



ICAO DAKAR UNITING AVIATION

# Avitech GmbH AIXM Capabilities & Experiences

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*Regional Sales Director*

Dakar/04. October 2016





## Avitech – Introduction

- Avitech GmbH of Germany, is a key piece in Indra ATM being the unique provider of Aeronautical Information Management (AIM), Message Handling, Communications (ATC MHS) and Tower Information and control solutions
- SW and HW Products, Turnkey Systems and Services, Maintenance Support, Training.
- More than 40 years of experience in Aviation Industry.
- Experience in AIM civil and military projects at national and international level



## Avitech's experiences with the implementation of the AIXM

- The AIXM Model & the Quality of the Data
- The Processes
- The people



From the overall air transportation information scope, the AIXM scope is roughly focused the ICAO Annex 15 – AIP content or information to be provided by the States.  
AIXM:

„Data necessary for the safety, regularity and efficiency of the international air navigation“;

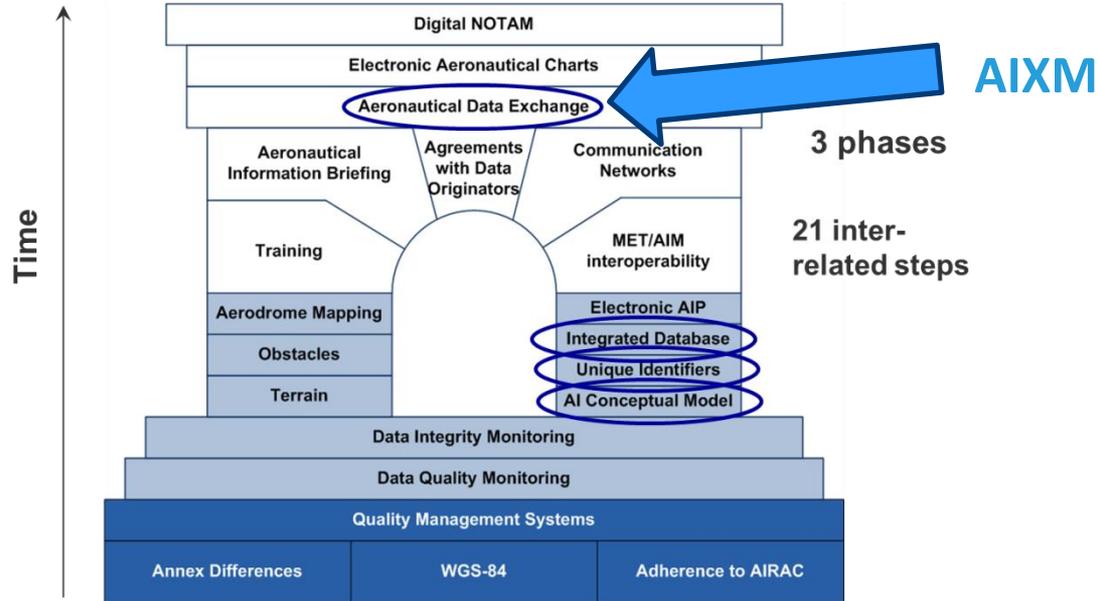
Beyond the requirements of ICAO Annex 15 – it takes into account existing industry standards

