

AIXM Status

ATIEC 2017

Presented by: D. Cowell (FAA) & E. Porosnicu (EUROCONTROL)

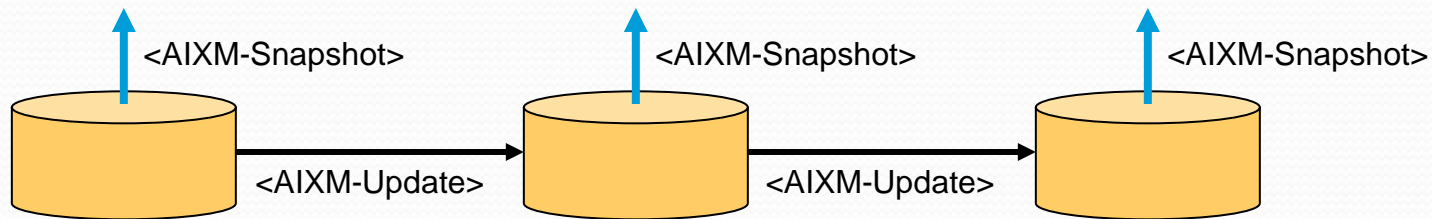


Content

- AIXM usage - current and future
- Interoperability
- Digital NOTAM

AIXM intended use

- **AIXM 2.1/3.3/4.5** - developed for the EAD (European AIS Database)



- **AIXM 5** – wider range of applications
 - See “White Paper” (public consultation in 2006)
 - http://www.aixm.aero/sites/aixm.aero/files/imce/AIXM50/aixm_5_proposal_20060620_whitepaper_.pdf
 - ground-ground data exchange
 - UML/XML + usage rules for specific use cases

AIXM use – current (October 2017)

- Data exchange in the European AIS Databased (EAD) context
 - National system to/from Regional system
- AIS data publication
 - Obstacles (growing number of States)
 - Airspace, Route, Airport, etc. data sets
 - ... mostly as side-effect of AIS automation, no ICAO requirements!
- Data exchange between AIS tools
 - Database to charting, AIP production, NOTAM, etc. tools
- Data origination
 - Procedure designer to AIS, etc.
- Local data provision to ATM systems
 - airspace, routes, points, etc.

AIXM use – new ICAO data sets

- Revised Annex 15
 - Digital data sets
 - AIP
 - Obstacles
 - Terrain
 - Airport Mapping
 - Instrument Procedures
- New PANS-AIM
 - More detailed requirements
 - Based on data catalogue
 - Subjects
 - Properties
 - Sub-properties
 - Types
 - Description, data quality...

Incentive : if the data set is provided,
no longer necessary to include the same data in the printed AIP!

Use of AIXM

- **AIP Data Set**
 - AIXM 5.1 Coding guidelines in development
 - Including data verification/validation rules
 - Including sample data set(s)
- **Airport Mapping Data Set**
 - ED-99A/DO-272A Mapping Guidelines for AIXM 5.1 available
<http://www.aixm.aero/sites/aixm.aero/files/imce/library/ed99atoaixm5.imappingvo.6.doc>
- **Obstacle Data Set**
 - AIXM 5.1 coding guidelines / data verification guidelines to be further developed (see eTOD Manual from EUROCONTROL)
- **Instrument Flight Procedures Data Set**
 - Will probably need AIXM 5.2 for complete coverage

AIP Data Set – harmonised coding rules

Pages 0

Overview

Created by EDUARD POROSNICU, last modified on 28 Jul 2017

The purpose of this Web site is to enable the AIXM community to collaboratively develop guidance material in support to the AIXM implementations and to provide information about such implementations. Three high-level areas of interest are identified: data sources, coding guidelines and extensions. In order to facilitate contributions from the global AIXM community, anonymous users are allowed to provide comments on certain sections of the Web site. Registered users have the possibility to make both inline and global comments and can also contribute to the development of the site.

www.aixm.aero/confluence


AIXM Data Sources



Presented as:

- map of the World
- list of sources

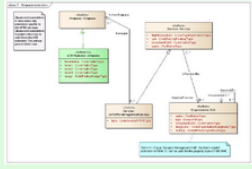
AIXM Coding Guidelines



Including:

- AIXM 5.1(1) Model Overview
- (ICAO) AIP Data Set
- Digital NOTAM

AIXM Extensions



Will be added progressively!

