Obstacle Data Set (ICAO) - Austria

Automated multi data format generation with a single workflow

ATM/AIM
Robert Wehofer, Manager AIM/Static Data Management

Content

- Project „eTOD Austria“
- Obstacle Data Set Formats
- Production process
- Future developments

Project „eTOD Austria“

- National Project „eTOD Austria“
  - started in 2016
  - initiated by the Ministry responsible for Traffic affairs
  - Austrian Geodetic Institute (BEV) contracted with implementation
  - Goal: Regular assurance of obstacle data quality via airborne photogrammetry and laserscanning
  - Goal: Centralized obstacle database as collaboration tool
  - Procedure:
    - National authorities report obstacles
    - BEV regularly improves quality
    - Download by Austro Control for publication

Obstacle Data Set Formats

- First ICAO digital data set from Austria
  - eTOD Area 1 (ENR) obstacles already well progressed
  - Start of ODS publication: WEF 04 DEC 2020 (only Area 1)
  - Transition period: AIP ENR 5.4 still remains as it is
  - After transition period: AIP ENR 5.4 to be emptied
  - Three different data formats:
    - AIXM 5.1.1 (for automatic data imports)
    - Excel (for human interpretation)
    - KML (for visualization in Google Earth)
  - Test with external partners/data warehouses
  - Data product specification for all 3 formats

Obstacle Data Set Formats – AIXM

- AIXM 5.1.1 Format
  - International standard
  - Mapping between ICAO SARPS and AIXM 5.1.1 by Eurocontrol
  - AIXM 5.1.1 BASELINE file

Obstacle Data Set Formats – AIXM

```
<message:hasMember>
    <aixm:VerticalStructure gml:id="uuid.961a34ff-4f47-40b6-936a-82265138ffb1">
        <gml:identifier codeSpace="urn:uuid:">961a34ff-4f47-40b6-936a-82265138ffb1</gml:identifier>
        <aixm:timeSlice>
            <aixm:VerticalStructureTimeSlice gml:id="vs_ts_10593">
                <gml:validTime>
                    <gml:TimePeriod gml:id="vs_ts_vt_10593">
                        <gml:beginPosition>2017-12-08T00:00:00Z</gml:beginPosition>
                        <gml:endPosition>2020-09-11T00:00:00Z</gml:endPosition>
                    </gml:TimePeriod>
                </gml:validTime>
                <aixm:interpretation>BASELINE</aixm:interpretation>
                <aixm:sequenceNumber>3</aixm:sequenceNumber>
                <aixm:correctionNumber>1</aixm:correctionNumber>
                <aixm:featureLifetime>
                    <gml:TimePeriod gml:id="vs_ts_fl_10593">
                        <gml:beginPosition indeterminatePosition="unknown"/>
                        <gml:endPosition>2020-09-11T00:00:00Z</gml:endPosition>
                    </gml:TimePeriod>
                </aixm:featureLifetime>
                <aixm:name>20 KV LEITUNG SST. MARGARITZE GROHAG</aixm:name>
                <aixm:type>TRANSMISSION_LINE</aixm:type>
```

Obstacle Data Set Formats – Excel

- Excel Format
  - Proper format for human interpretation
  - Similar to the display of AIP ENR 5.4 with additional columns
  - Structured obstacle format, but not standardized
  - 5 Excel sheets:
    - Metadata
    - All obstacles
    - New obstacles
    - Changed obstacles
    - Deleted obstacles

