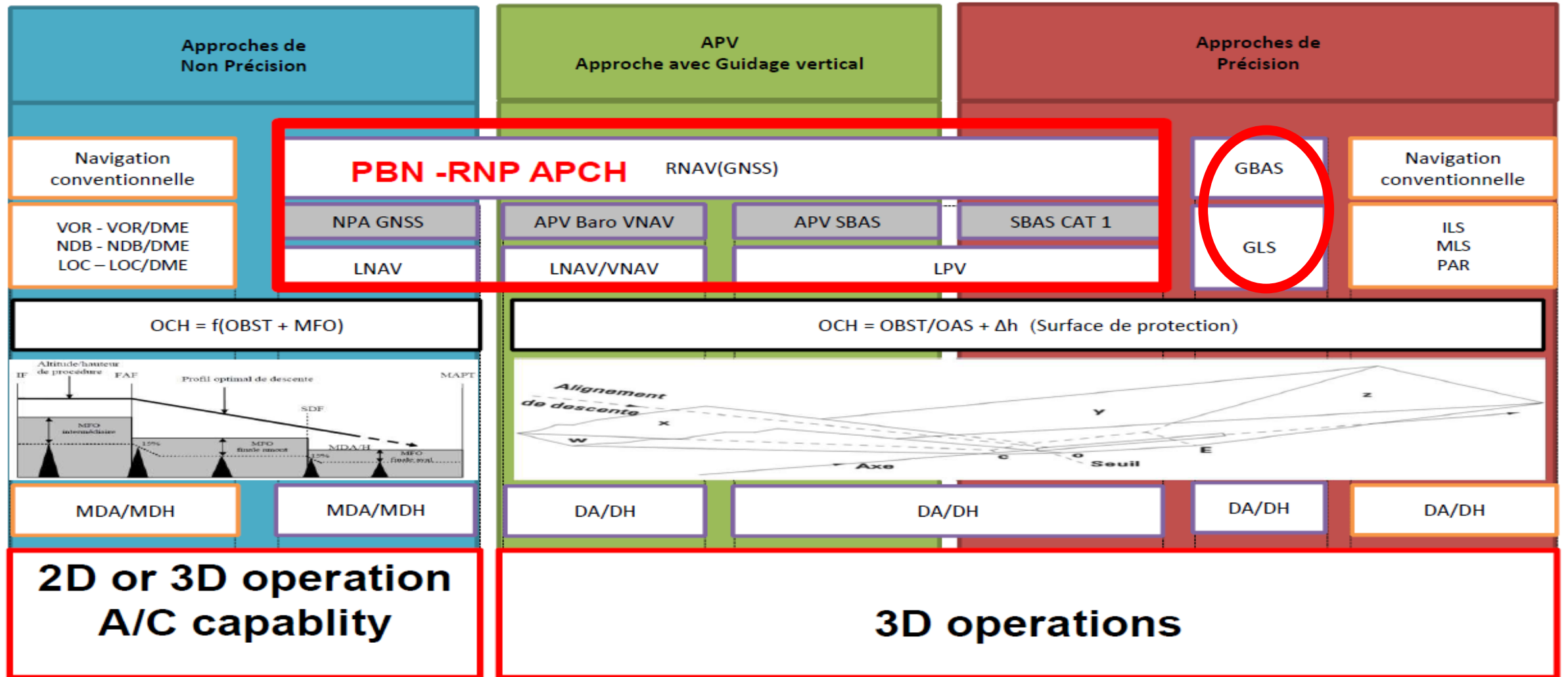


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GBAS Basic Concepts

GBAS Classification



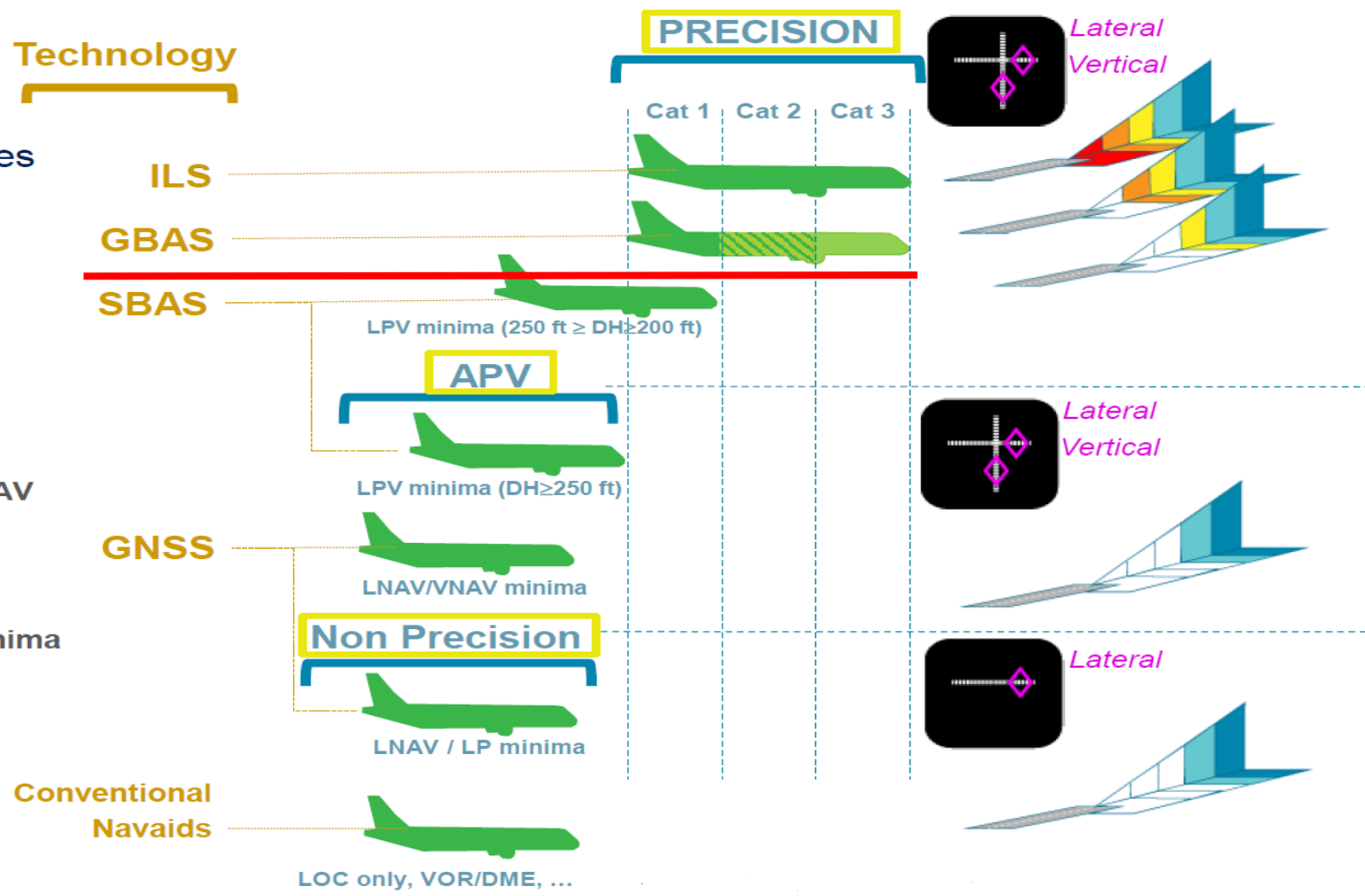
GBAS Classification

Introduction:

Reminders of all Straight-In approaches

- 3 main categories: **PA** & **APV** & **NPA**
 - ILS CAT 1 and Cat 2/3 Autoland
 - NAVAIDS based approaches with lateral guidance (VOR, VOR/DME, NDB, LOC only)
 - APV with Lateral & vertical guidance
- GNSS: NPA & APV
 - With lateral guidance to **LNAV/LP** minima
 - With lateral & vertical guidance to **LNAV/VNAV** minima
- GNSS with SBAS: APV & PA
 - With lateral and vertical guidance to **LPV** minima (down to 200 ft = Cat 1 equivalent)
- **GBAS stations as precision approaches**
 - In service at Cat 1 minima with Autoland
 - Cat 2 reachable
 - Cat 3 GBAS approaches – next step