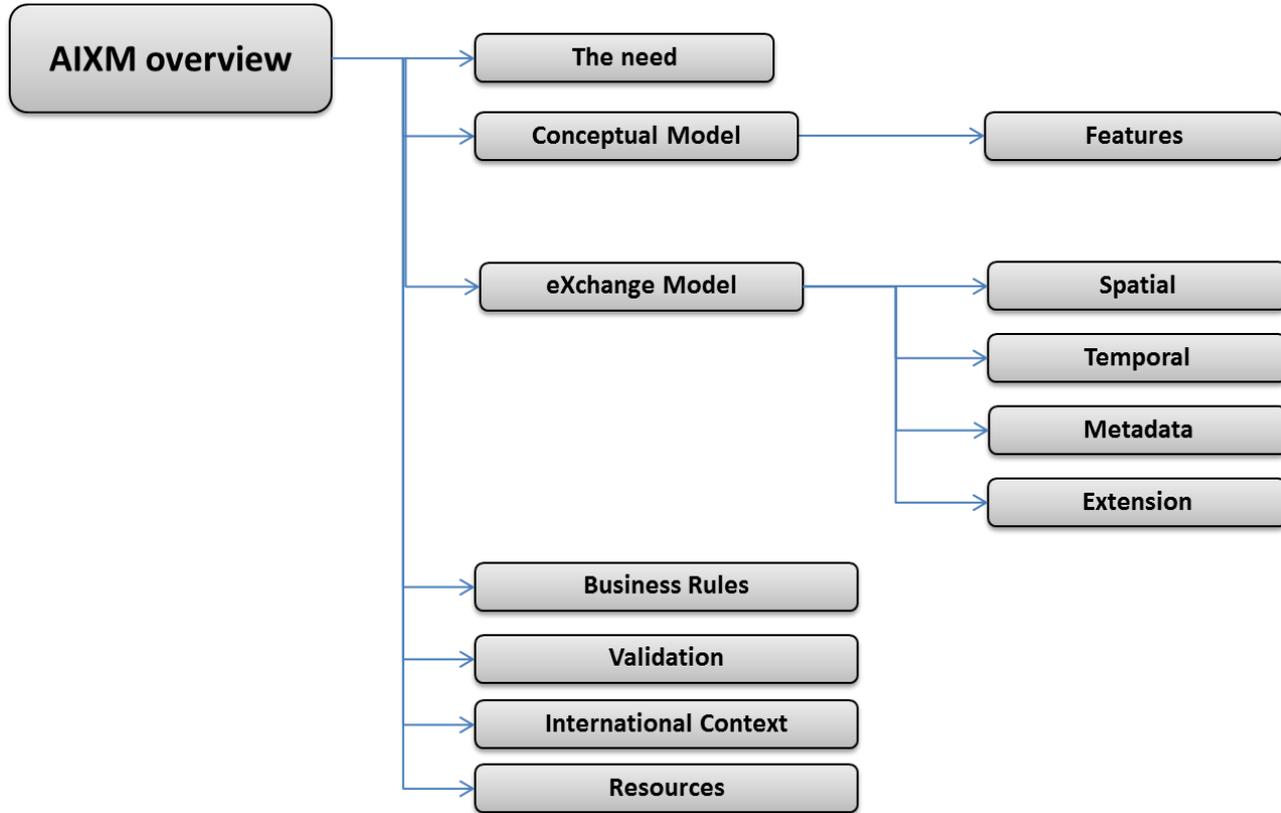


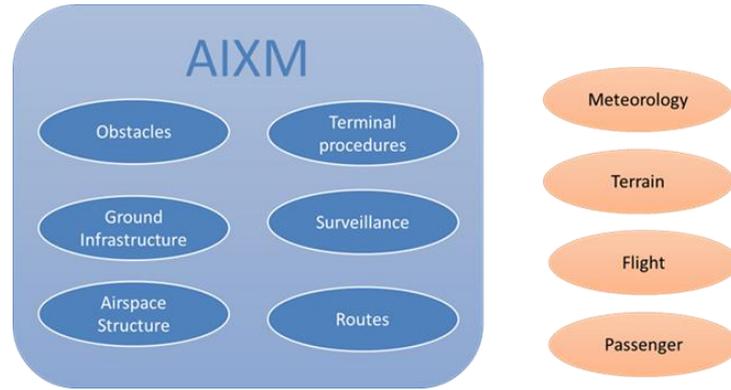
In order to enhance interoperability and allow for system-to-system communication a **commonly used standard format** for the exchange of aeronautical information needed to be developed.

Therefore, the following were introduced:

- aeronautical information logical model  
→ Conceptual Model (UML)
- data exchange format  
→ Aeronautical Information eXchange Model (AIXM)







## AIXM

The Conceptual Model describes the various entities, their attributes, roles, and relationships, plus the constraints that govern the domain.

The Conceptual Model is specified using a subset of Unified Modelling Language (UML).



## Two main distribution concepts of Aeronautical data:

- AIP
- NOTAM



Q) EGTG/QRMCA/IV/BO /W /000/022/5253N00124E001  
A) EGTG B) 1105231315 C) 1108202359  
E) AIR DEFENCE RADAR SITE ACTIVE CENTRED ON 5253N 00124E  
(TRIMINGHAM). PILOTS OF ACFT ARE REQUESTED TO AVOID  
OVERFLIGHT OF THE  
DATUM BY 1NM. CTC 01692 633352  
11-03-0379/AS 3  
F) SFC G) 2200FT AMSL

H1908/11 NOTAMN

AIXM is able to communicate both

- permanent changes, such as those that occur at AIRAC cycles and
- temporary situations, typically promulgated through NOTAM

The AIXM temporality model is based on the GML “**Timeslice**” concept with some specific adoptions

ISO 19108 (Geographic information - Temporal schema) defines the standard concepts needed to describe the temporal characteristics of geographic information.



