



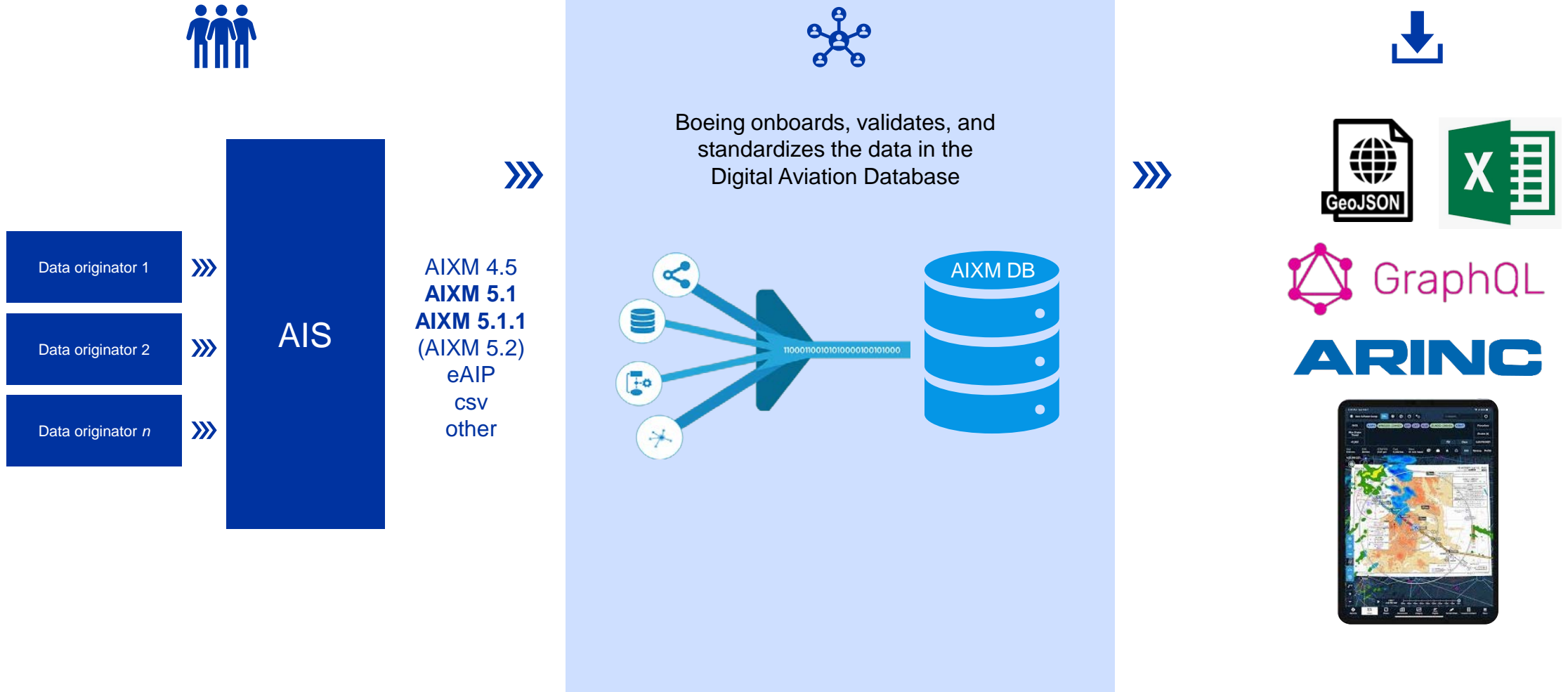
User Perspective on Digital Aviation Data

Boeing Research Project

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High Level Data Supply Chain



AIXM Data Validation – What We Check

Datasets from ANSPs

AIXM 4.5 | AIXM 5.1 | AIXM 5.1.1 | Other formats
AIP Datasets | Obstacle Datasets | IFP Datasets
Baseline | Snapshot | Permdelta | Tempdelta



Possible Data Validation Checks

- 1. AIXM Schema Validation**
Check for AIXM syntax
Usage of non-standard symbols (AIXM-specific pattern requirement)
Number of symbols of a string value
- 2. Missing Links Validation**
Check for references to non-existing features
- 3. AIXM Visualization for Geometry Correctness**
- NEW! 4. Import Issues Check**
Allows to identify the Import issues which can prevent data upload
UUID, UOM availability, wrong XML structure, etc.
- 5. Geometry Completeness Validation Report include all features with geometry**
Check for features with missing geo properties
- 6. AIXM Business Rules Validation filtered for rules relevant for Boeing**
Check for compliance with AIXM business rules
AIXM Model Business Rules
ICAO Annex 10, 11, 14, 15 Business Rules
FAA Business Rules
Customized, etc.