Technology



GLS-GBAS Landing System

GBAS Benefits



- **No Sensitive area;**
- **Flexible approach;**

Efficiency



- **48 approaches;**
- **Low cost;**
- **Save time and fuel;**

Economy



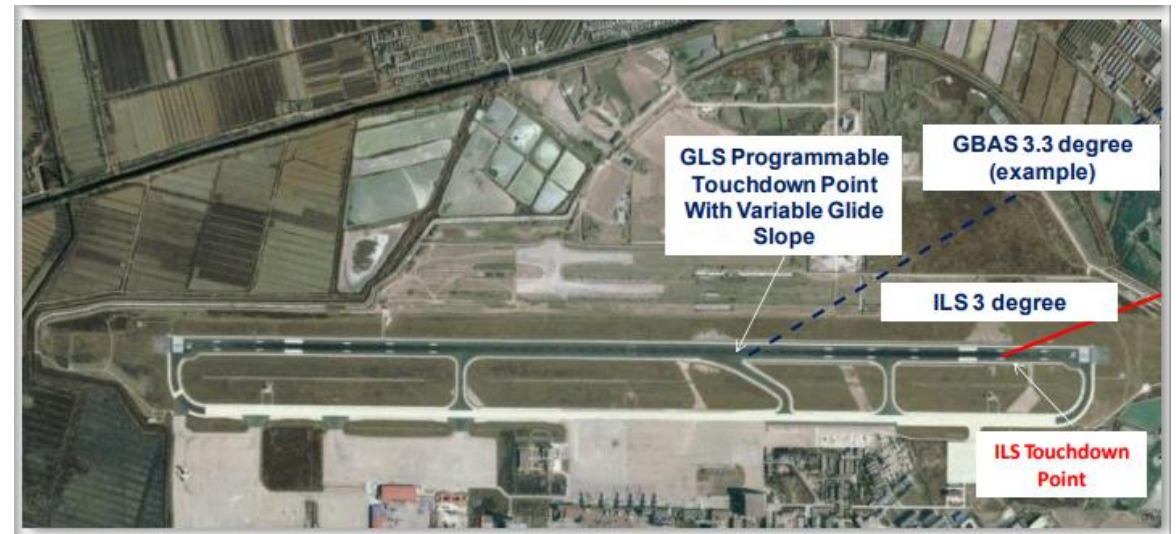
- **Stabilized path;**
- **Precision approach;**

Safety

GBAS Benefits

Comparing to ILS, the glide path angle for GLS procedure could be modified as appropriate for the reasons as below:

- Increase **vertical separation** between a/c and obstacles;
- Reduce **horizontal separation** between a/c and preceding a/c(wake turbulence);
- Increase **lateral separation** between parallel operational a/c;



GBAS Application

A P P L I C A B L E



➤ **Highland airports** with complex topography where the



conventional nav aids can not work well or be installed!;

➤ **Major busy** airports with multiple runways;



NOT

A P P L I C A B L E



➤ **Small airports** without terrain problems;



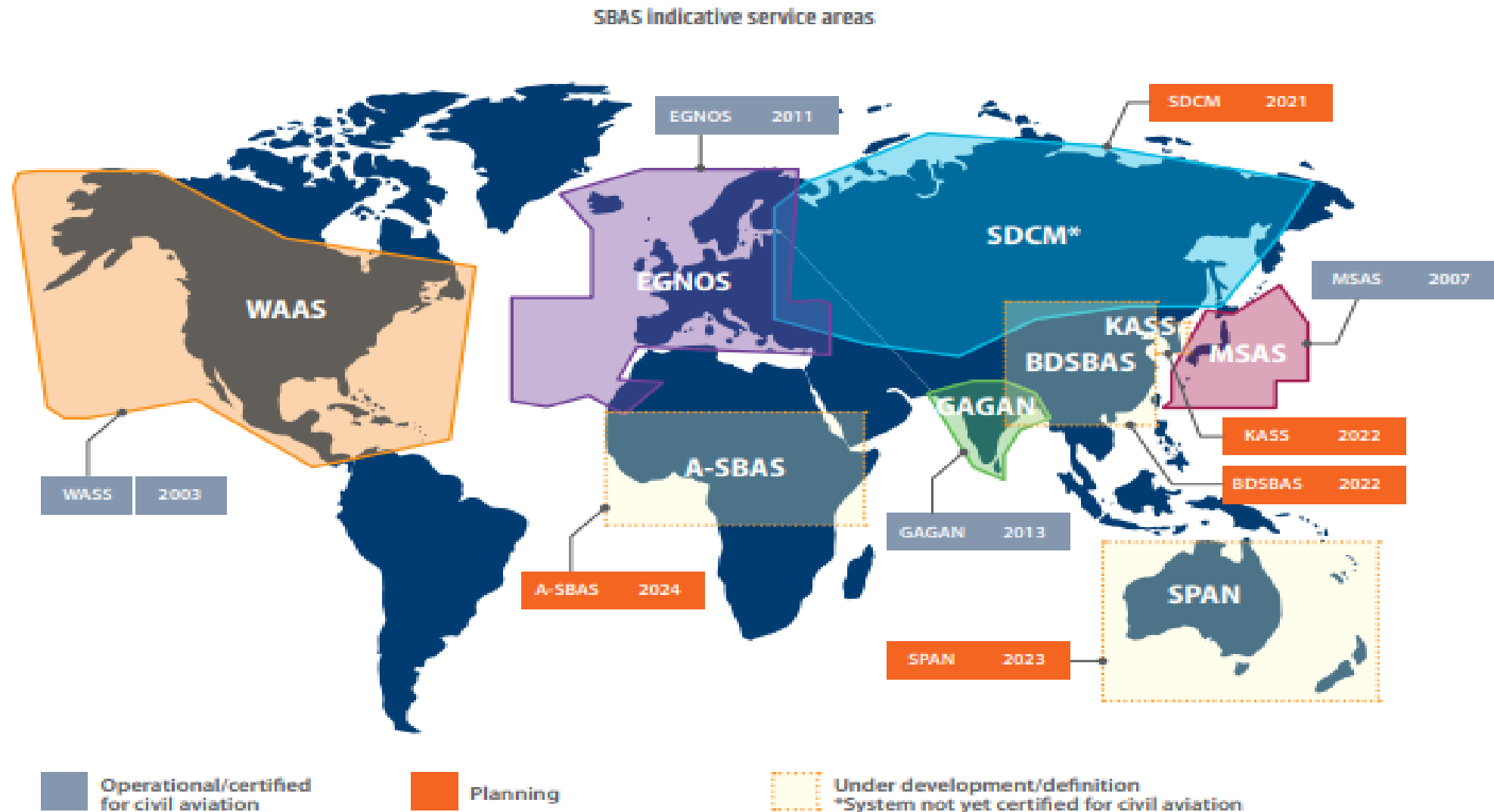
➤ Airports with severe **ionosphere interference** (especially near the equator);



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SBAS

SBAS Implementation





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FAS Data Block

FAS Data Block

- a) a set of digital data to describe the final approach segment path;
- b) Path accuracy totally dependent on **accuracy**, **integrity** of original data and the designers' calculation;
- c) All the path data (glide path, lateral guidance course width, alignment and other parameters) are **not affected** by the location of ground facilities;
- d) The FAS data block is digital data;
- f) some of the data of data block are not the responsibility of designers;
- **22** fields including the CRC, first 21 fields protected by the CRC;

FAS Data Block

Definition

Used to define the FAS path.

Path Accuracy

Totally dependent on accuracy , integrity of original data and the designers' calculation.

Not Affected

All the path are not affected by the location of ground facilities.



23

23 fields including the CRC, first 22 fields protected by the CRC;

Responsibility

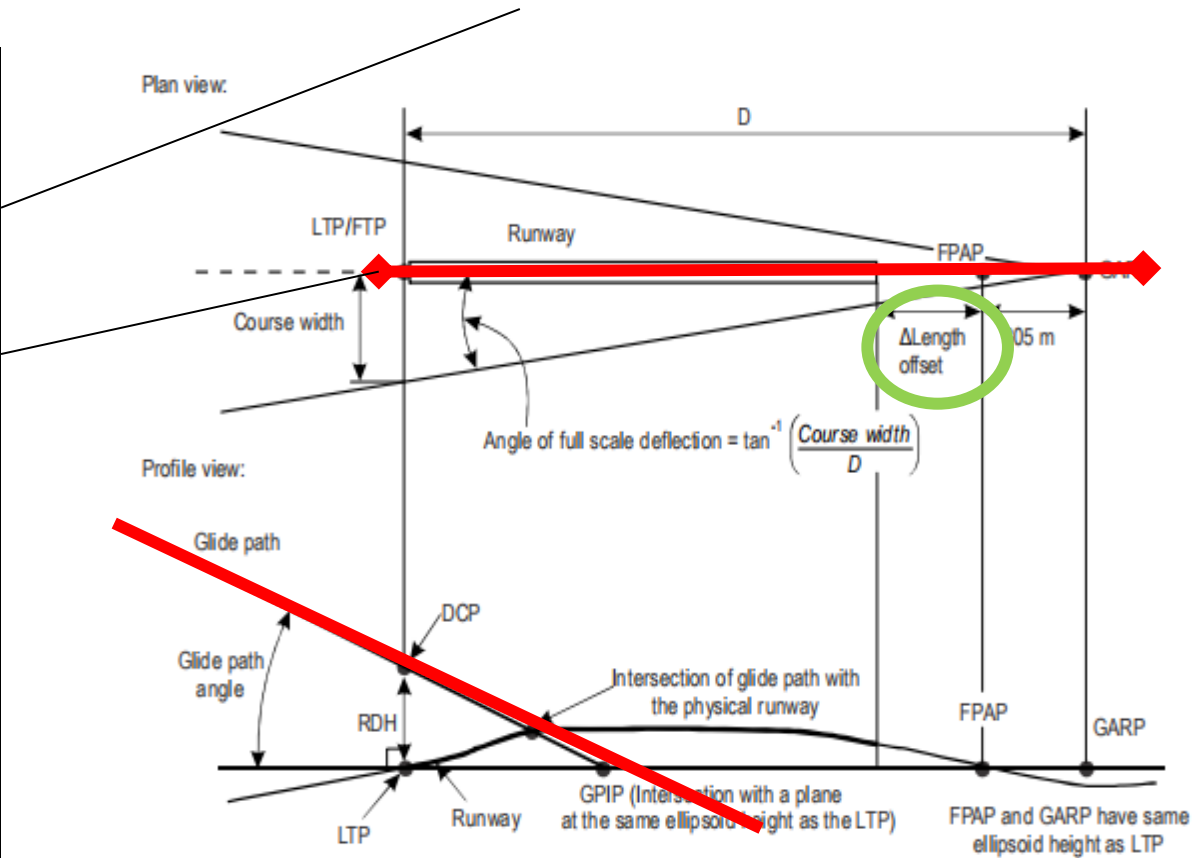
Some elements of FAS data block are not the responsibility of designers.