## Semantics of Business Vocabulary and Business Rules (SBVR)

- formal and detailed natural language declarative description for complex rules
- rules can be interpreted and used by computer systems

Examples:

“Each **AirportHeliport** shall *have* exactly one name”

“A **Runway** shall not *be situated at* **AirportHeliport** with **type=‘HP’**”

Where possible Schematron code is provided for each of the AIXM Business Rules

- rule-based validation language expressed in XML
- ISO Standard



## ICAO

- Global AIR Navigation Plan (GANP), DOC 9750  
Aviation System Block Upgrades (ASBU)  
Globally Interoperable Systems and Data  
AIS to AIM Roadmap, SWIM

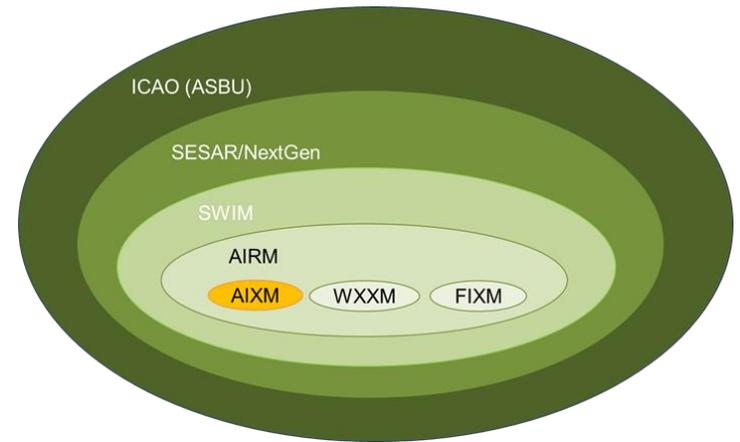
## SESAR/ EUROCONTROL

- EUROCONTROL  
CS 5 European ATM Information  
management Service (EAIMS)

## European Commission / EASA

- COMMISSION REGULATION (EU) No 73/2010  
Aeronautical Data Quality Requirements for Data Specification &  
Exchange

*Note: AIXM 5.1 is a Means of Compliance but that does not mean it is the only one.*





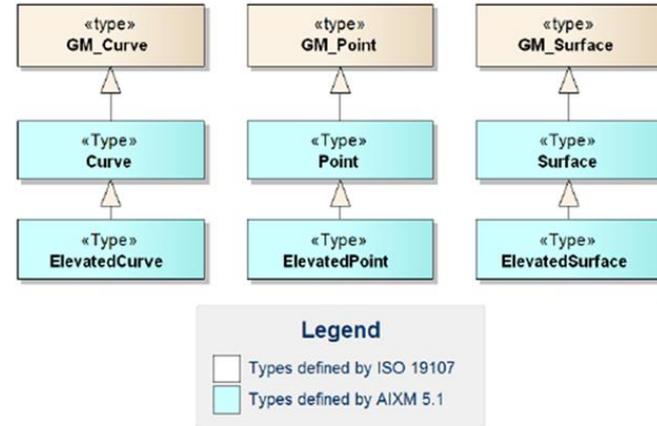
The geographic part of the Exchange Model is specified using the Geography Markup Language (GML) version 3.2.1 - XML grammar for exchanging geographical features.

AIXM 5 uses 2.5D geometry model. 3D geometries are represented as 2D projections with additional AIXM feature properties specifying the vertical dimension.

