SUPPORTING
EUROPEAN
AVIATION

Why Geodetic Reference Frames Matter for AIM

B.Coric & A.Wojtowicz
EUROCONTROL

CONSORTIUM COORDINATOR sesar DEPLOYMENT MANAGER

FOUNDING MEMBER sesar JOINT UNDERTAKING

NETWORK MANAGER

INTRODUCING MYSELF

Boris Coric

AIM Expert @ EUROCONTROL

AIRI SG Secretary

Instructor and SME @ ALC

19+ years of work experience

EUROCONTROL

KEY OBJECTIVES

1. Understanding Aeronautical Data and Aeronautical Information
2. Insights on Data Quality Requirements (DQR)
3. Why Aeronautical DQR Matters
4. Regulatory Compliance
5. Why WGS-84?
6. ETRS89 vs WGS-84 – same but different?

EUROCONTROL

WEBINAR ON FUTURE REFERENCE FRAMES

UNDERSTANDING AERONAUTICAL DATA AND AERONAUTICAL INFORMATION

EUROCONTROL

AERONAUTICAL DATA AND AERONAUTICAL INFORMATION

Definitions

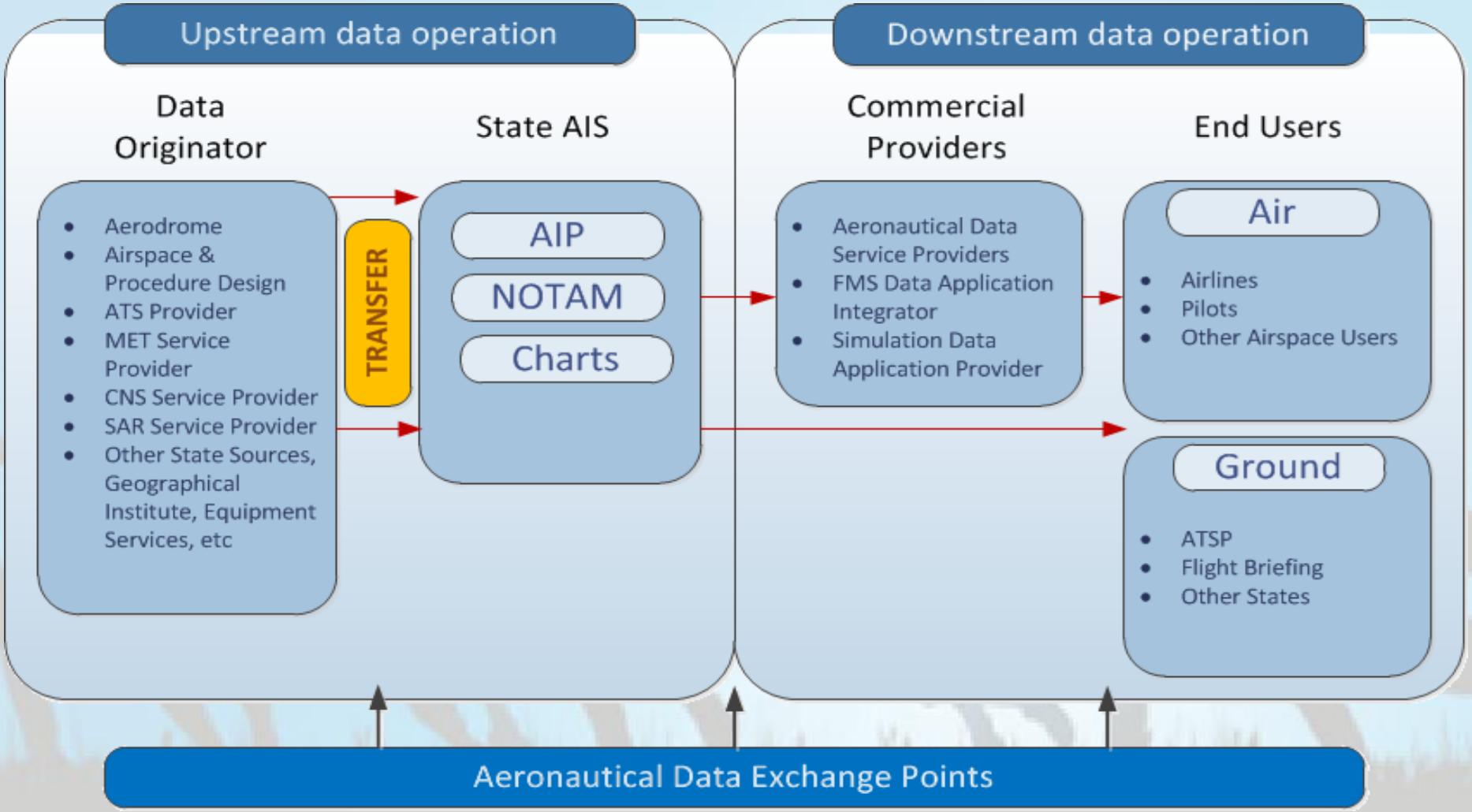
Aeronautical Data: A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing (coordinates, obstacles, airspace limits, etc.).

Aeronautical Information: Information resulting from the assembly, analysis and formatting of aeronautical data.

Aeronautical Information Service (AIS): A service established within the defined area of coverage responsible for the provision of aeronautical data and aeronautical information necessary for the safety, regularity and efficiency of air navigation.

Originator (aeronautical data or aeronautical information). An entity that is accountable for data or information origination and/or from which the AIS organization receives aeronautical data and aeronautical information.