How to use

Structure

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Style and format aspects

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AIP Data Set – harmonised coding rules

- Mapping of the ICAO PANS-AIM AIP Data Set to AIXM 5.1(.1)
- AIXM 5.1(.1) coding rules for the AIP Data Set
- Interoperability rules for the AIP Data Set (including conformance testing)
- AIXM 5.1(.1) verification rules for the AIP Data Set
- Reference implementation - sample AIXM 5.1(.1) AIP Data Set (DONLON)

AIP Data Set verification rules

Identifier	Data Encoding Rule	Justification	Data Verification Rule (UID)	Remarks
DPN-107	If DesignatedPoint.type equal-to ('ICAO' , 'COORD' , 'OTHER') then there should not exists any other designated point with type of ('ICAO' , 'COORD' , 'OTHER') located within 1NM.	Data consistency	TBD	
DPN-108	If DesignatedPoint.type equal-to 'ICAO', then DesignatedPoint.designator should be unique world-wide.	ICAO Annex 11 [1]	AIXM-5.1_RULE-2CEC0	
DPN-109	The DesignatedPoint.location property is mandatory.	Minimum AIP data set	AIXM-5.1_RULE-1A3384	
DPN-110	The Point.horizontalAccuracy (or ElevatedPoint.horizontalAccuracy) attribute is mandatory.	Minimum AIP data set	TBD	
DPN-111	If coded, the value of the horizontalAccuracy for the DesignatedPoint used in the enroute environment (i.e is used as EnRouteSegmentPoint) shall be 100 M or less.	PANS-AIM	AIXM-5.1_RULE-EC542 (rule does not check the DesignatedPoint but the EnRouteSegmentPoint feature), AIXM-5.1_RULE-EC543 (rule checks 300FT which is not defined in PANS-AIM)	
DPN-112	Coordinates of DesignatedPoint used in the enroute environment (i.e is used as EnRouteSegmentPoint) shall be published with at least 4 decimals resolution.	PANS-AIM	AIXM-5.1_RULE-639C1, AIXM-5.1_RULE-EB1B9	PANS-AIM requires a publication resolution of 1 second, which can be achieved by minimum 4 decimal of a degree.
DPN-113	Coordinates of DesignatedPoint used in the terminal environment (i.e is used as TerminalSegmentPoint) shall be published with at least 5 decimals resolution.	PANS-AIM	AIXM-5.1_RULE-639C2, AIXM-5.1_RULE-1A8CE1	PANS-AIM requires a publication resolution of 1/10 second, which can be achieved by minimum 4 decimal of a degree.

AIP Data Set verification rules

- Conformance testing



Rule

The AIP Data Set shall comply with all the rules from the corresponding AIXM Business Rules - AIP Data Set Profile that are identified with an 'Error' level in case of non-compliance.



Recommendation

The AIP Data Set should comply with all the rules from the corresponding AIXM Business Rules - AIP Data Set Profile that are identified with an 'Warning' level in case of non-compliance.

... work in progress

- 2018 → Eurocontrol verification service for the AIP data set (proof of concept)

AIXM and interoperability

- “AIXM interoperability” issues
 - Raised initially by CANSO,
 - Also in the IFAIMA Congress 2017
 - Examples
 - Use of GML for aviation data - difficulties
 - Limited set of TimeSlices supported by different systems
 - Use of UUID not formally required
 - Lack of “mandatory attributes”
 - Lack of “mandatory business rules”
 - Lack of metadata profile
 - Etc.
- Action taken by the AIXM CCB
 - Set-up a dedicated working group (started in July 2016)
 - Document the issues & propose solutions