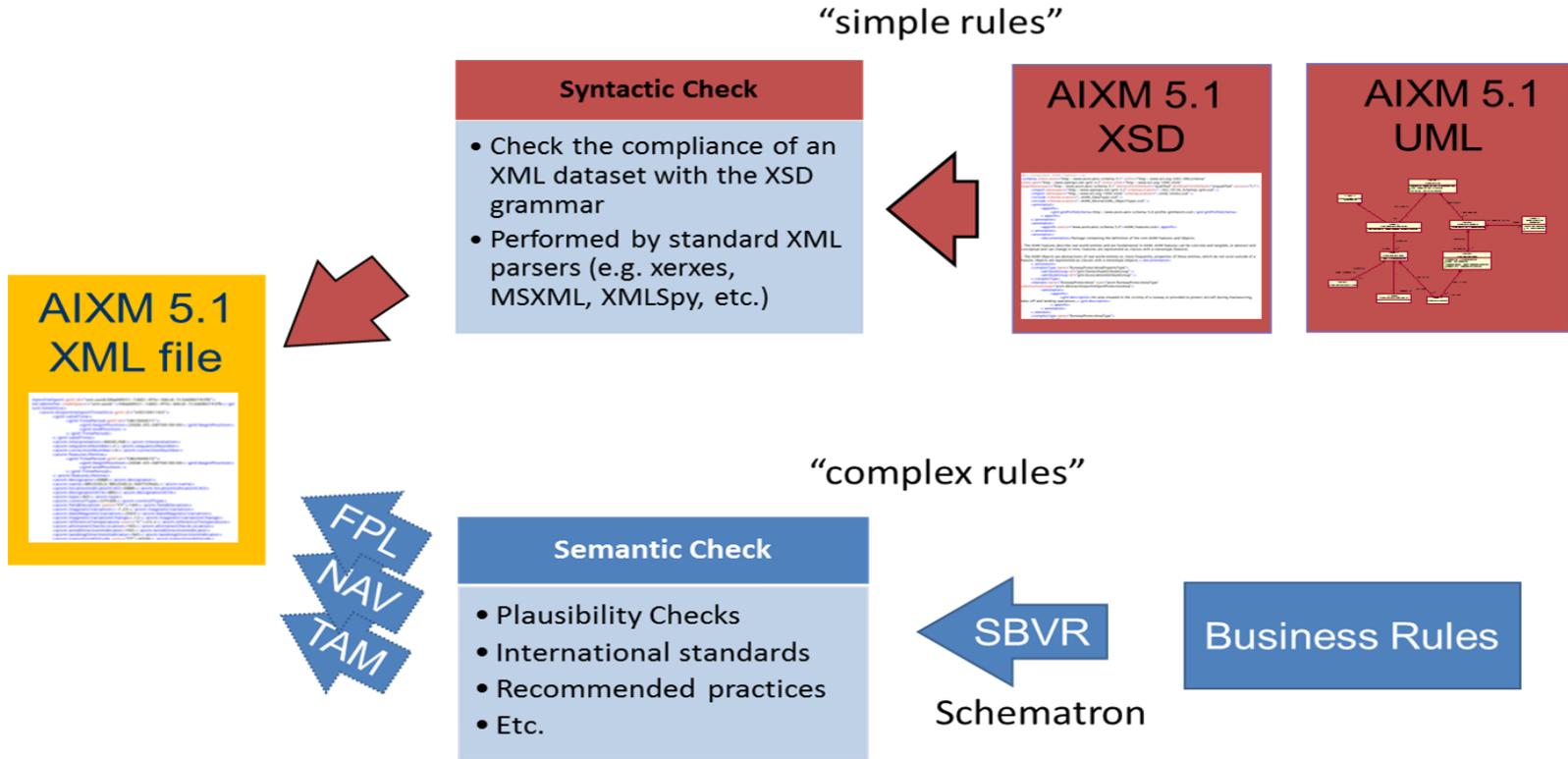
AIXM provides:

- Point and Elevated Point
- Curve and Elevated Curve
- Surface and Elevated Surface

For all geometries a Coordinate Reference System (CRS) must be specified. Recommended by ICAO is WGS84 (EPSG: 4326)