Resolution

The fields value should be published in high resolution.

Final Approach Segment (FAS) Data Block

<i>Data element</i>
FPAP (latitude and longitude)
LTP/FTP (latitude and longitude)
LTP/FTP (ellipsoidal height)
Approach TCH
Glide path angle
Course width
Delta length offset



Final Approach Segment (FAS) Data Block

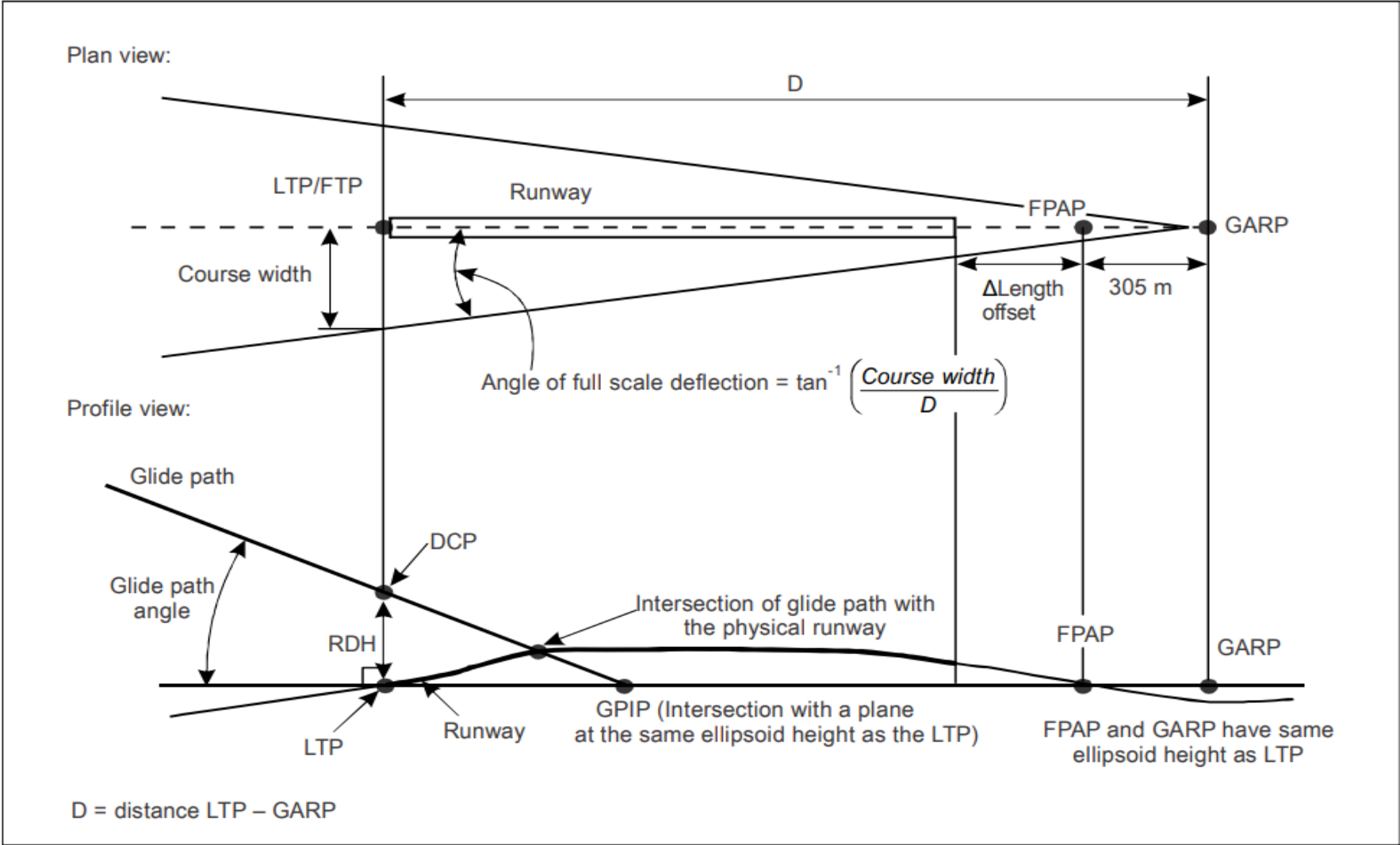


Figure III-3-6-1. Illustration of definitions

FAS Data Block Quality Assurance

<i>Data element</i>	<i>Accuracy</i>	<i>Resolution</i>	<i>Integrity</i>
FPAP (latitude and longitude)	0.3 m (1 ft)	0.0005" (0.01")	10 ⁻⁸
LTP/FTP (latitude and longitude)	0.3 m (1 ft)	0.0005" (0.01")	10 ⁻⁸
LTP/FTP (ellipsoidal height)	0.25 m	0.1 m	10 ⁻⁸
Approach TCH	0.5 m	0.05 m	10 ⁻⁸
Glide path angle	0.01°	0.01°	N/A
Course width	N/A	0.25 m	10 ⁻⁸
Delta length offset	N/A	8 m	N/A

FAS Data Block

<i>Data Content</i>	<i>Example Data</i>
Operation Type	0
SBAS Provider Identifier	1
Airport Identifier	LFLC
Runway Number	26
Runway Letter	
Approach Performance Designator	0
Route Indicator	Z
Reference Path Data Selector	0
Reference Path Identifier	E26A
LTP/FTP Latitude	454718.3185N
LTP/FTP Longitude	0031114.4545E
LTP/FTP Height above ellipsoid	372.3
FPAP Latitude	454705.1260N
FPAP Longitude	0030900.4790E
Approach Threshold Crossing Height (TCH)	15
Approach TCH Units Selector	1
Glidepath Angle (GPA)	3
Course Width at threshold	105
Length Offset	48
Horizontal Alert Limit (HAL)	40
Vertical Alert Limit (VAL)	0
Final Approach Segment CRC	AB8761C6