AIXM and Interoperability

- **Interoperability**

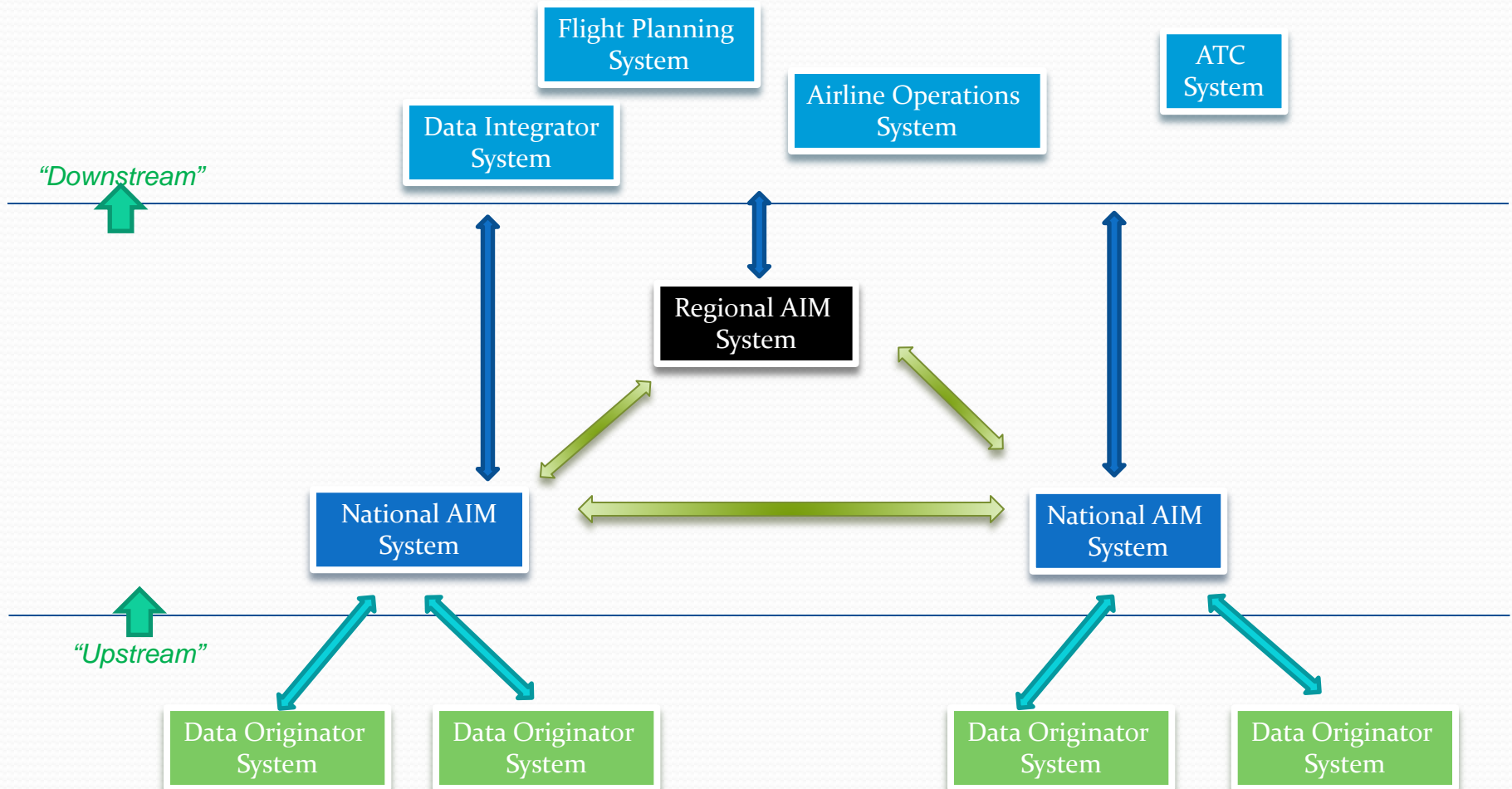
- *“a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, at present or future, in either implementation or access, without any restrictions”*

- *Source: Wikipedia*

- *“the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge.*

- *Source: (Draft) ICAO IMP SWIM Controlled Vocabulary*

AIM Systems Interoperability



AIXM and interoperability

- AIXM
 - Data coding format (XML Schema)
 - UML model – AIRM mapping (semantic interoperability)
 - Usage rules (temporality, feature identification and reference, coding guidelines, use of GML, etc.)
 - By design (explicit requirement for flexibility!), AIXM 5.x allows options on certain points (such as use of UUID)
 - **AIXM alone cannot ensure the interoperability!**
 - Partial implementations and non-coordinated use of the AIXM 5.x options can harm interoperability!
 - Solution: **Business Rules (SBVR)** & data set verification services