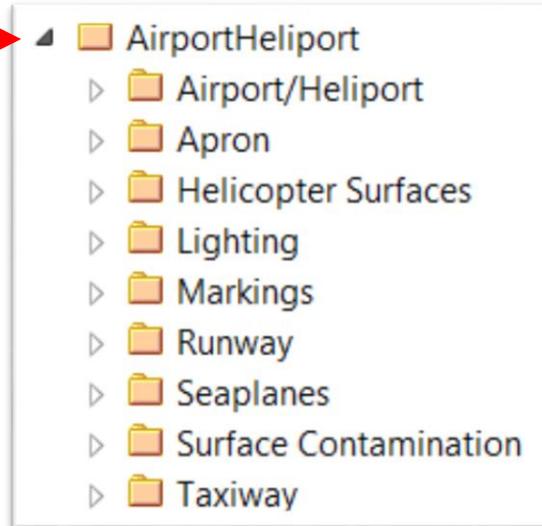
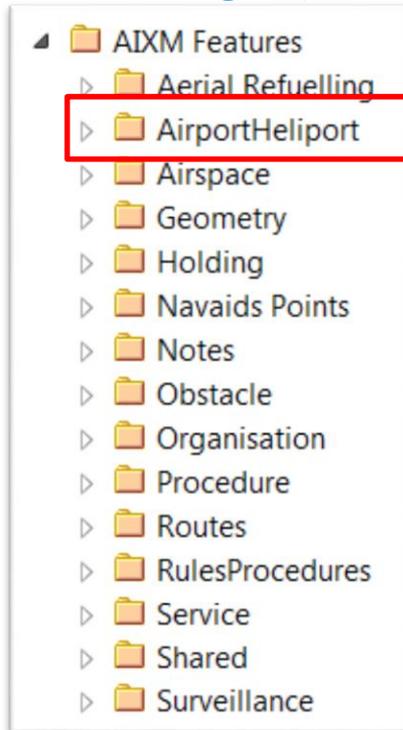


*Note: The ISO 19107 spatial schema, which is implemented by GML, is very complex. It contains an extensive list of geometries, geometric properties and operations – many of which are not necessary for aeronautical information applications. In addition, the ISO 19107 contains an exhaustive 3D geometry model that is probably not needed in its entirety for AIXM either. Therefore, work is being done to define a GML profile for AIXM.*





There are 15 Main Packages (“Conceptual Areas”) which may have several sub packages



- *Features*
- *Properties*
- *Attributes*
- *Data Types*
- *Relationship:*
  - *to objects*
  - *to Features*
- *Naming*



## The AIXM Data Exchange Format is an implementation of the AIXM Conceptual Model as an XML (Extensible Markup Language) schema.

```
<!-- Component: AIXM: Features -->
<schema xmlns:aixm="http://www.aixm.aero/schema/5.1" xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:xlink="http://www.w3.org/1999/xlink"
targetNamespace="http://www.aixm.aero/schema/5.1" elementFormDefault="qualified" attributeFormDefault="unqualified" version="5.1">
  <import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://www.aixm.aero/schema/5.1/ISO_19136_Schemas/gml.xsd"/>
  <import namespace="http://www.w3.org/1999/xlink" schemaLocation="http://www.w3.org/1999/xlink/xlinks.xsd"/>
  <include schemaLocation="http://www.aixm.aero/schema/5.1/AIXM_DataTypes.xsd"/>
  <include schemaLocation="http://www.aixm.aero/schema/5.1/AIXM_AbstractGML_ObjectTypes.xsd"/>
  <annotation>
    <appinfo>
      <gml:gmlProfileSchema>http://www.aixm.aero/schema/5.0/profile/gml4aixm.xsd</gml:gmlProfileSchema>
    </appinfo>
  </annotation>
  <annotation>
    <appinfo source="http://www.aixm.aero/schema/5.0">AIXM_Features.xsd</appinfo>
  </annotation>
  <annotation>
    <documentation>Package containing the definition of the core AIXM Features and Objects.
  </documentation>
  </annotation>
  <complexType name="RunwayProtectAreaPropertyType">
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <element name="RunwayProtectArea" type="aixm:RunwayProtectAreaType"
substitutionGroup="aixm:AbstractAirportHeliportProtectionArea">
    <annotation>
      <appinfo>
        <gml:description>An area situated in the vicinity of a runway or provided to protect aircraft during manoeuvring,
take-off and landing operations.</gml:description>
      </appinfo>
    </annotation>
  </element>
</complexType name="RunwayProtectAreaType">
```