AIXM Data Validation – What We Find

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Examples of Findings

1. Import Issues Check

UOM not defined

Annotations for non-existing properties

2. AIXM Schema Validation

Usage of language specific symbols: [ÁÃÉÕçâé](#)

Value should contain no more than specific number of symbols (depending on value): 10, 16, 60 or other

Space characters in phone numbers: [\(0\) 4 77 60 49 87](#)

3. Missing Links Validation

Non-standard references, without using UUIDs

References to features of bordering countries

4. Geometry Completeness Validation

Incomplete geometry for some features: [AircraftStands](#)

No geometry at all for some critical features: [Airspaces](#)

5. AIXM Business Rules Validation

Elevation is in [FT](#) and vertical accuracy is in [M](#)

RouteSegment [WidthLeft](#) and [WidthRight](#) have different UOMs

No [lowerlimit](#) reference coded for Airspace

Missing accuracy of some values: [field elevation](#)



AIXM Data Validation – Example – 2023



Check of UAE AIP Dataset

AIXM Schema Validation

No AIXM schema violation identified



Missing Links Validation

No missing links identified



Geometry Completeness Validation

*16 feature types without geometry
(mostly related to features within aerodromes)*

AIXM Business Rules Validation

Business Rules are available, but UAE has not activated them for now

AIXM Data Validation – Example – 2024



Check of UAE AIP Dataset

AIXM Schema Validation

No AIXM schema violation identified



Missing Links Validation

No missing links identified



Geometry Completeness Validation

*18 out of 42 feature types with geometry
16 feature types partially without geometry (mostly belonging to aerodromes, which are under AMD dataset while AIP dataset was tested)
New geometries added to AircraftStands, Airspaces, VerticalStructures and more*

AIXM Business Rules Validation

*35 out of 1278 business rules affected
(more than 97% passed)*

Import Issues Check

7 out of 74 feature types affected

AIXM Data Validation – Example – 2024



Check of UAE AIP Dataset – Geometry Completeness Validation

Feature Type	January 2024		May 2023	
	Total Count	Without Geo	Total Count	Without Geo
Total	7889	1316	6748	1787
TaxiwayLightSystem	774	774	657	657
RunwayDirectionLightSystem	137	137	150	150
TaxiwayElement	129	129	140	140
RunwayProtectArea	85	85	83	83
ApronElement	82	82	82	82
ApproachLightingSystem	33	33	36	36
RunwayMarking	31	31	31	31
AircraftStand	672	13	576	576
RadioFrequencyArea	12	12	12	12
RunwayVisualRange	33	5	33	5
Navaid	24	5	24	5
RunwayProtectAreaLightSystem	5	5	not available	not available
RunwayCentrelinePoint	70	2	68	2
Airspace	136	1	128	4
TouchDownLiftOff	3	1	3	1
ArrestingGear	1	1	1	1
VerticalStructure	4807	0	4724	2
DesignatedPoint	743	0	not avbl previously in the report	
AirportHeliport	23	0	not avbl previously in the report	
DME	22	0	not avbl previously in the report	
AirportHotSpot	18	0	not avbl previously in the report	
Glidepath	17	0	not avbl previously in the report	
Localizer	17	0	not avbl previously in the report	
AeronauticalGroundLight	5	0	not avbl previously in the report	
VOR	5	0	not avbl previously in the report	
NDB	2	0	not avbl previously in the report	
RunwayElement	2	0	not avbl previously in the report	
CheckpointINS	1	0	not avbl previously in the report	

Check of Several AIP Datasets – Example: Business Rules Validation

1

Unit of measurement must be the same

```
<aixm:elevation uom="FT">6.0</aixm:elevation>  
<aixm:geoidUndulation uom="M">8.681</aixm:geoidUndulation>  
<aixm:verticalDatum>EGM_96</aixm:verticalDatum>  
<aixm:verticalAccuracy uom="M">1.0</aixm:verticalAccuracy>
```

2

No assigned Airspace lowerLimitReference value

```
<aixm:upperLimit uom="FT">2300.0</aixm:upperLimit>  
<aixm:upperLimitReference>MSL</aixm:upperLimitReference>  
<aixm:lowerLimit uom="FT">0.0</aixm:lowerLimit>  
</aixm:AirspaceVolume>
```


Check of Several AIP Datasets – Example: Business Rules Validation

3

RouteSegment Upper Limit should be greater than 0

```
<aixm:upperLimit uom="FT">0.0</aixm:upperLimit>  
<aixm:upperLimitReference>MSL</aixm:upperLimitReference>  
<aixm:lowerLimit uom="FT">0.0</aixm:lowerLimit>  
<aixm:lowerLimitReference>MSL</aixm:lowerLimitReference>
```

4

UOM not defined

Runway:

```
<aixm:nominalLength uom="M">20.0</aixm:nominalLength>  
<aixm:nominalWidth>20.0</aixm:nominalWidth>
```

VerticalStructure:

```
<aixm:verticalExtent>590.0</aixm:verticalExtent>
```

AIXM Data Validation – What We Need

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User Requirements and Recommendations

Close Collaboration with Data Providers

Early announcement of plans to transition to AIXM data format
Regular feedback on data testing and discussion about findings
Data issue clarifications
Communication in general



Additional Requirements in the Near Future

Certified data
Transparent data ownership
Web services provided by ANSP (e.g. SWIM, API)
Timelines