AIS DATA CHAIN

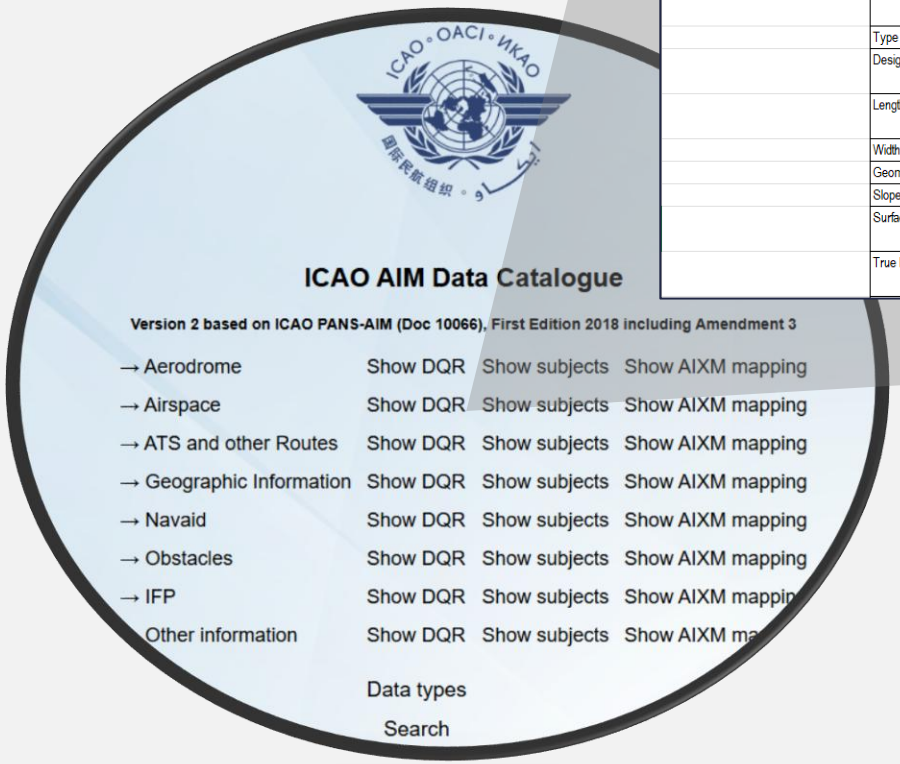


EUROCONTROL

To reach the required levels of data quality we need to address all parties in the data chain

AERONAUTICAL DATA CATALOGUE

Subject	Property	Sub-Property	Type	Description	Note	Accuracy	Integrity	Orig Type	Pub. Res.	Chart Res.
FATO				Final approach and take-off area. A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by helicopters operated in performance class 1, the defined area includes the rejected take-off area available.						
	Threshold			The beginning of that portion of the FATO usable for landing.						
		Position	Point	Geographical location of FATO threshold		1m	critical	surveyed	1/100 sec	1 sec
		Elevation	Elevation	Elevation of the FATO threshold		See Note 1)				
		Geoid undulation	Height	WGS-84 Geoid undulation at FATO threshold position		See Note 2)				
	Departure end of runway			Departure end of the runway (DER), which is the end of the area declared suitable for take-off (i.e. the end of the runway or, where a clearway is provided, the end of the clearway or the end of the final approach and take-off (FATO) area).						
		Position	Point	Geographical location of DER		1m	critical	surveyed	1/100 sec	1 sec
		Elevation	Elevation	The elevation of the DER is the higher of the elevations of the beginning and end of the						
	Type		Text	Ty						
	Designation		Text	Th						
	Length		Distance	Th						
	Width		Distance	Th						
	Geometry		Polygon	Ge						
	Slope		Value	Th						
	Surface type		Text	Th						
	True bearing		Bearing	The true bearing of FATO		1/100 deg	routine	surveyed	1/100 degree	



SCOPE OF AERONAUTICAL DATA (features, attributes…)

DATA QUALITY REQUIREMENTS

IDENTIFICATION OF DATA ORIGINATROS

REFERENCE FOR FORMAL ARRANGEMENTS

ADAPTIVE TO FUTURE REQUIREMENTS

AERONAUTICAL DATA QUALITY

Corrupt or Erroneous aeronautical information/data can potentially affect the safety of Air Navigation.

EUROCONTROL

WHAT IS AERONAUTICAL DATA QUALITY?

A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution, integrity (or equivalent assurance level), traceability, timeliness, completeness and format.

ICAO Annex 15

TRUST

WEBINAR ON FUTURE REFERENCE FRAMES

AERONAUTICAL DATA QUALITY MATTERS

EUROCONTROL

KATHMANDU INCIDENT$_1$

RUNWAY EXCURSION ACCIDENT OF TURKISH AIRLINES TC-JOC, A330-303, AT TIA, KATHMANDU, NEPAL ON 4th MARCH 2015

EUROCONTROL

KATHMANDU INCIDENT$_2$

- Coordinates for RWY02 THR published in the AIP
  - 27°41′02.007″N
  - 085°21′12.215″E
  - *Resolution: 1/1000th of an arc second*

- 01 JAN 2015: AIRAC AIP SUP displacing RWY02 THR 120m North

- Coordinates published in AIP SUP
  - 27°41′06″N
  - **085°21′13″E**
  - *Resolution: Degrees, Minutes, Seconds*