Additional information published

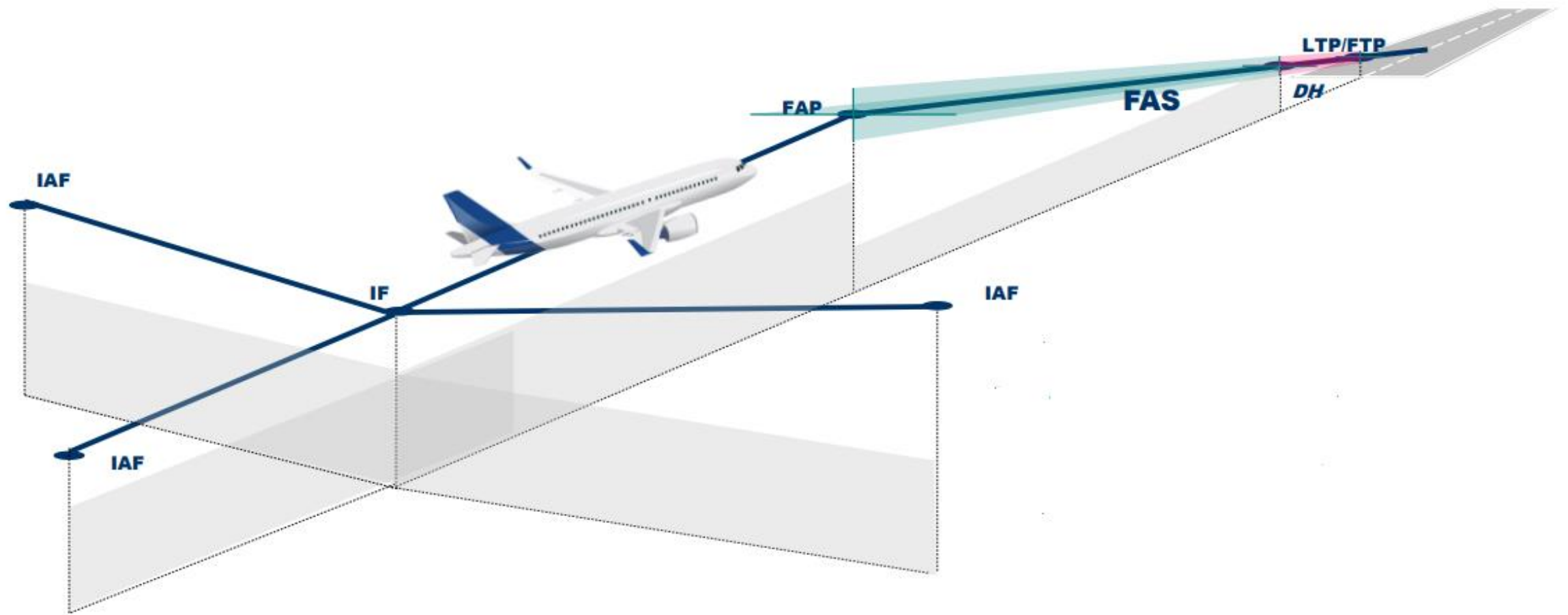
FAS DATA BLOCK

Required additional data

Coding

Example-GBAS

FAS Data Block



FAS Data Block

Number	Data Content	Example Data
1	Operation Type	0
2	SBAS Service Provider ID	14
3	Airport ID	EDDF
4	Runway number	25
5	Runway letter	R
6	Approach performance designator	1
7	Route indicator	Z
8	Reference path data selector	1
9	Reference path identifier	G25A
10	LTP/FTP latitude	500244.9700N
11	LTP/FTP longitude	0083201.3800E
12	LTP/FTP height above ellipsoid	+00478
13	FPAP latitude	500213.4000N
14	FPAP longitude	0082949.4800E
15	ΔFPAP latitude	-31.5700
16	ΔFPAP longitude	-131.9000
17	Approach TCH	15.00
18	Approach TCH units selector	1
19	Glide path angle	3.00
20	Course width	105.00
21	ΔLength offset	0
22	Channel number	20748
23	Final approach segment CRC	0x78A199B7

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20	Course width	105.00
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22	Channel number	20748
23	Final approach segment CRC	0x78A199B7

Operation type:

- A number from **0-15** that indicates the type of final approach segment;
- **0** is coded for **straight-in** approach including **offset** approach procedure.
- Codes for other procedures are reserved for future definition.

FAS Data Block

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SBAS service provider identifier:

- A number from **0-15** that associates approach to a particular satellite-based approach service provider in Annex 10 ;
- **15** implies any service provider(WAAS, EGNOS, etc) may be used .
- 14 implies this FAS data block is not to be used by SBAS.

FAS Data Block

Table B-27. SBAS service provider identifiers

Identifier	Service provider
0	WAAS
1	EGNOS
2	MSAS
3	GAGAN
4	SDCM
5	BDSBAS
6	KASS
7	A-SBAS
8	SouthPAN
9 to 13	Spare
14, 15	Reserved

FAS Data Block

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Airport Identifier:

- 4-letter code issued by the ICAO.

Runway

- The landing runway

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Approach Performance Designator:

- Indicates approach performance .
- 0=APV
- 1=CAT I
- 2=CAT II
- 3=CAT III

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Route Indicator:

One-letter identifier used to differentiate between multiple GLS approach procedures to the **same** runway end.

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LTP/FTP/FPAP parameters:

The latitude and longitude of the LTP/FTP/FPAP are defined as WGS-84 coordinates and enter to the resolution of 5/10000 of an arc second.

Example: +00356(35.6m)

LTP/FTP latitude: The WGS-84 latitude of the LTP/FTP.

Example: DDMMSS.0005N where:

DD = degrees

MM = minutes

SS = seconds

N = Northern Hemisphere

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▲ FPAP coordinate:

- **▲ FPAP latitude:** the difference of the latitude of the FPAP from the LTP/FTP in arc seconds;
- **▲ FPAP longitude:** the difference of the longitude of the FPAP from the LTP/FTP in arc seconds;

FAS Data Block

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Course width:

- The lateral displacement, in meters, from the path defined by the FAS at the LTP/FTP at which the full scale deflection of the course deviation indicator is attained;

Length offset:

- The distance, in meters, from the stop end of runway to FPAP;



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4.Charts & Coding

Charts(ILS&GLS)

AD 2 EDDF 4-2-15
Effective: 04 NOV 2021

LUFTFAHRTHANDBUCH DEUTSCHLAND
AIP GERMANY

FRANKFURT MAIN

ILS Y
RWY 25R

FRANKFURT ATIS	118.030	FRANKFURT GROUND	121.805
LANGEN RADAR (N)	120.805	FRANKFURT APRON	121.755
LANGEN RADAR (S)	125.355		121.855
FRANKFURT DIRECTOR	127.280		121.955
FRANKFURT TOWER	136.500		

ELEV 364
OCH RELATED TO VAR 3° E
THR 25R ELEV 353

INSTRUMENT
APPROACH
CHART - ICAO

LUFTFAHRTHANDBUCH DEUTSCHLAND
AIP GERMANY

AD 2 EDDF 4-7-23
05 NOV 2020

INSTRUMENT
APPROACH
CHART - ICAO

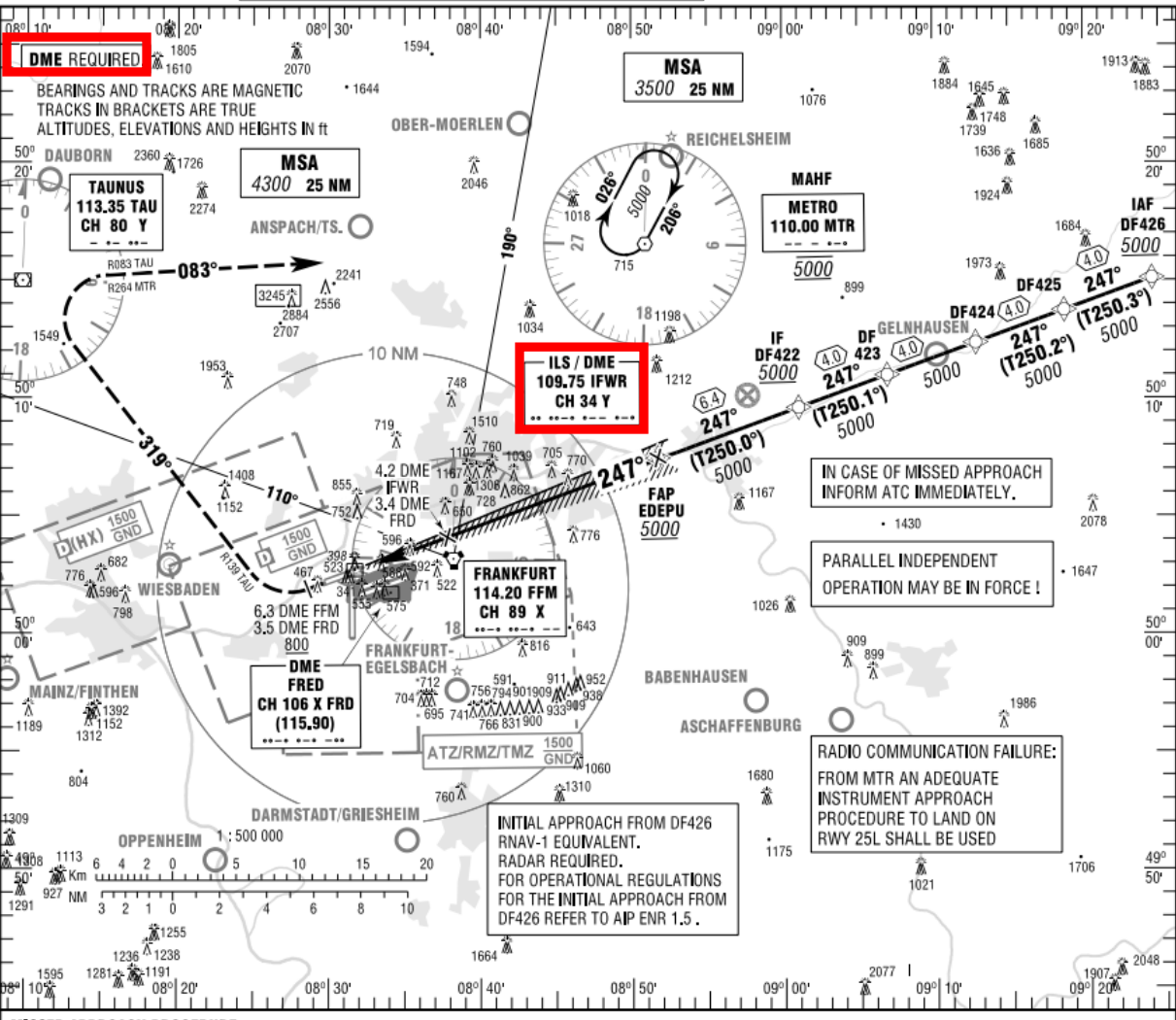
VAR 2° E
ELEV 364
OCH RELATED TO
THR 25R ELEV 353