AIXM and interoperability

- Proposed **SOLUTION** : **Interoperability scenarios**
(AIXM use cases)

 ICAO Data Sets (downstream interoperability)

 AIM to Data Originator (upstream interoperability)

 Hub scenario (where applicable)

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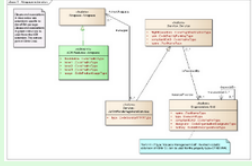
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Interoperability rules (proposed)

- AIXM version for AIP Data Set



Rule

An AIP Data Set shall be valid against the AIXM 5.1.1 BasicMessage XMLSchema (http://www.aixm.aero/schema/5.1.1/message/AIXM_BasicMessage.xsd).

- GML Profile



Rule

The Data Set shall comply with the GML limitations and usage rules stated in the OGC 12-028r1 ^[1] document.



Rule

The GML pointProperty element shall not be used, except when necessary:

- in order to encode references to places, as stated in chapter Chapter 10 of the OGC 12-028r1 ^[1] document;
- in order to provide an accuracy value for a Curve point that is different from the accuracy of the whole Curve;
- in order to provide an srsName for a Curve point that is different from the srsName of the whole Curve;



Recommendation

Sequences of more than two consecutive GML pos elements should not be used in the Data Set. The GML posList should be used instead.

Interoperability rules (proposed)

- Feature identification and reference

**Rule**

Each AIXM feature included in an AIP Data Sets shall have a non-empty gml:identifier.

**Rule**

The gml:identifier shall be a UUID value, as defined in the AIXM Feature Identification and Reference ^[1] document.

**Rule**

The UUID values shall be generated with a compliant Version 4 UUID.

**Rule**

Abstract references (by gml:identifier), as defined in the ^[1] document, shall be used whenever the target record is not contained in the same data set.

**Rule**

Either abstract references (by gml:identifier) or internal references (by gml:id), as defined in the ^[1] document, shall be used whenever the target record is contained in the same data set.

Interoperability rules (proposed)

- Use of extensions

i **Permission**

An AIP Data Set may include extension of the core model, on condition that:

✓ **Rule**

The Data Set shall remain valid against one of the AIXM BasicMessage schema mentioned.

✓ **Rule**

The extension schema shall be made available through a public URL.

✓ **Rule**

A document explaining the purpose of the extension and the usage of each extension element shall be made available to all recipients of the data set.

i **Recommendation**

The UML representation of the extension should be made available to all the recipients of the data set.

Interoperability rules (proposed)

- Common ICAO data subset

✓ **Rule**

An AIP Data Set shall not re-define locally the data features declared in the Common ICAO AIP Data Subset, available at:

http://www.aixm.aero/dataset/5.1.1/aixm_5_1_1_icao_common_data_subset.xml

! **Open issue**

What should be the `validTime.BeginPosition` and the `featureLifetime.BeginPosition` for the features included in the common ICAO AIP data set?

One proposal is to omit the `featureLifetime` for all the features included in the data set.

`validTime.BeginPosition` could be Nov 2018, as no AIP Data Sets would not be published before. Alternatively, the individual features could have a start of validity long time in the past as the data subset itself would be valid from the date of publication. That would ensure that references from legacy data are also covered in the past.

✓ **Rule**

An AIP Data Set shall use abstract references (as defined in section 3.4 of the AIXM Feature Identification and Reference [1]) in order to encode associations with features contained in the Common ICAO AIP Data Subset.

i **Permission**

An AIP Data Set may include the Common ICAO AIP Data Subset using the following XML include statement:

```
<xi:include href="http://www.aixm.aero/dataset/5.1.1/aixm_5_1_1_icao_common_data_subset.xml" parse="xml" xmlns:xi="http://www.w3.org/2001/XInclude" />
```

Additional issues

- For example, FIR/UIR boundaries...