Obstacle Data Set Formats – Excel

Bundesland	Standort	Art	Geometrie	Koordinaten	Koordinaten (Dezimalgrad)
Region	Location	Type	Geometry	Coordinates	Coordinates (decimal degrees)
Salzburg	"Radauerkurve" / Gaisberg,	Sendemast / Radio mast	Point / Punkt	47 48 42.0000N 013 04 52.0000E	47.8116666666667 13.0811111111111
Salzburg	10EUB Panorama Link, Wagrain	Seilbahn / Cableway	Curve / Linie	47 19 31.2000N 013 20 37.4000E	47.325333333 13.343722222
				47 19 28.2000N 013 20 37.6000E	47.3245 13.343777778
				47 19 13.2000N 013 20 38.2000E	47.320333333 13.343944444
				47 19 05.3000N 013 20 38.5000E	47.318138889 13.344027778
				47 19 01.5000N 013 20 38.7000E	47.317083333 13.344083333
				47 18 50.6000N 013 20 39.2000E	47.314055556 13.344222222
				47 18 48.5000N 013 20 39.3000E	47.313472222 13.34425
				47 18 41.3000N 013 20 39.6000E	47.311472222 13.344333333
				47 18 30.9000N 013 20 40.0000E	47.308583333 13.344444444
				47 18 25.6000N 013 20 40.3000E	47.307111111 13.344527778
				47 18 22.8000N 013 20 40.4000E	47.306333333 13.344555556
				47 18 17.9000N 013 20 40.6000E	47.304972222 13.344611111
				47 18 12.5000N 013 20 40.8000E	47.303472222 13.344666667
				47 18 02.8000N 013 20 41.2000E	47.300777778 13.344777778

Obstacle Data Set Formats – Excel

Koordinaten (Dezimalgrad) Coordinates (decimal degrees)	Vertikales Referenzsystem Vertical reference system	Maximale Höhe AMSL (M / FT) ELEV (M / FT)	Maximale Höhe AGL (M MAX HGT AGL (M / FT)	Tageskenn-zeichnung Day marking	Befeuert Lighted	Kennung Identifier
47.8116666666667 13.0811111111111	ADRIA	627 / 2057	33 / 108	ja / yes	nein / no	ea320764-4a36-4916-82fd-91687918df08
47.325333333 13.343722222	EVRS	1786 / 5860	32 / 105	nein / no	nein / no	5ada7f8c-1490-4a1e-8563-41fdb9029a2d
47.3245 13.343777778		1793 / 5883	106 / 348	nein / no	nein / no	
47.320333333 13.343944444		1829 / 6001	15 / 49	nein / no	nein / no	
47.318138889 13.344027778		1847 / 6060	18 / 59	nein / no	nein / no	
47.317083333 13.344083333		1856 / 6089	18 / 59	nein / no	nein / no	
47.314055556 13.344222222		1939 / 6362	17 / 56	nein / no	nein / no	
47.313472222 13.34425		1955 / 6414	22 / 72	nein / no	nein / no	
47.311472222 13.344333333		1970 / 6463	45 / 148	nein / no	nein / no	
47.308583333 13.344444444		1992 / 6535	26 / 85	nein / no	nein / no	
47.307111111 13.344527778		2002 / 6568	15 / 49	nein / no	nein / no	
47.306333333 13.344555556		2002 / 6568	21 / 69	nein / no	nein / no	
47.304972222 13.344611111		1983 / 6506	21 / 69	nein / no	nein / no	
47.303472222 13.344666667		1942 / 6371	56 / 184	nein / no	nein / no	
47.300777778 13.344777778		1862 / 6109				