FRANKFURT ATIS	118.030	FRANKFURT GROUND	121.805
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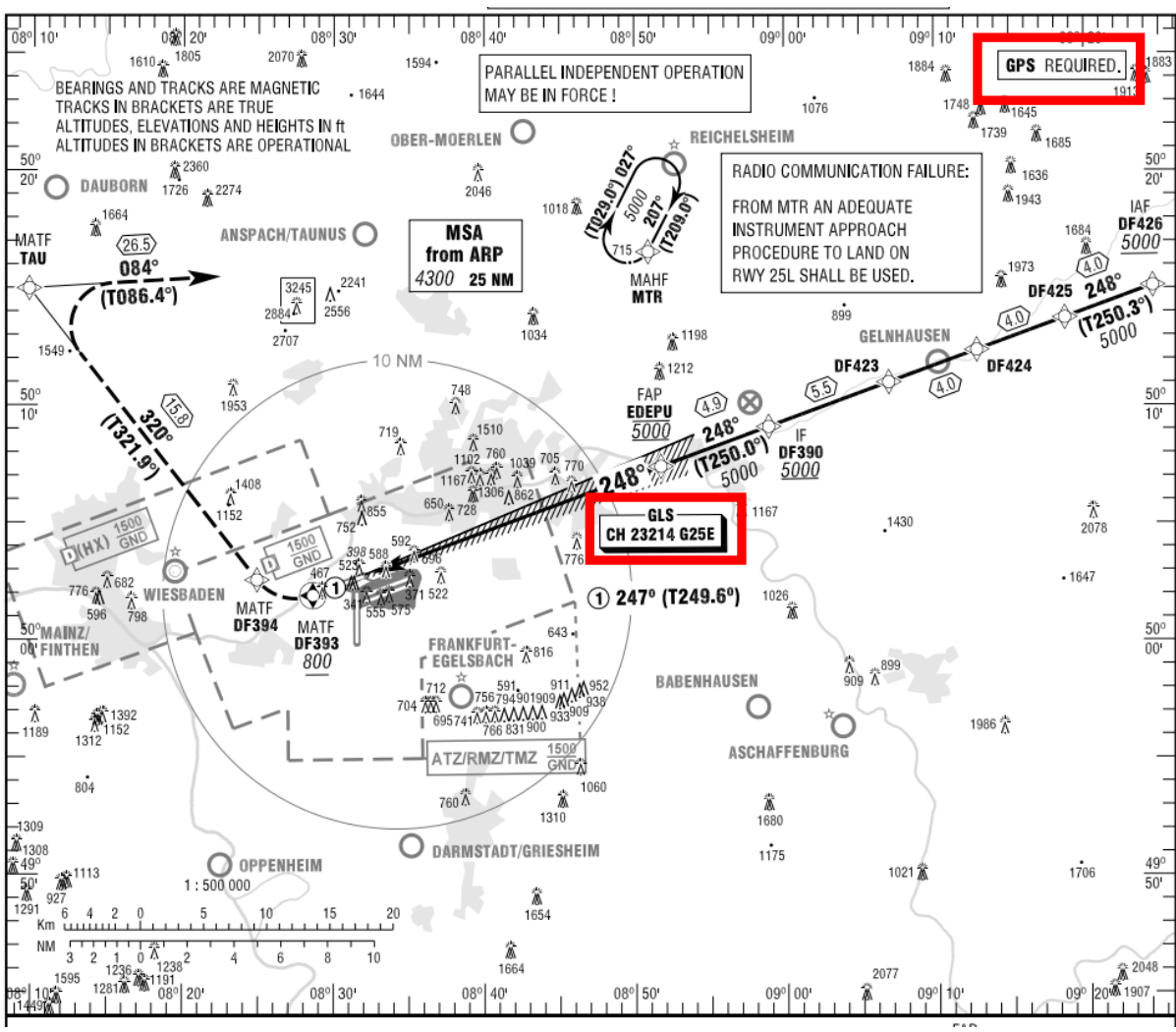
FRANKFURT MAIN

GLS Y
RWY 25R

Charts(ILS&GLS)

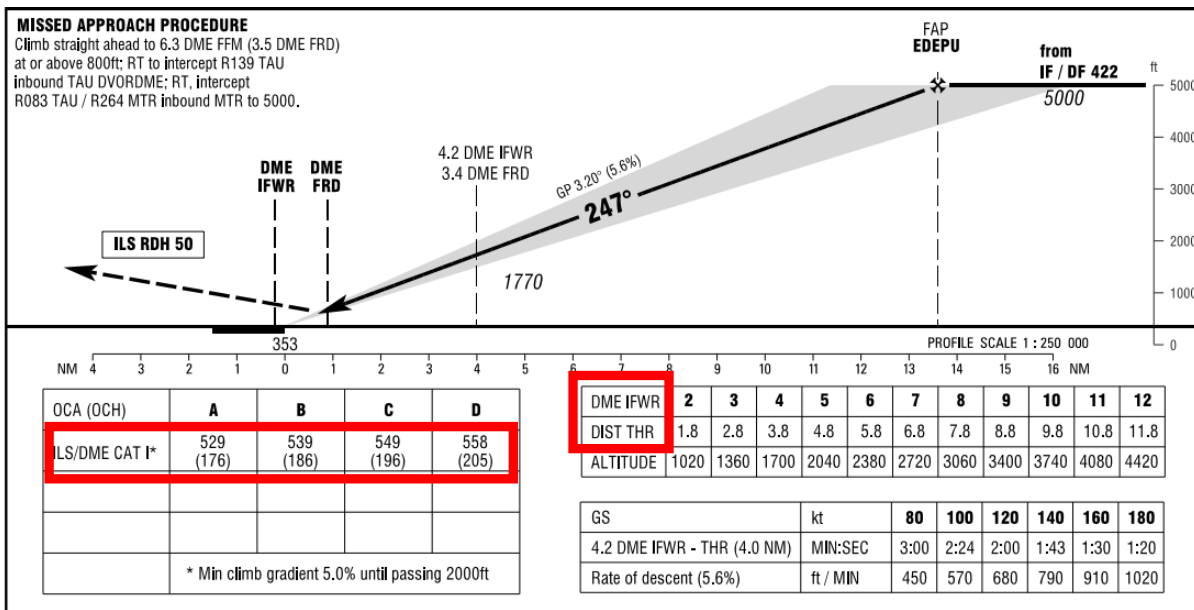


ILS

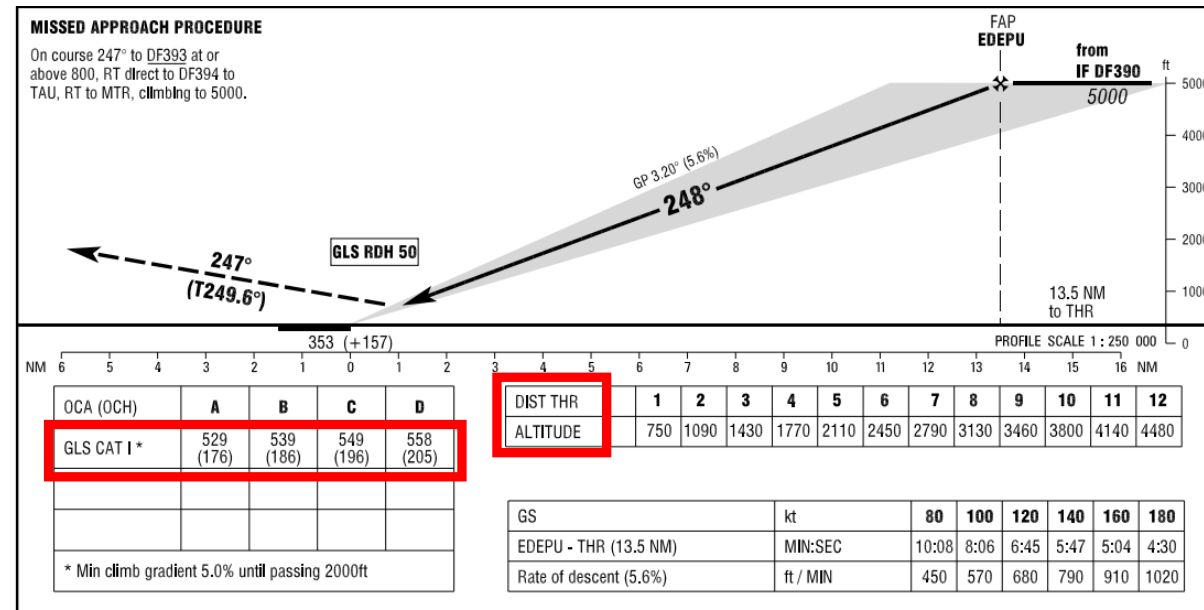


GLS

Charts(ILS&GLS)