BRUSSELS FIR

Lateral limits	510521N 0023244E - 510700N 0020000E - 513000N 0020000E - 512223N 0032147E - along the <u>Belgian-Dutch border</u> - 504515N 0060116E - along the <u>Belgian-German border</u> - 500748N 0060816E - along the <u>German-Luxembourg border</u> - 492810N 0062202E - along the <u>French-Luxembourg border</u> - 493247N 0054907E - along the <u>Belgian-French border</u> - 510521N 0023244E.
Vertical limits	



Revised ICAO Annex 15
and PANS-AIM

AIP Data Set

```
<?xml version="1.0" encoding="UTF-8"?><message:AIXBASICMessage xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:messa
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:html="http://www.w3.org/1999/xhtml" gml:id="uniqueId" xsi:s
http://www.aixm.aero/schema/5.1/extensions/EUR/ADR http://www.aixm.aero/schema/5.1/extensions/EUR/ADR18.5/AD
gml:id="uuid.d6ae921c-9daf-4475-8853-f083be9a8ala"><gml:identifier codeSpace="urn:uuid:">d6ae921c-9daf-4475-
gml:id="uuid.fbc8c2d5-8577-40fb-a761-32ae22612ce5"><gml:validTime xlink:type="simple"><gml:TimePeriod gml:id
indeterminatePosition="unknown"/></gml:TimePeriod></gml:validTime><aixm:interpretation>BASELINE</aixm:interp
xlink:type="simple"><gml:TimePeriod gml:id="uuid.b306d310-6581-4c56-96d3-8a735d697189"><gml:beginPosition>20
indeterminatePosition="unknown"/></gml:TimePeriod></aixm:featureLifetime><aixm:type>R</aixm:type><aixm:desig
ryComponent gml:id="uuid.20964f31-505c-4e2e-a6e7-6f0efc4fea73"><aixm:theAirspaceVolume><aixm:AirspaceVolume
uom="FT">3000</aixm:lowerLimit><aixm:lowerLimitReference>MSL</aixm:lowerLimitReference><aixm:horizontalProje
interpolation="planar"><gml:exterior><gml:Ring><gml:curveMember xlink:type="simple"><gml:Curve xsi:type="aix
xlink:type="simple"><gml:Point xsi:type="aixm:PointType" srsName="urn:ogc:def:crs:EPSG::4326" gml:id="uuid.2
xlink:type="simple"><gml:Point xsi:type="aixm:PointType" srsName="urn:ogc:def:crs:EPSG::4326" gml:id="uuid.5
interpolation="geodesic"><gml:pointProperty xlink:type="simple"><gml:Point xsi:type="aixm:PointType" srsName
137.18389</gml:pos></gml:Point></gml:pointProperty><gml:pointProperty xlink:type="simple"><gml:Point xsi:typ
137.29944</gml:pos></gml:Point></gml:pointProperty></gml:Geodesic><gml:Geodesic interpolation="geodesic"><gml
```

Up to 10 000
points for
some FIR!
... Unusable
for downstream
operations

... no reference to State boundary
... degree/minute resolution

51.07056 35.27611
51.05417 35.27333
51.05417 35.27333
51.05444 35.25722
51.05444 35.25722
51.06417 35.25278
51.06417 35.25278
51.04583 35.22222
51.04583 35.22222
51.05389 35.21278
51.05389 35.21278
51.05306 35.19056
51.05306 35.19056
51.07889 35.17111
51.07889 35.17111
51.08167 35.15083
51.08167 35.15083
51.08889 35.17222
51.08889 35.17222
51.10167 35.16639
51.10167 35.16639
51.10194 35.16139
51.10194 35.16139
51.11111 35.15861
51.11111 35.15861
51.12278 35.17556
51.12278 35.17556
51.1475 35.13278
51.1475 35.13278
51.18 35.13222
51.18 35.13222
51.22556 35.15389
51.22556 35.15389
51.23194 35.07417
51.23194 35.07417
51.20611 35.04083
51.20611 35.04083
51.22 35.03389
51.22 35.03389
51.23306 34.97694
51.23306 34.97694



Digital NOTAM

Digitally enhanced briefing

- SESAR Project 13.2.2

- Overview
- Aerodromes
- DEP : KJFK
- Airport**
- TMA
- MET
- ARR : LOWW
- Alternate
- Emergency
- En-Route
- Settings
- Flight Plans