Obstacle Data Set Formats – Excel

- Changed obstacles

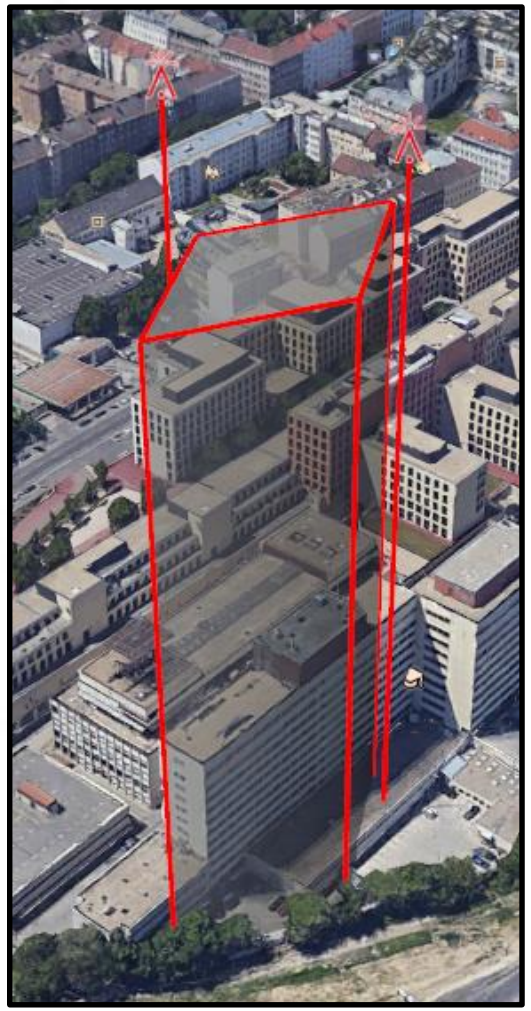
Bundesland Region	Standort Location	Art Type	Geometrie Geometry	Koordinaten Coordinates	Koordinaten (Dezimalgrad) Coordinates (decimal degrees)	Vertikales Referenzsystem Vertical reference system	Maximale Höhe AMSL ELEV (M / FT)	Maximale Höhe AGL (M / MAX HGT AGL (M / FT)	Tageskenn-zeichnung Day marking	Befeuert Lighted
Burgenland	Windpark Gattendorf Nord II	Windkraftanlage / Windpower plant	Point (grouped) / Punkt (gruppiert)	48 01 52.5900N 016 59 47.6100E	48.031275 16.996558333	EVRS	339 / 1112	203 / 666	ja / yes	ja / yes
				48 01 49.0400N 017 00 05.3800E	48.030288889 17.001494444		338 / 1110	203 / 666	ja / yes	ja / yes
				48 01 43.1700N 016 59 39.6300E	48.028658333 16.994341667		340 / 1115	203 / 666	ja / yes	ja / yes
				48 01 34.4500N 017 00 00.9100E	48.026236111 17.000252778		339 / 1113	203 / 666	ja / yes	ja / yes
Burgenland	Windpark Nikitsch II	Windkraftanlage / Windpower plant	Point (grouped) / Punkt (gruppiert)	47 33 33.8341N 016 40 07.5191E	47.559398361 16.668755306	EVRS	457 / 1499	190 / 623	ja / yes	ja / yes
				47 33 09.7799N 016 41 12.0817E	47.552716639 16.686689361		434 / 1424	190 / 623	ja / yes	ja / yes
Burgenland	Windpark Potzneusiedl Repowering II	Windkraftanlage / Windpower plant	Point (grouped) / Punkt (gruppiert)	48 02 44.1100N 016 54 47.8200E	48.045586111 16.913283333	EVRS	381 / 1251	199 / 651	ja / yes	ja / yes
				48 02 27.7600N 016 54 35.6200E	48.041044444 16.909894444		382 / 1252	199 / 651	ja / yes	ja / yes
				48 02 37.6800N 016 55 04.4100E	48.0438 16.917891667		381 / 1250	199 / 651	ja / yes	ja / yes
				48 02 26.5600N 016 54 55.1100E	48.040711111 16.915308333		381 / 1251	199 / 651	ja / yes	ja / yes
				48 02 23.0200N 016 55 17.1800E	48.039727778 16.921438889		380 / 1246	199 / 651	ja / yes	ja / yes
				48 02 09.2000N 016 55 03.5100E	48.035888889 16.917641667		379 / 1244	199 / 651	ja / yes	ja / yes
				48 02 06.5300N 016 55 31.9600E	48.035147222 16.925544444		379 / 1242	199 / 651	ja / yes	ja / yes
				48 01 56.8600N 016 55 22.6300E	48.032461111 16.922952778		378 / 1240	199 / 651	ja / yes	ja / yes
				48 01 50.5800N 016 55 42.6400E	48.030716667 16.928511111		377 / 1238	199 / 651	ja / yes	ja / yes
				48 01 50.2300N 016 56 00.2500E	48.030619444 16.933402778		372 / 1222	199 / 651	ja / yes	ja / yes
Niederösterreich	Windpark Japons Repowering	Windkraftanlage / Windpower plant	Point (grouped) / Punkt (gruppiert)	48 47 43.4500N 015 31 24.6200E	48.795402778 15.523505556	EVRS	766 / 2511	245 / 802	ja / yes	ja / yes
				48 47 27.4600N 015 31 22.1000E	48.790961111 15.522805556		783 / 2569	245 / 802	ja / yes	ja / yes
				48 46 59.2200N 015 31 07.3300E	48.783116667 15.518702778		781 / 2561	245 / 802	ja / yes	ja / yes