ILS



GLS

Charts(GLS)

LUFTFAHRTHANDBUCH DEUTSCHLAND
AIP GERMANY

AD 2 EDDF 4-7-11
05 NOV 2020

INSTRUMENT
APPROACH
CHART - ICAO

VAR 2° E

ELEV 364
OCH RELATED TO
THR 25R ELEV 353

FRANKFURT ATIS	118.030	FRANKFURT GROUND	121.805
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FRANKFURT MAIN

GLS Z
RWY 25R

LUFTFAHRTHANDBUCH DEUTSCHLAND
AIP GERMANY

AD 2 EDDF 4-7-23
05 NOV 2020

INSTRUMENT
APPROACH
CHART - ICAO

VAR 2° E

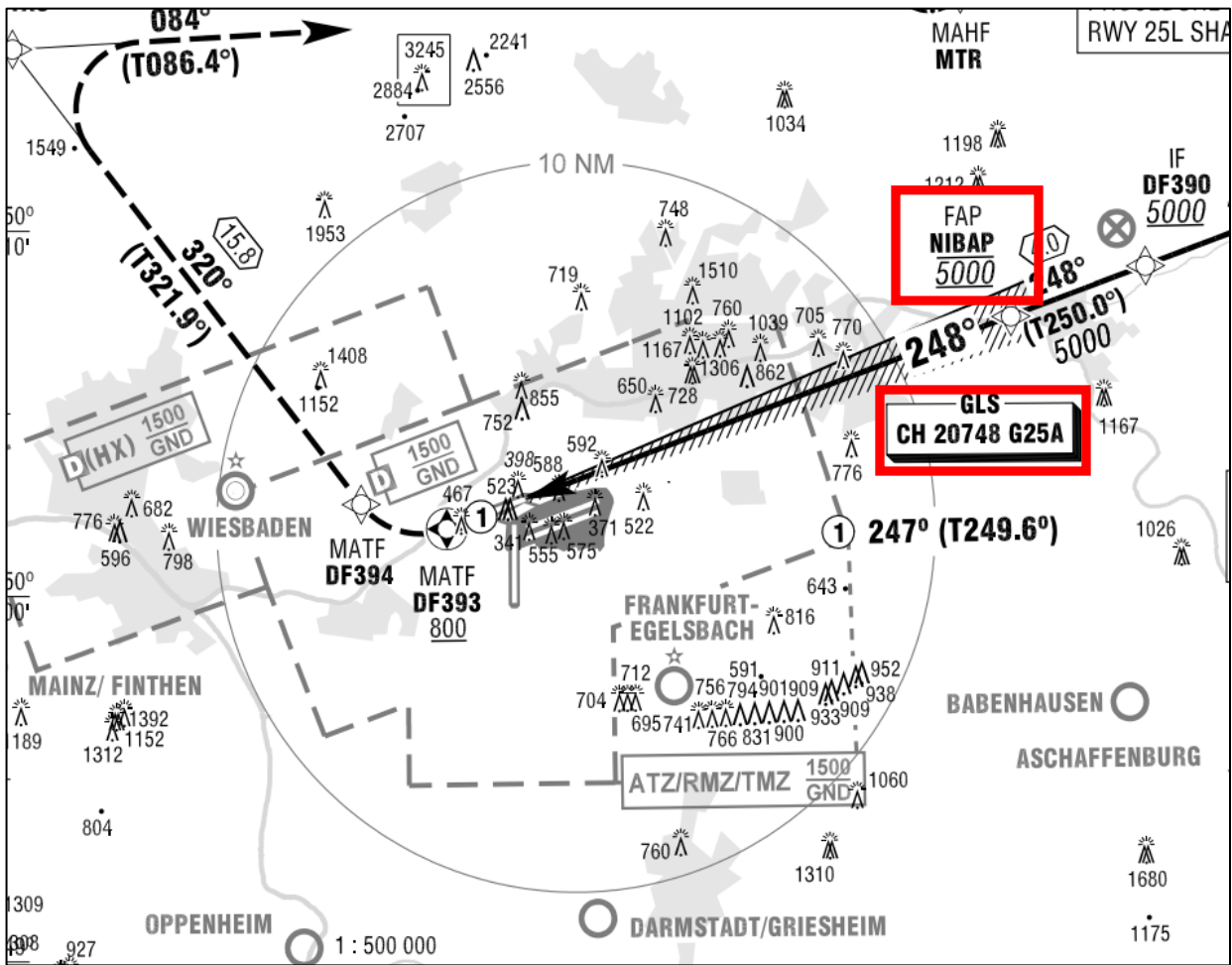
ELEV 364
OCH RELATED TO
THR 25R ELEV 353

FRANKFURT ATIS	118.030	FRANKFURT GROUND	121.805
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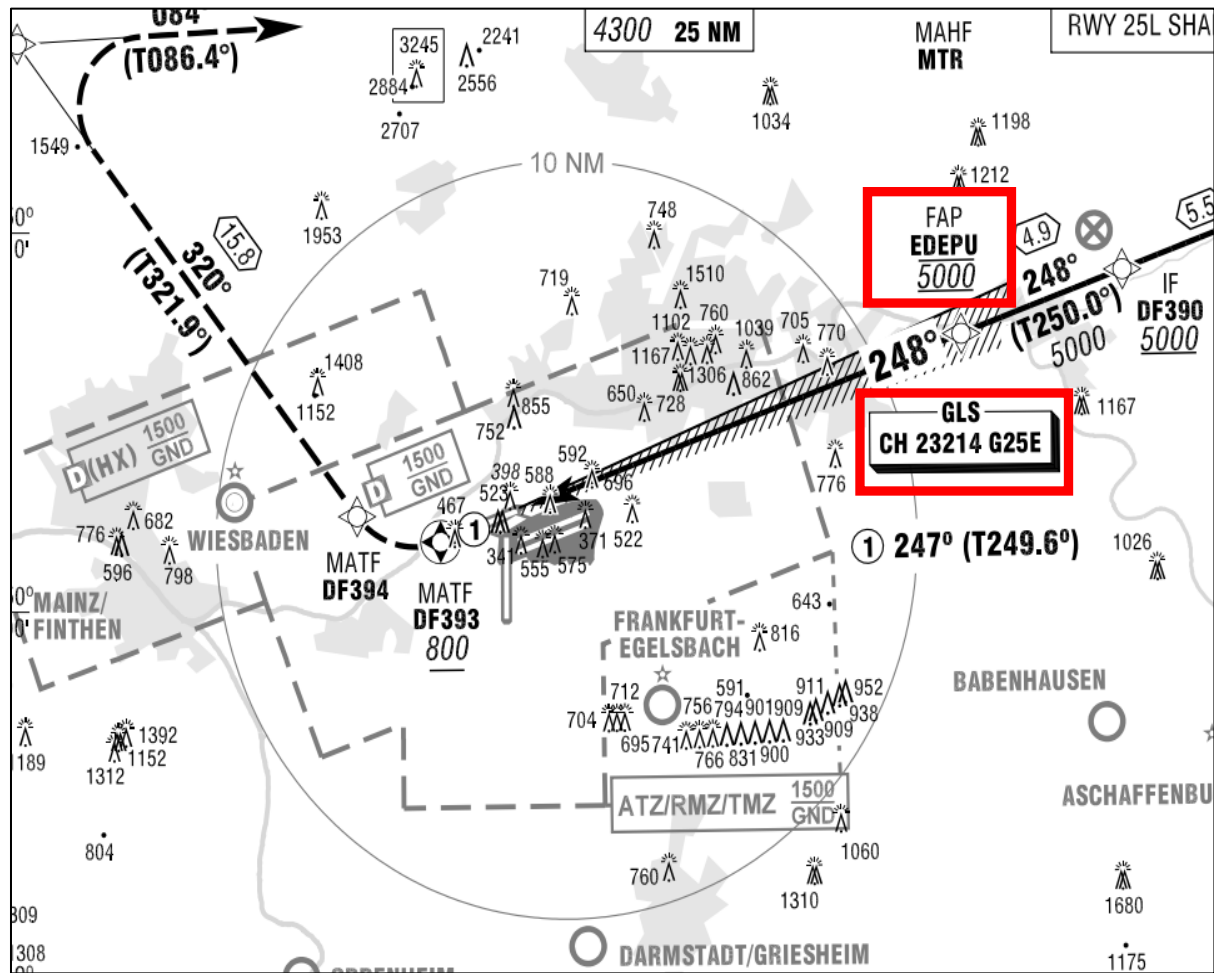
FRANKFURT MAIN