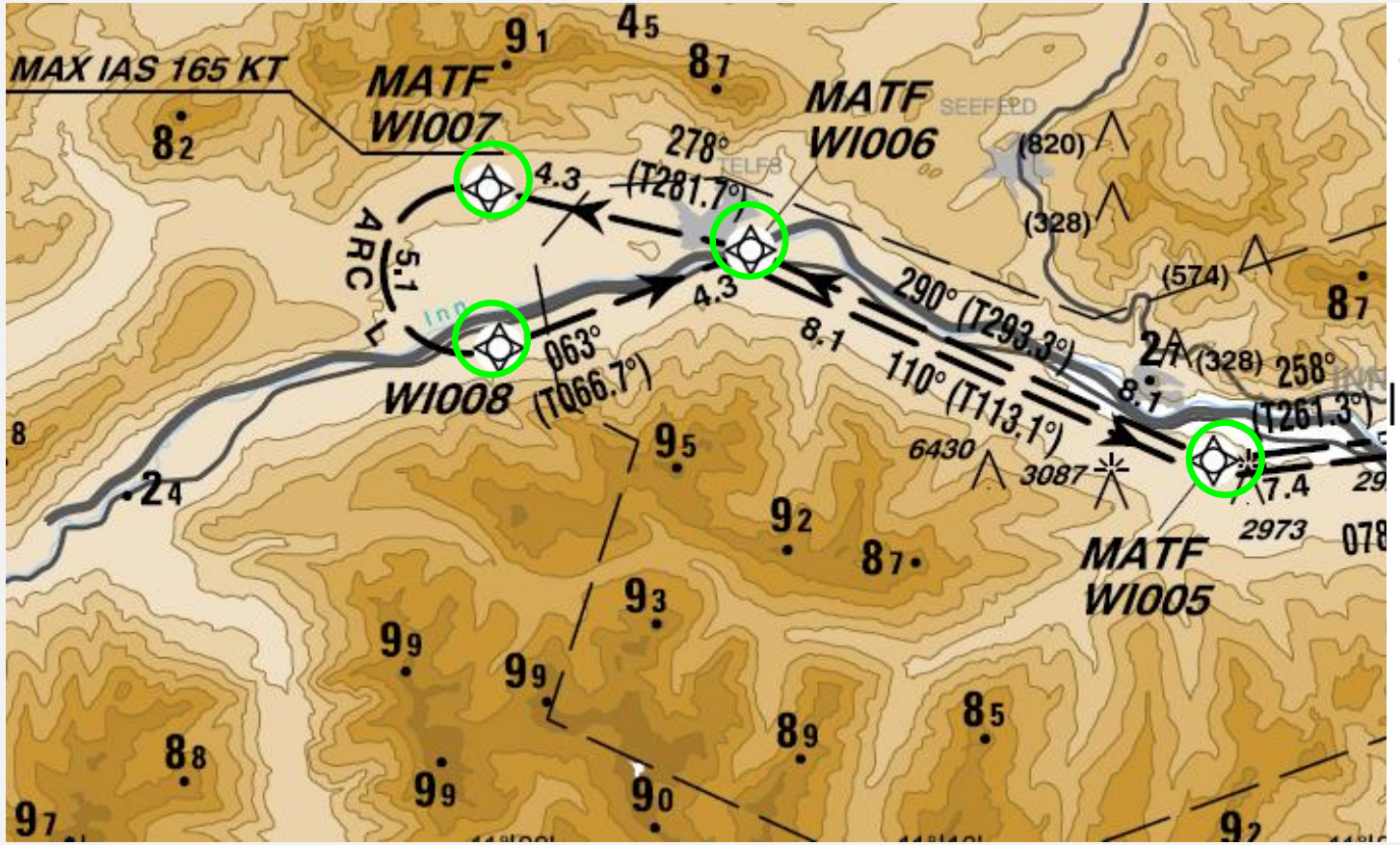
EUROCONTROL

KATHMANDU INCIDENT$_2$

Offset from about 26m on the left of the runway centerline

TOD APPLICATIONS

Innsbruck, RNP Z approach, RWY 26 (AR)



Instrument Approach Procedure

INNSBRUCK
RNP Z RWY 26 (AR)