Obstacle Data Set Formats – KML

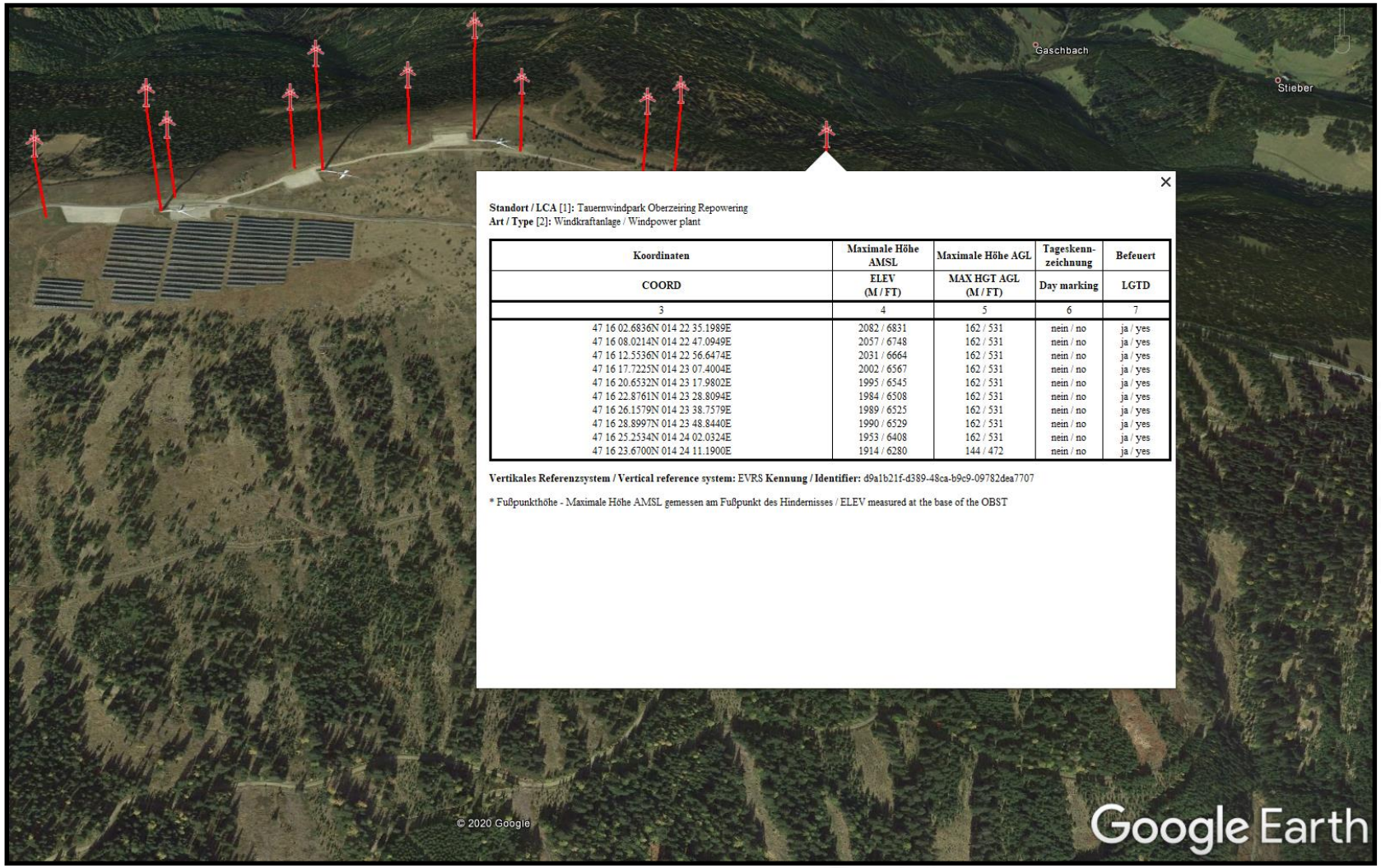
- KML
  - Easy to use
    - Google Earth, Google Earth Web
  - Visual representation of obstacle data
    - Can be used for plausibility checks
  - Small file size due to compressed KML (KMZ)
  - Intended to accompany the AIXM and Excel data set