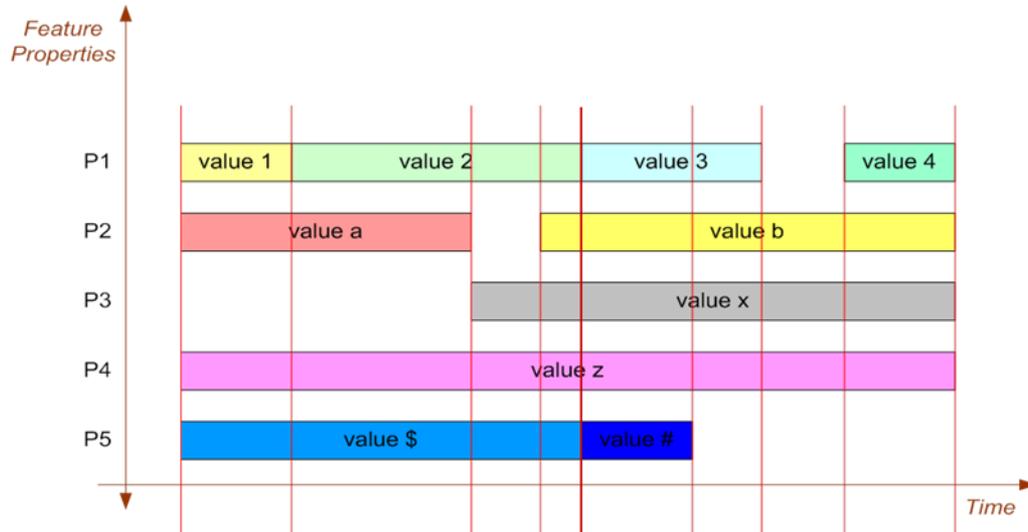


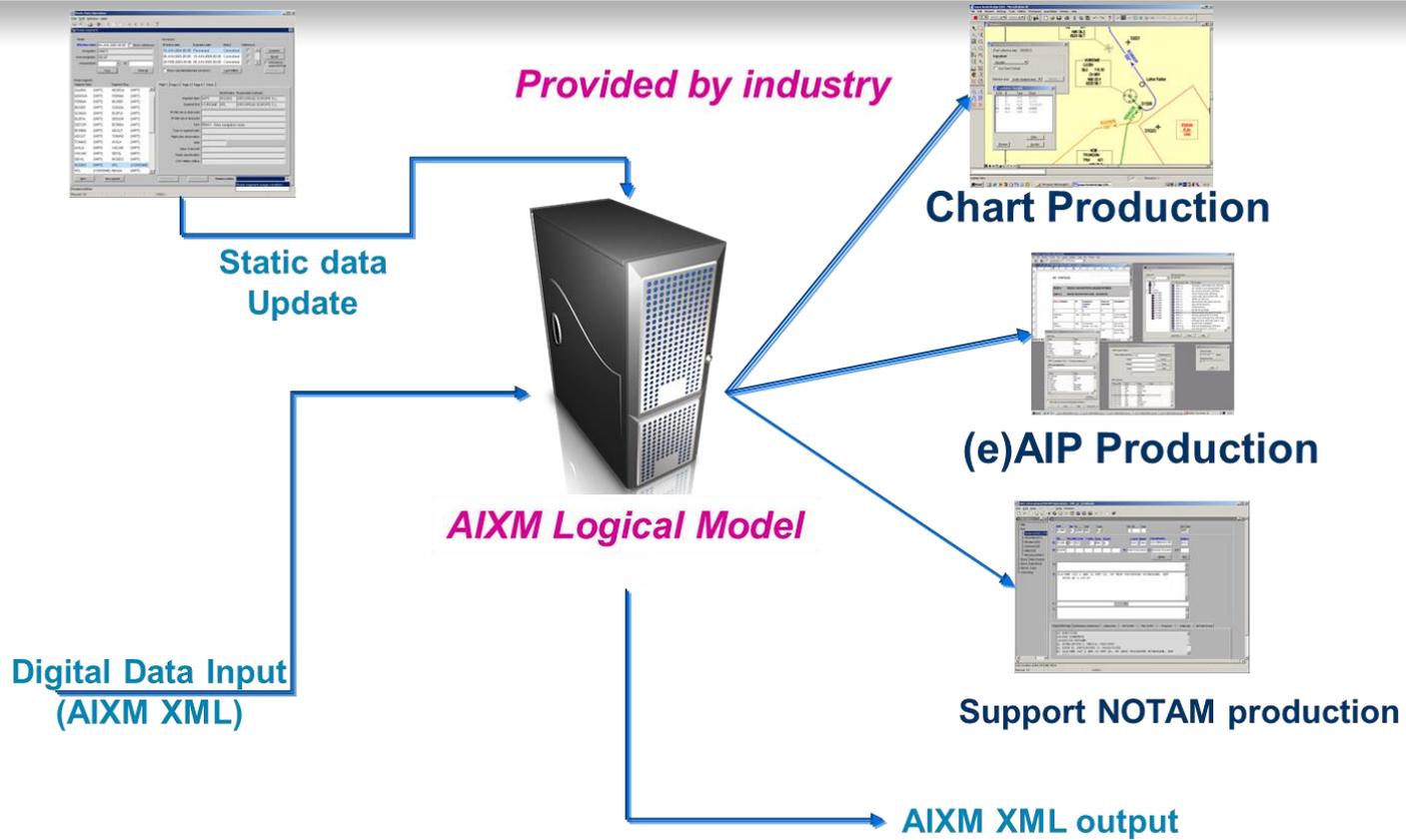


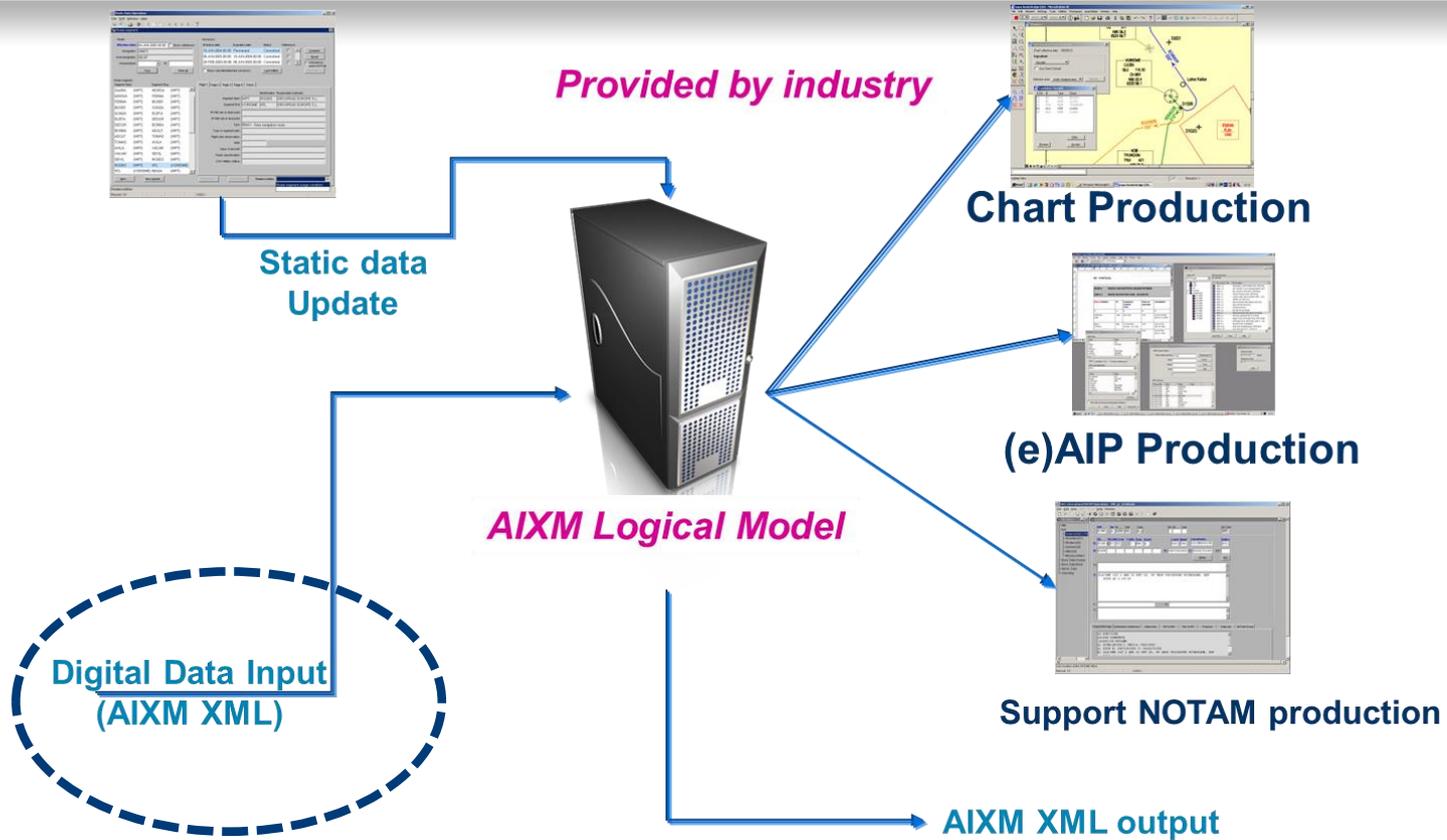
- The Basic Time Slice Model