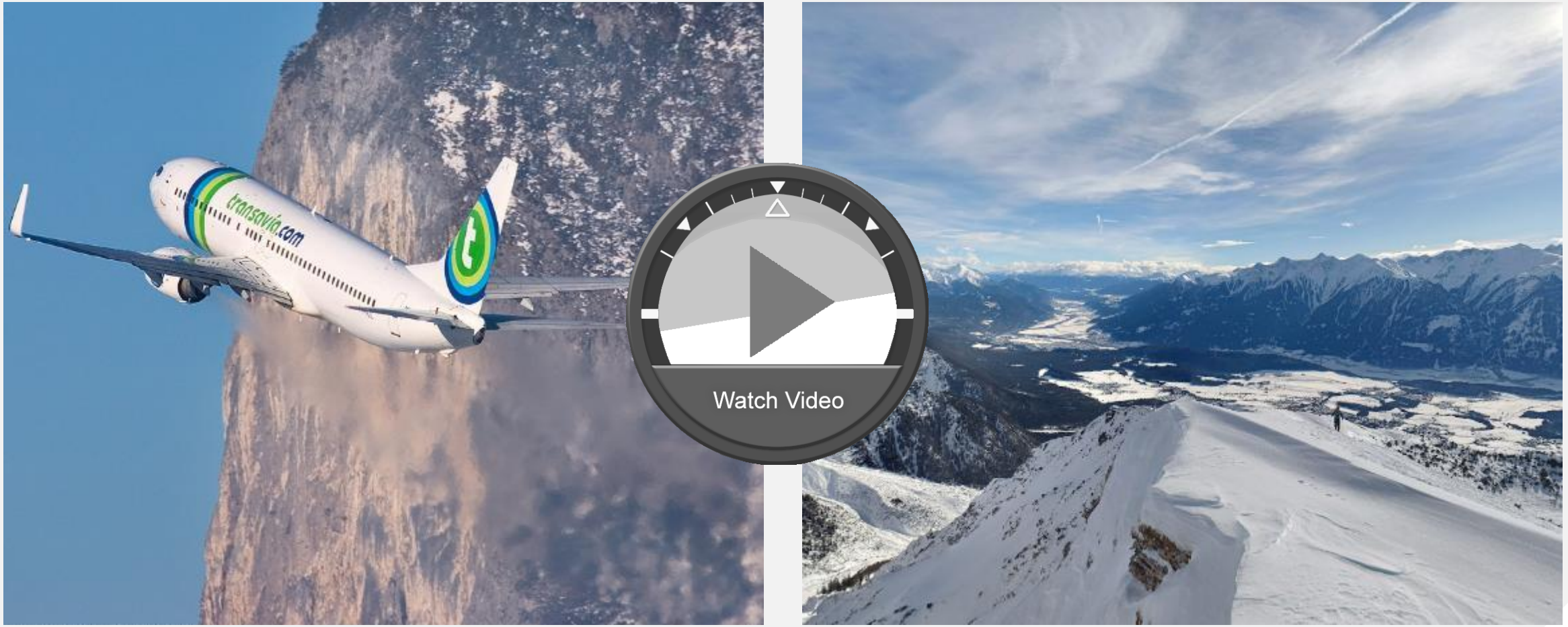
Instrument Approach Procedure Coding Table
Innsbruck RNP Z RWY 26 (AR)

Path Terminator	Waypoint				Course/ Track ° MAG (° True)	DIST NM	Turn Direction	ARC Centre Waypoint		ARC Radius NM
	Identifier	Type	Flyover	Coordinates				Identifier	Coordinates	
IF	RTT	IAF	no	N472551.3 E0115624.9						
TF	WI002	FAP	no	N472236.0 E0114930.1	232° (235.3°)	5.7				
TF	WI103		no	N471616.4 E0112647.6	244° (247.9°)	16.7	ght			
TF	RW26		yes	N471541.6 E0112125.4	258° (261.1°)	3.7	ght			
TF	WI005	MATF	no	N471508.7 E0111606.2	258° (261.3°)	3.7				
TF	WI006	MATF	no	N471820.4 E0110509.0	290° (293.3°)	8.1	ght			
TF	WI007	MATF	no	N471912.8 E0105859.4	278° (281.7°)	4.3	eft			
RF	WI008		no	N471638.5 E0105821.2		5.1	eft	WI009	N471753.02 E0105834.83	1.3
TF	WI006	MATF	no	N471820.4 E0110509.0	063° (066.7°)	4.3				
TF	WI005	MATF	no	N471508.7 E0111606.2	110° (113.1°)	8.1	ght			
TF	WI103	MATF	no	N471616.4 E0112647.6	078° (081.1°)	7.4	eft			
TF	WI002	MATF	no	N472236.0 E0114930.1	064° (067.6°)	16.7	eft			
TF	RTT	MAHF	yes	N472551.3 E0115624.9	052° (055.2°)	5.7	eft			