Obstacle Data Set Formats – KML

- Examples for different geometry types in KML (point, line, polygon)



Obstacle Data Set Formats – KML



Standort / LCA [1]: Tauernwindpark Oberzeiring Repowering
Art / Type [2]: Windkraftanlage / Windpower plant

Koordinaten	Maximale Höhe AMSL	Maximale Höhe AGL	Tageskenn-zeichnung	Befeuert
COORD	ELEV (M / FT)	MAX HGT AGL (M / FT)	Day marking	LGTD
3	4	5	6	7
47 16 02.6836N 014 22 35.1989E	2082 / 6831	162 / 531	nein / no	ja / yes
47 16 08.0214N 014 22 47.0949E	2057 / 6748	162 / 531	nein / no	ja / yes
47 16 12.5536N 014 22 56.6474E	2031 / 6664	162 / 531	nein / no	ja / yes
47 16 17.7225N 014 23 07.4004E	2002 / 6567	162 / 531	nein / no	ja / yes
47 16 20.6532N 014 23 17.9802E	1995 / 6545	162 / 531	nein / no	ja / yes
47 16 22.8761N 014 23 28.8094E	1984 / 6508	162 / 531	nein / no	ja / yes
47 16 26.1579N 014 23 38.7579E	1989 / 6525	162 / 531	nein / no	ja / yes
47 16 28.8997N 014 23 48.8440E	1990 / 6529	162 / 531	nein / no	ja / yes
47 16 25.2534N 014 24 02.0324E	1953 / 6408	162 / 531	nein / no	ja / yes
47 16 23.6700N 014 24 11.1900E	1914 / 6280	144 / 472	nein / no	ja / yes