Time filter: 16-01-28 14:00 to 16-01-28 16:00 Edit

<input checked="" type="checkbox"/>	1 TWY Closure	16Jan18 14:00 to 16Jan28 23:00	A0296/16
	TWY JB, JA, Y between RWY 13R/31L and TWY J closed		
<input checked="" type="checkbox"/>	2 TWY Closure	16Jan18 14:00 to 16Jan28 23:00	A0296/16
	TWY H between TWY Y and TWY Z closed		
<input checked="" type="checkbox"/>	3 TWY Closure	16Jan18 14:00 to 16Jan28 23:00	A0296/16
	TWY NB closed to Southbound turns to TWY A		
<input checked="" type="checkbox"/>	4 TWY Closure	16Jan18 14:00 to 16Jan28 23:00	A0294/16
	TWY Y between TWY J and TWY H closed		
<input checked="" type="checkbox"/>	5 OTHER	15Dec30 17:35 to 16Dec31 17:35	A9408/14
	RWY 22R PAPI beyond 8 deg right of rcl unusable		
<input checked="" type="checkbox"/>	6 OTHER	15May05 20:10 to 99Dec31 00:00	A4415/14
	RWY 22L engineered materials arresting system not STD		
<input checked="" type="checkbox"/>	7 OTHER	16Jan17 23:45 to 16Jan29 23:15	A0286/14
	RWY 13R/31R wet deiced liquid and deiced solid observed at 1601172149		
<input checked="" type="checkbox"/>	8 OTHER	15Nov05 05:25 to 16Jan29 22:00	A8166/14
	RWY 22R PAPI commissioned		
<input checked="" type="checkbox"/>	9 OTHER	15Dec02 17:00 to 16Apr01 17:00	A8773/14
	Runway status lights (rws) are in an operational test and must be complied with. Runway status lights are red in-pavement lights that serve as warning lights on runways and taxiways indicating that it is unsafe to enter, cross, or begin takeoff on a runway. Note: runway status lights indicate runway status only. They do not indicate clearance. Pilots and vehicle operators must still receive a clearance from air traffic control before proceeding. For additional information visit: http://www.Faa.Gov/air?Traffic/technology/rws		
<input checked="" type="checkbox"/>	10 OTHER	16Jan17 23:22 to 16Jan29 23:15	A0281/14
	RWY 13R/31L wet deiced liquid and deiced solid observed at 1601172122.		
<input checked="" type="checkbox"/>	11 OTHER	16Jan17 23:15 to 16Jan29 23:15	A0280/14
	RWY 04R/22L wet deiced liquid and deiced solid observed at 1601172115.		
<input checked="" type="checkbox"/>	12 OTHER	16Jan17 23:45 to 16Jan29 23:15	A0284/14
	RWY 04L/22R wet deiced liquid and deiced solid observed at 1601172145		
<input checked="" type="checkbox"/>	13 RWY Closure	16Jan22 05:10 to 16Feb13 14:00	A1388/16
	RWY 13L/31R closed		

Key enabler - Digital NOTAM

- Identify types of “events” for which the information is currently provided through NOTAM
 - Example: runway closed, navaid u/s, new obstacle, etc.
- Provide the AIXM encoding rules for each type of event
 - Including data verification
- ... also, support the automatic generation of NOTAM messages (as long as necessary)

Digital NOTAM Specification

- Version 2.0 – work in progress

<i>scenarios</i>	<i>scenarios</i>
•Published special activity area – activation	•Displaced threshold
•Published ATS airspace - activation or deactivation	•Declared distances changes
•Ad-hoc special activity area – creation	•Runway portion closure
•Ad-hoc ATS airspace – creation	•Airport Usage limitation
•Route portion closure	•Runway usage limitation
•Route portion opening	•Taxiway usage limitation
•Aerodrome closure	•Approach lights unserviceable
•Runway closure	•Approach lights downgraded
•Navaid unserviceable	•Runway lights unserviceable
•New obstacle	•Obstacle lights unserviceable
•Taxiway closure	•Visual Approach slope indicator unserviceable
•Surface contamination (SNOWTAM)	•Taxiway lights unserviceable
•Other Event (any other situation that does not have a dedicated scenario)	

Conclusions

- Revised ICAO Annex 15 and PANS-AIM
- Digital data sets (AIP, obstacles, IFP, ...)
 - AIXM 5.1 as coding format (proposed)
 - Harmonised coding rules in support to interoperability objective
 - AIXM 5.2 will improve the coding, in particular for IFP
- Digital NOTAM – version 2.0
 - additional scenarios,
 - alignment with the ICAO data sets