EUROCONTROL

APPLICATIONS

Innsbruck airport surroundings

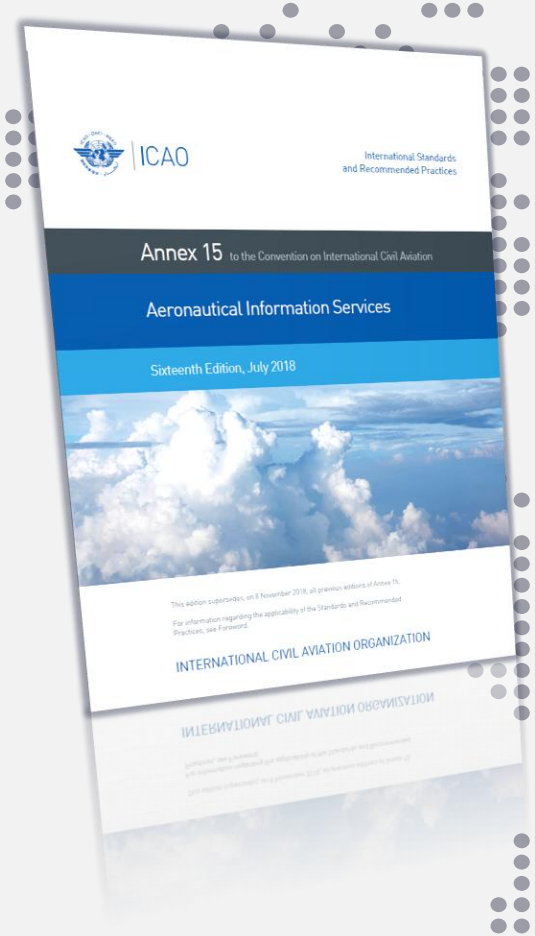


WEBINAR ON FUTURE REFERENCE FRAMES

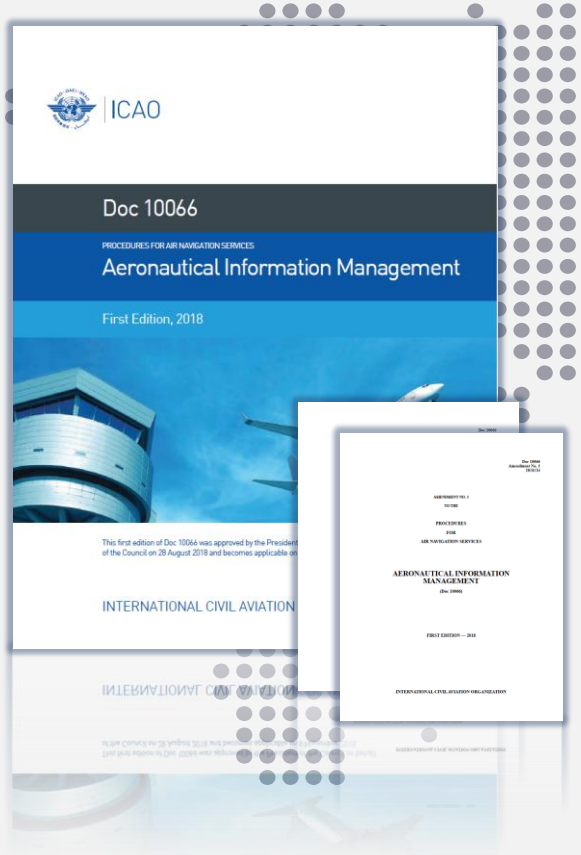
REGULATORY COMPLIANCE

EUROCONTROL

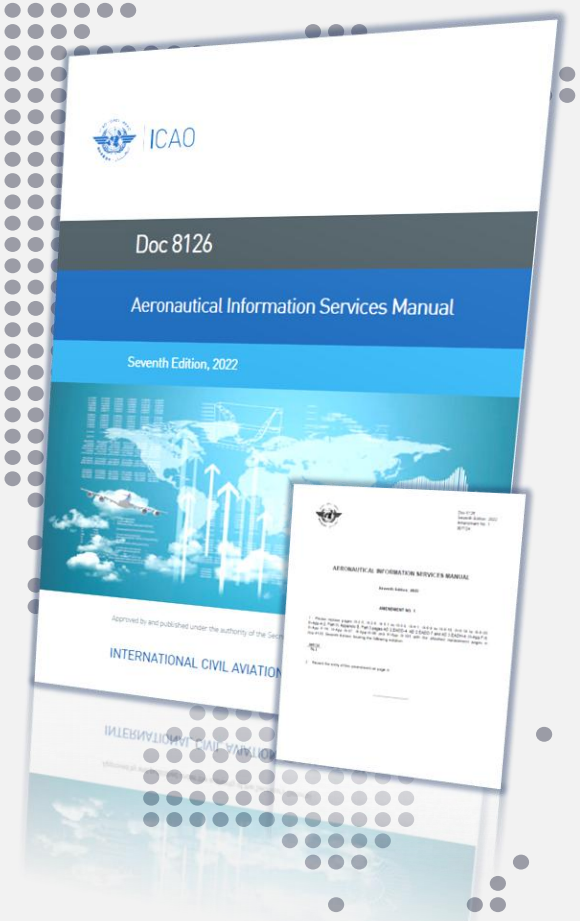
ICAO AIS/AIM DOCUMENTS