GLS Y
RWY 25R

Charts(GLS)



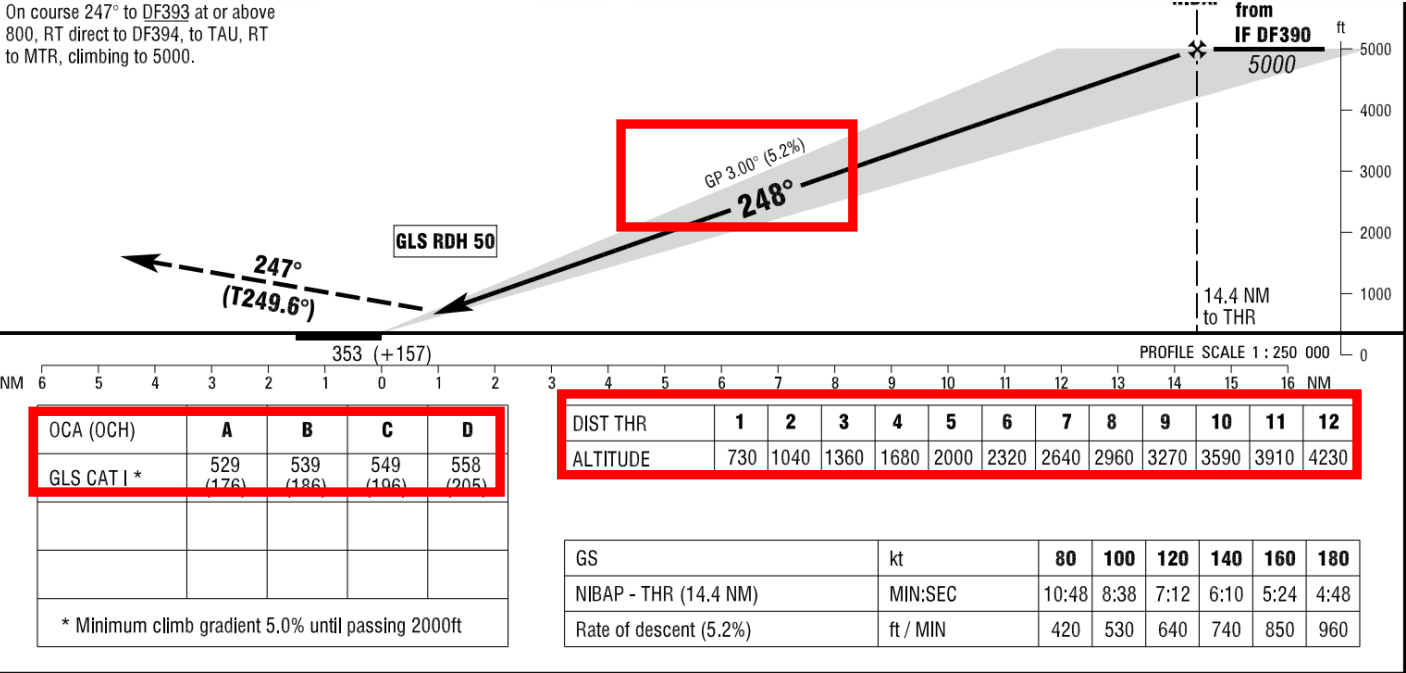
RWY25R: GLS-Z



RWY25R: GLS-Y

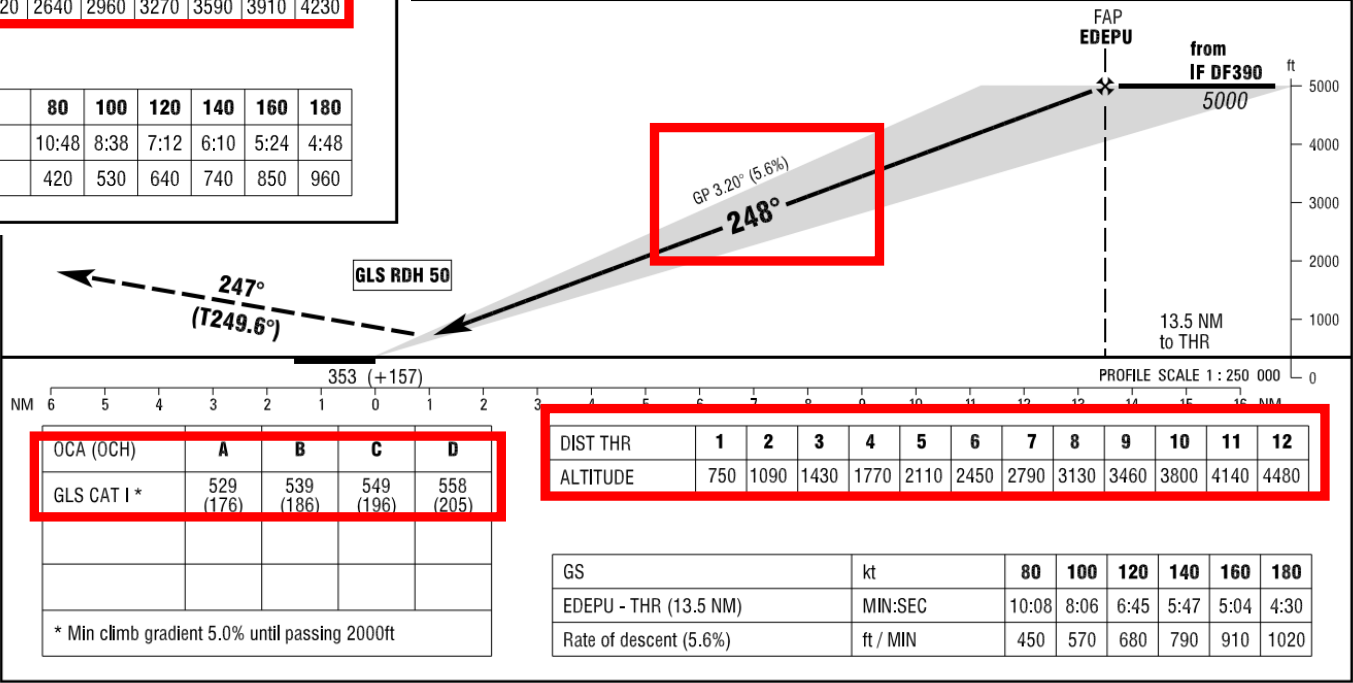
Charts

On course 247° to DF393 at or above 800, RT direct to DF394, to TAU, RT to MTR, climbing to 5000.