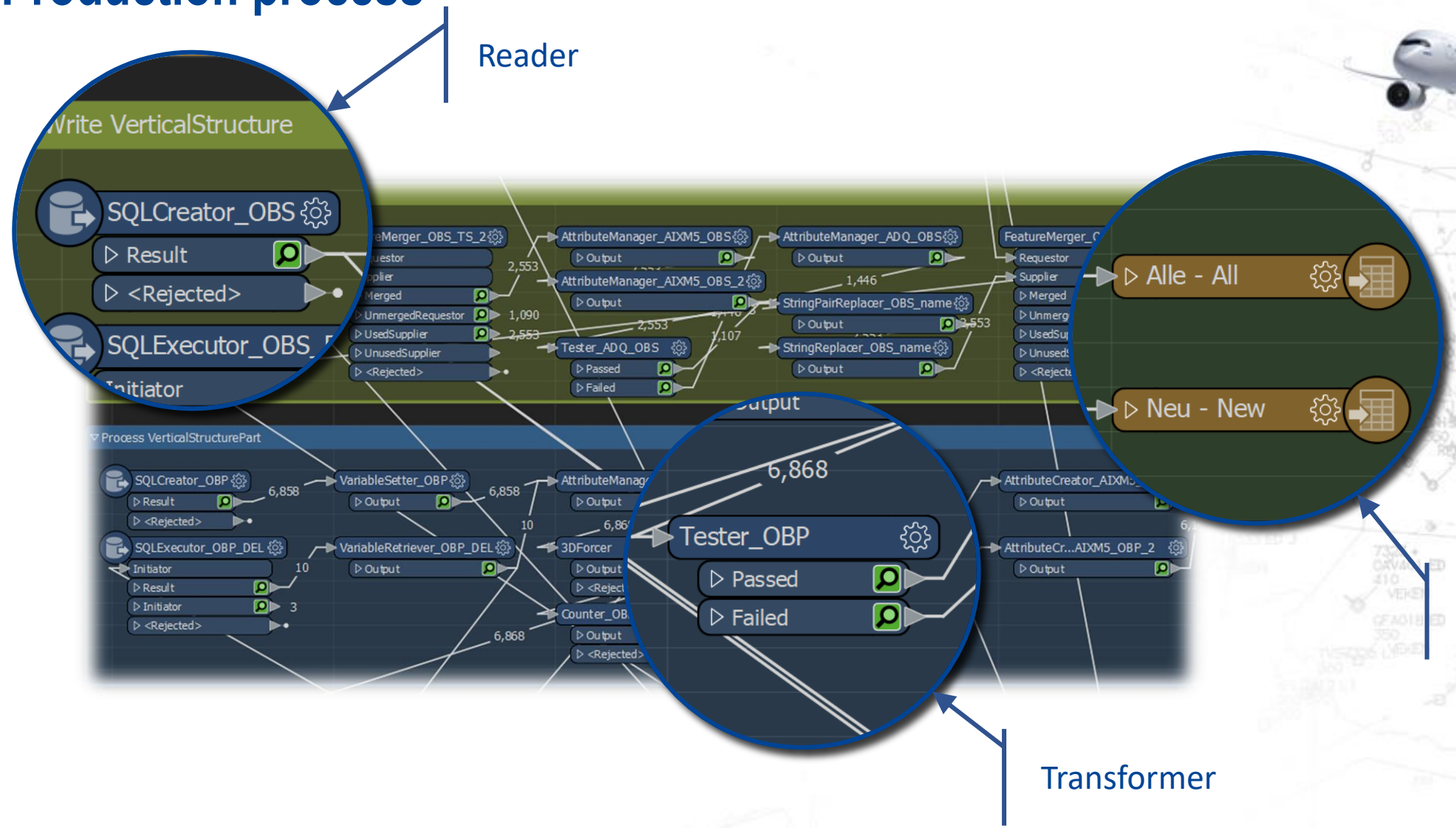
Vertikales Referenzsystem / Vertical reference system: EVRS **Kennung / Identifier:** d9a1b21f-d389-48ca-b9c9-09782dea7707

* Fußpunkthöhe - Maximale Höhe AMSL gemessen am Fußpunkt des Hindernisses / ELEV measured at the base of the OBST

Production process

- Automated multi-format generation
  - Software used: FME – Feature Manipulation Engine (www.safe.com)
    - Able to read and/or write over 450 different formats
    - including AIXM 4.5, AIXM 5.1(.1)
    - Can handle large amount of data
  - Single workflow to ensure data integrity
    - Data is loaded once
    - Then processed using integrated transformers
    - And exported into the 3 different formats
  - No additional processing or manual intervention required
    - Except the compression of the KML into a KMZ file

Production process



Future developments

- Obstacle Data Sets for Area 2
- AIP Data Sets (step by step)
- currently no plan for other types of digital data sets

Thank you for your attention!