Annex 15, 16th Edition
Amendment 43, effective as of 28 November 2024



PANS-AIM, 1st Edition
Amendment 3, effective as of 28 November 2024

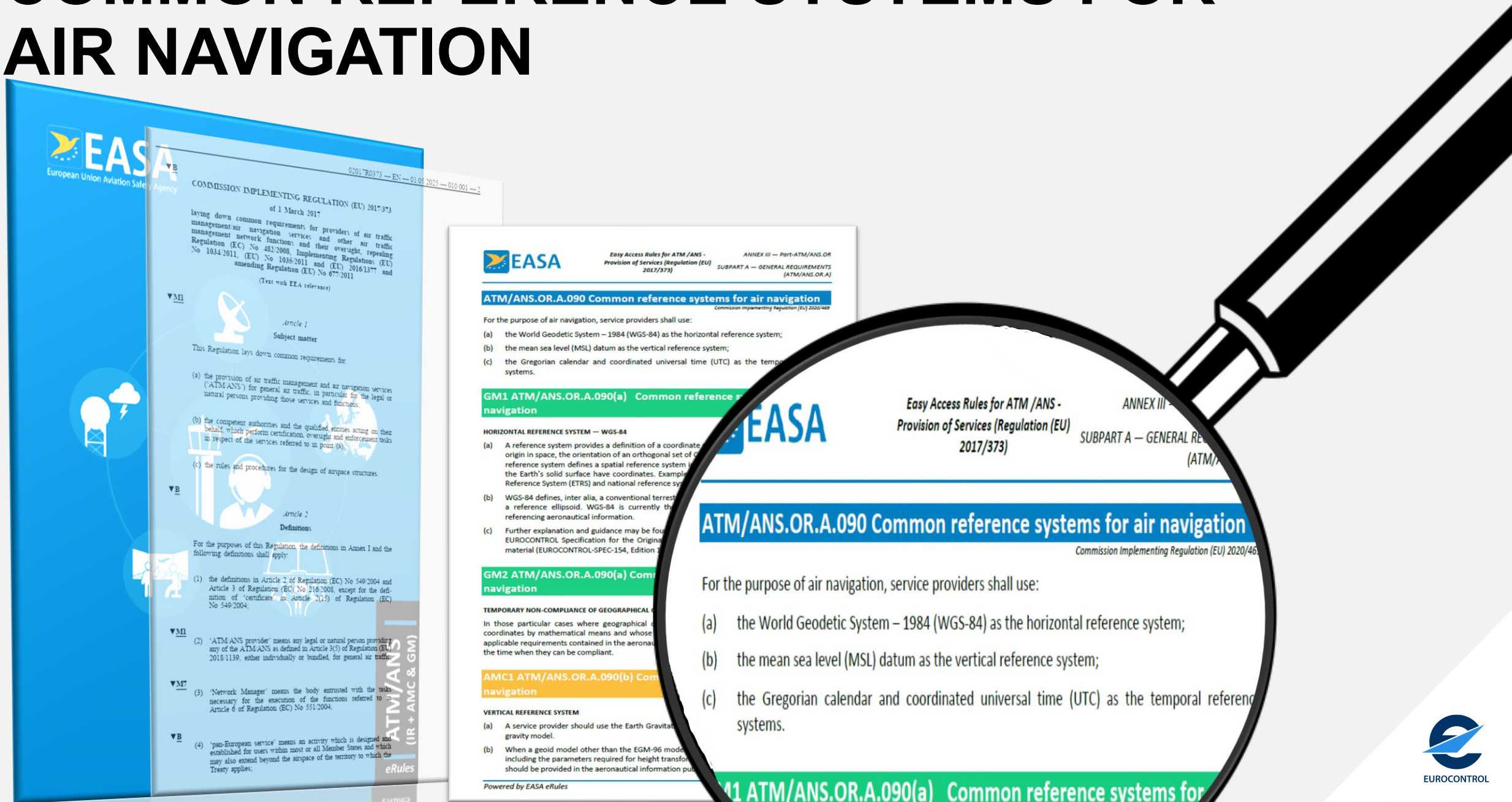


Aeronautical Information Services Manual
7th Edition, Amendment 1, available as of 30 July 2024