25R GLS-Y

25R GLS-Z



Effective: 05 NOV 2020

AIP GERMANY

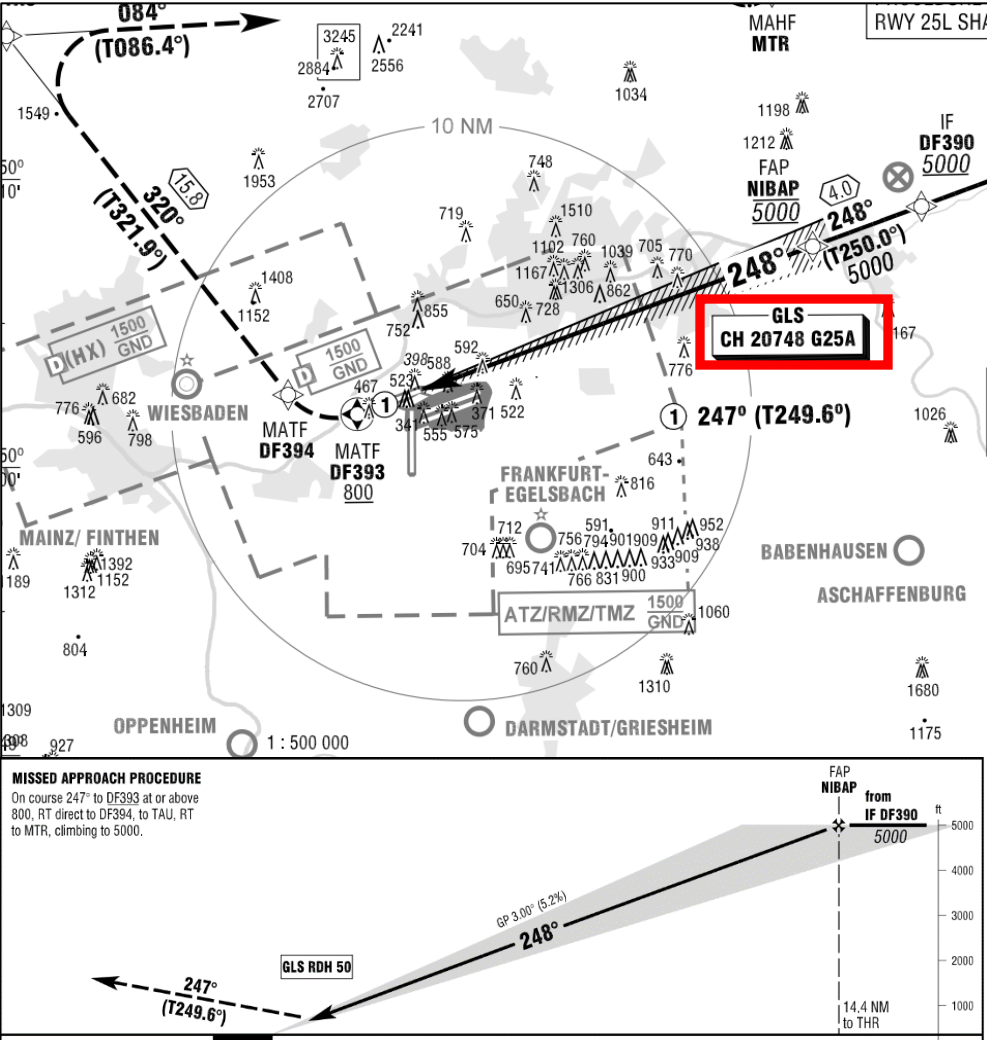
FRANKFURT MAIN
GLS Y
RWY 25R

INSTRUMENT APPROACH PROCEDURE TABULAR DESCRIPTION

INITIAL, INTERMEDIATE AND MISSED APPROACH												
Approach Segment	Recommended Path Terminator	Waypoint Identifier	Coordinates	Fly Over	(True Track°) MAG Track°	Distance (NM)	Turn Direction	Altitude (ft) / Flight Level	Speed Limit (kt IAS)	Vertical Path Angle (°) / TCH (ft)	NAV Specification	Remarks
Initial Intermediate APCH from DF426	IF	DF426	N 50 15 03.04 E 009 24 30.17	-	-	-	-	A5000+	-	-	RNP APCH	-
	TF	DF425	N 50 13 41.98 E 009 18 37.71	-	(T250.3) 248	4.0	-	-	-	-	RNP APCH	-
	TF	DF424	N 50 12 20.62 E 009 12 45.59	-	(T250.3) 248	4.0	-	-	-	-	RNP APCH	-
	TF	DF423	N 50 10 58.96 E 009 06 53.81	-	(T250.3) 248	4.0	-	-	-	-	RNP APCH	-
	TF	DF390	N 50 09 06.62 E 008 58 54.17	-	(T250.3) 248	5.5	-	A5000+	-	-	RNP APCH	-
	TF	EDEPU	N 50 07 25.72 E 008 51 44.46	-	(T250.0) 248	4.9	-	@A5000	-	-	RNP APCH	FAP for GLS FAS
Missed APCH	-	RW25R	N 50 02 44.97 E 008 32 01.38	-	-	-	-	-	-	-	RNP APCH	-
	CF	DF393	N 50 01 56.38 E 008 28 38.44	Y	(T249.6) 247	-	-	A800+	-	-	RNP APCH	-
	DF	DF394	N 50 02 36.50 E 008 24 56.21	-	-	-	R	-	-	-	RNP APCH	-
	TF	TAU	N 50 15 01.67 E 008 09 45.09	-	(T321.9) 320	15.8	R	-	-	-	RNP APCH	-
	TF	MTR	N 50 16 34.59 E 008 50 55.05	-	(T086.4) 084	26.5	-	@A5000	-	-	RNP APCH	-

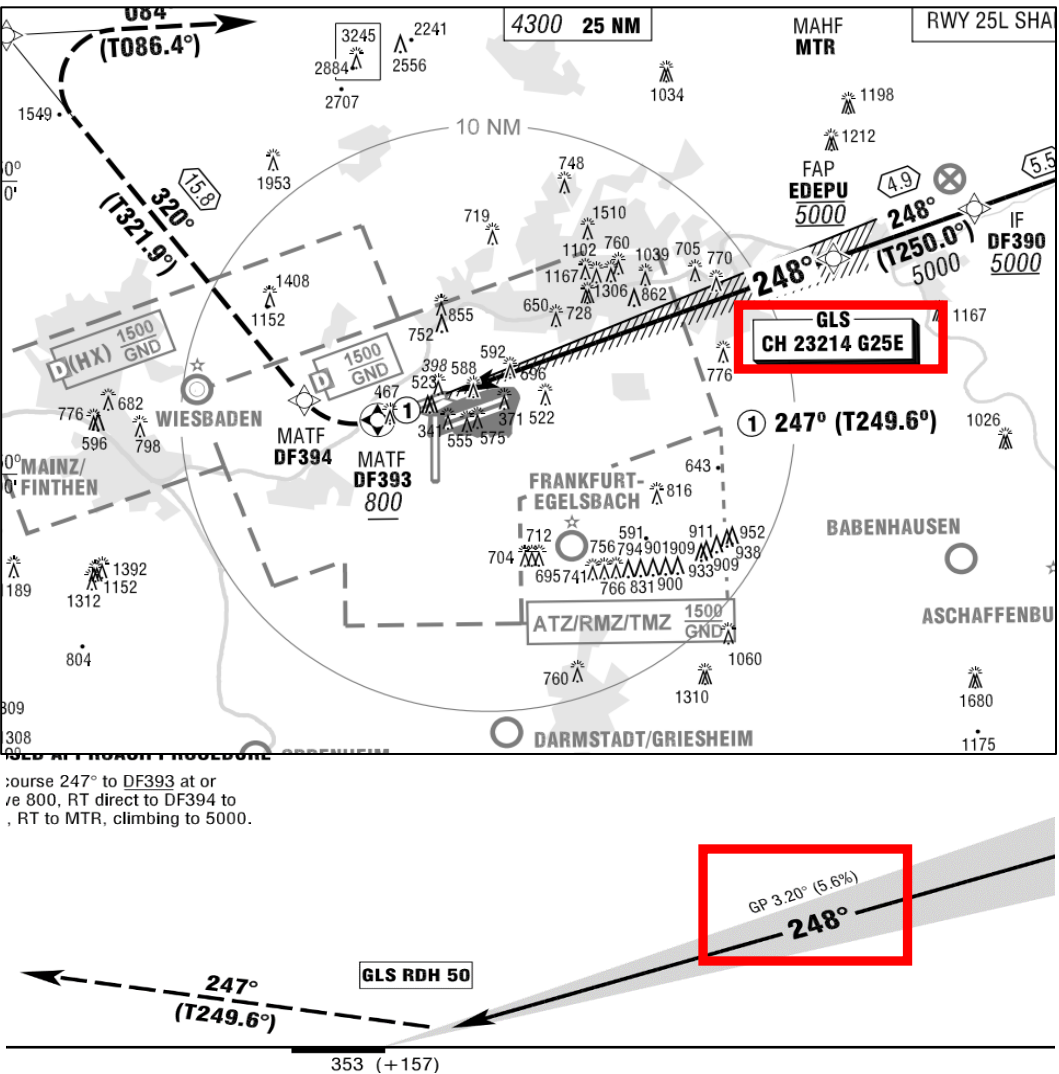
25R GLS-Y

Coding



Number	Data Content	Example Data
1	Operation Type	0
2	SBAS Service Provider ID	14
3	Airport ID	EDDF
4	Runway number	25
5	Runway letter	R
6	Approach performance designator	1
7	Route indicator	Z
8	Reference path data selector	1
9	Reference path identifier	G25A
10	LTP/FTP latitude	500244.9700N
11	LTP/FTP longitude	0083201.3800E
12	LTP/FTP height above ellipsoid	+00478
13	FPAP latitude	500213.4000N
14	FPAP longitude	0082949.4800E
15	ΔFPAP latitude	-31.5700
16	ΔFPAP longitude	-131.9000
17	Approach TCH	15.00
18	Approach TCH units selector	1
19	Glide path angle	3.00
20	Course width	105.00
21	ΔLength offset	0
22	Channel number	20748
23	Final approach segment CRC	0x78A199B7

Coding



Number	Data Content	Example Data
1	Operation Type	0
2	SBAS Service Provider ID	14
3	Airport ID	EDDF
4	Runway number	25
5	Runway letter	R
6	Approach performance designator	1
7	Route indicator	Y
8	Reference path data selector	2
9	Reference path identifier	G25E
10	LTP/FTP latitude	500244.9700N
11	LTP/FTP longitude	0083201.3800E
12	LTP/FTP height above ellipsoid	+00478
13	FPAP latitude	500213.4000N
14	FPAP longitude	0082949.4800E
15	ΔFPAP latitude	-31.5700
16	ΔFPAP longitude	-131.9000
17	Approach TCH	15.00
18	Approach TCH units selector	1
19	Glide path angle	3.20
20	Course width	105.00
21	ΔLength offset	0
22	Channel number	23214
23	Final approach segment CRC	0x69A199C7

Example-SBAS



Q&A?

Thanks!!