EUROCONTROL

THE EUROPEAN REGULATORY APPROACH

COMMON REFERENCE SYSTEMS FOR AIR NAVIGATION



EUROCONTROL

WEBINAR ON FUTURE REFERENCE FRAMES

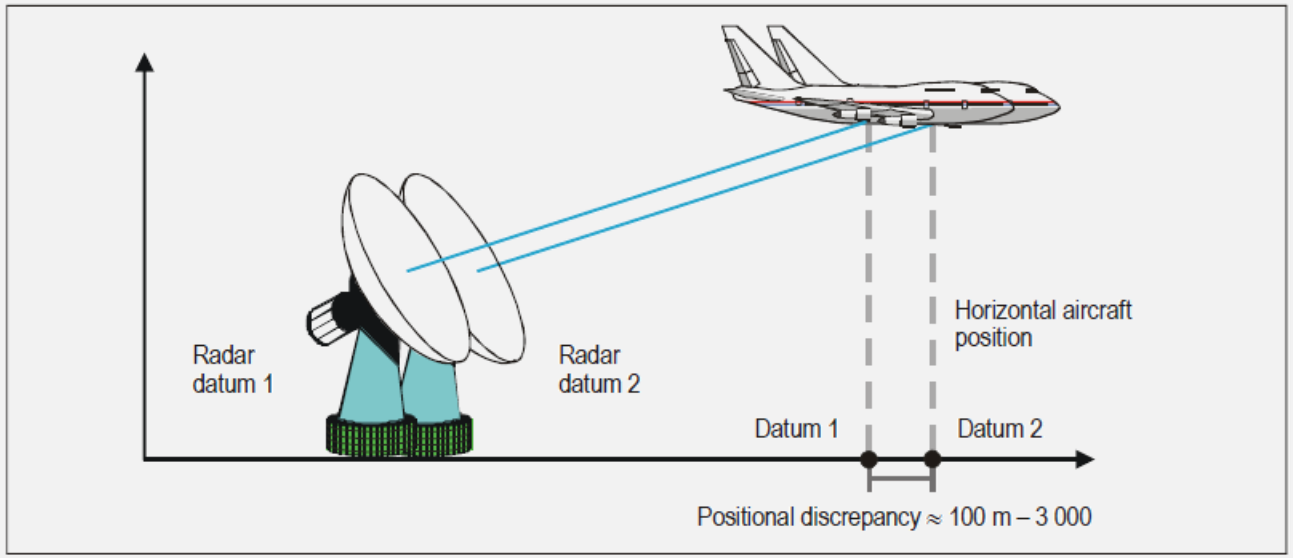
WGS84, ETRS89 AND MORE

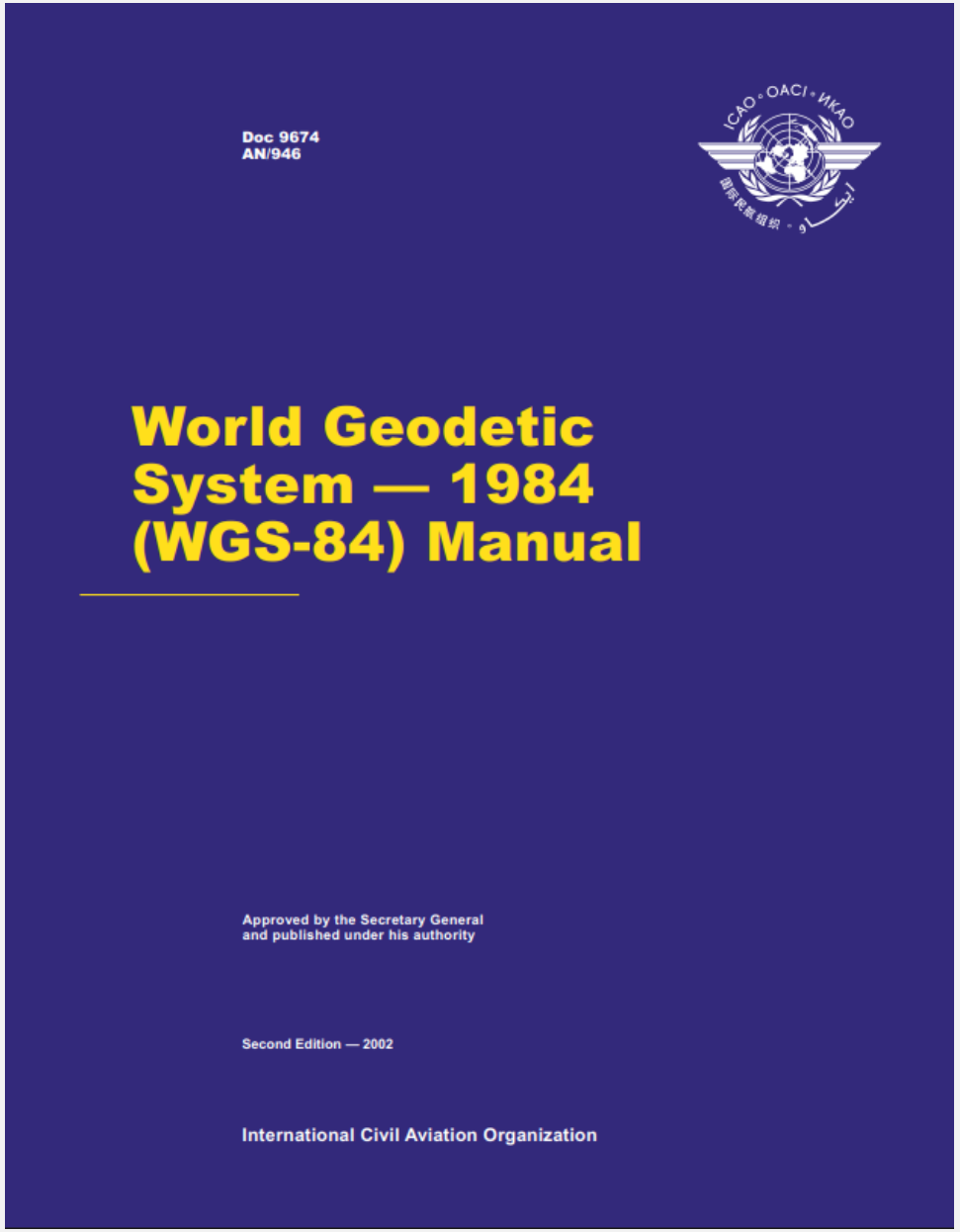
EUROCONTROL

WGS-84 MANUAL

ICAO Manual, but US driven

- Good transversal global applicability
- Potentially requires an update
- Does not cover the European specificities for surveying





EUROCONTROL

INSPIRE perspective

2.1.2.1 Horizontal Reference System

[DO-REF-010] The horizontal reference system for the publication of all coordinate data shall be the World Geodetic System-1984 (WGS-84).

Note(1): The latest updated WGS-84 (G1762) reference frame is based on epoch 2005.0. (G indicates that the coordinates were obtained through Global

2.1.2.1 Horizontal Reference System

[DO-REF-010] The horizontal reference system for the publication of all coordinate data shall be the World Geodetic System-1984 (WGS-84).

The Infrastructure for Spatial Information in Europe (INSPIRE) directive[4] requires that the European Terrestrial Reference System 1989 (ETRS89) *shall* be the datum used for spatial data sets. Within the geographical scope of ETRS89, the use of ETRS89 as the datum for the aviation domain should be considered for data storage and to transform data to ITRF for publication. For practical reasons associated with the densification of European Terrestrial Reference Frame 1989 (ETRF89), a survey relative to ETRF89 is often easier than to ITRF. Since appropriate transformations are available, the quality of the data is not expected to be impacted by this approach.

Note(3) The Infrastructure for Spatial Information in Europe (INSPIRE) directive[4] requires that the European Terrestrial Reference System 1989 (ETRS89) *shall* be the datum used for spatial data sets. Within the geographical scope of ETRS89, the use of ETRS89 as the datum for the aviation domain should be considered for data storage and to transform data to ITRF for publication. For practical reasons associated with the densification of European Terrestrial Reference Frame 1989 (ETRF89), a survey relative to ETRF89 is often easier than to ITRF. Since appropriate transformations are available, the quality of the data is not expected to be impacted by this approach.

https://www.eurocontrol.int/publication/eurocontrol-specification-origination-aeronautical-data-do

EUROCONTROL

CASE FOR TRACEABILITY: ETRS89 VS WGS-84 – SAME BUT DIFFERENT?

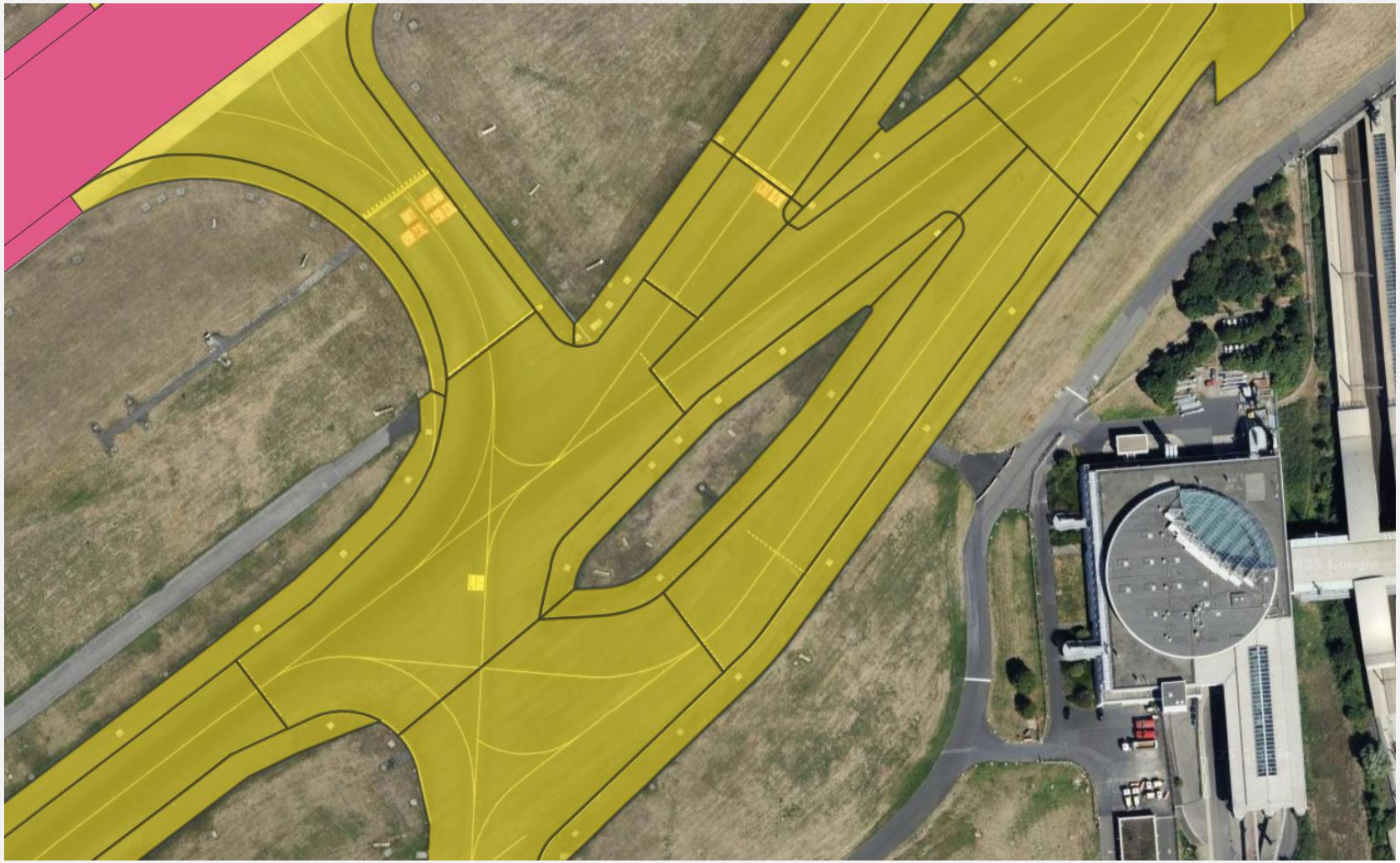
- Small discrepancies identified in the European AIS Database (EAD), caused by data providers loading ETRS89 native data using a WGS-84 EPSG code.
- Data surveyed locally in ETRS89, but uploaded “unde the disguise” of WGS-84, without proper transformation.
- Users’ expectation: what they see should be what they get — true WGS-84 coordinates.

```
<aixm:location>
  <aixm:ElevatedPoint srsName="urn:ogc:def:crs:EPSG::4326"
    gml:id="navelNONAME1">
    <gml:pos>52.368389 -32.375222</gml:pos>
    <aixm:horizontalAccuracy uom="M">3</aixm:horizontalAccuracy>
    <aixm:elevation uom="M">30.0</aixm:elevation>
    <aixm:verticalDatum>EGM_96</aixm:verticalDatum>
    <aixm:verticalAccuracy uom="M">30</aixm:verticalAccuracy>
  </aixm:ElevatedPoint>
</aixm:location>
```

EUROCONTROL

CASE FOR (RELATIVELY HIGH) ACCURACY – AERODROME MAPPING

- Aerodrome mapping is a product designed to visualize highly complex airport environments
- Support to the upcoming Digital NOTAM
- Accuracy requirements of 0.5 to 1 meter, ensuring that every element is correctly represented for reliable decision-making



Aerodrome mapping data (taxiway elements, part of runway) overlaying Google Maps imagery in EPSG:3857 Pseudo-Mercator projection

EUROCONTROL

SUPPORTING
EUROPEAN
AVIATION

Thank you!

boris.coric@eurocontrol.int
www.eurocontrol.int

CONSORTIUM COORDINATOR sesar DEPLOYMENT MANAGER
FOUNDING MEMBER sesar JOINT UNDERTAKING
NETWORK MANAGER