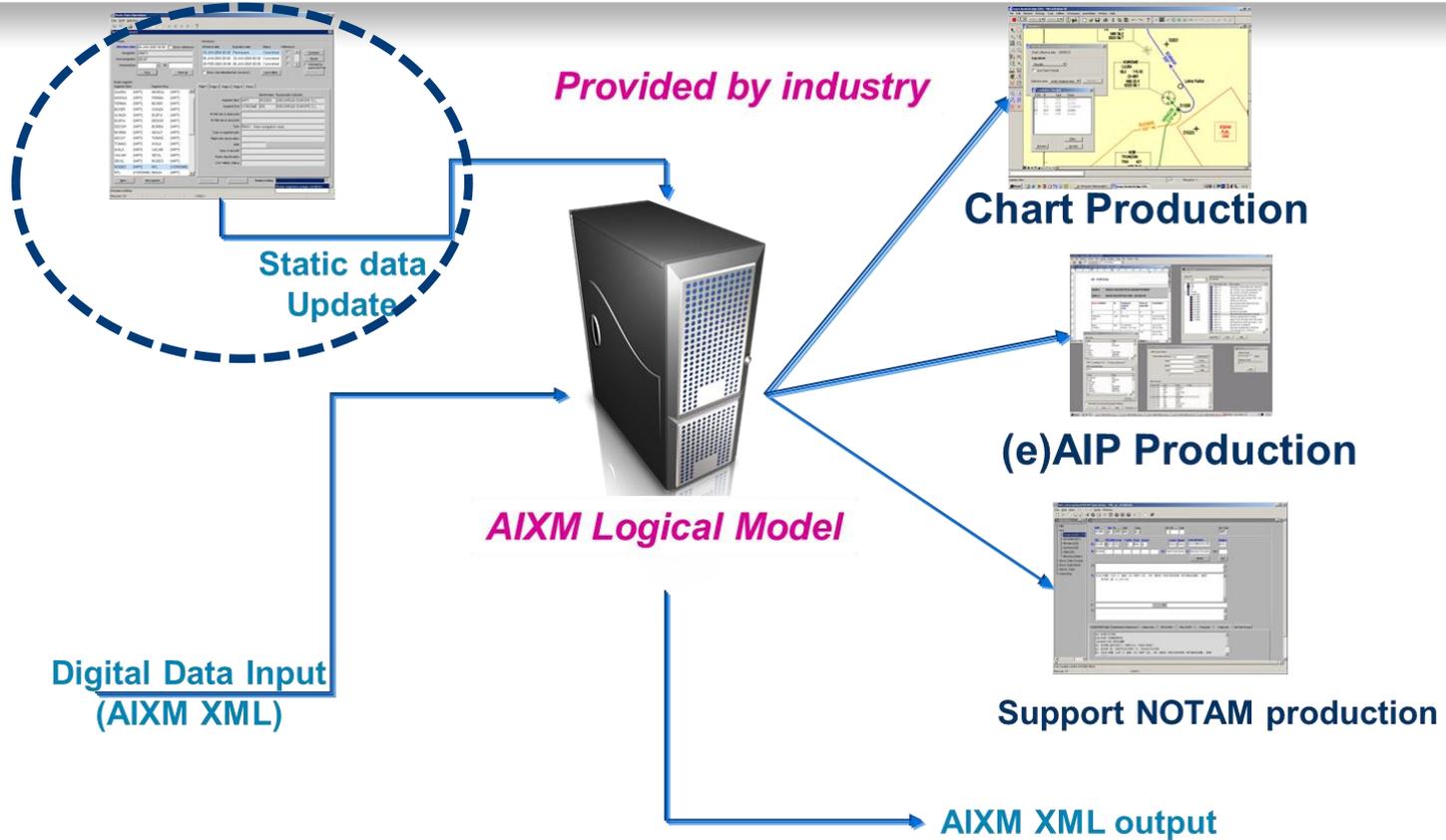
Events occur at **instants** of time when one or more properties of the feature change. The time is “slice up” based on when the values of a property change

In order to describe the feature properties during states and events a container called *TimeSlice* is used in AIXM on feature level











## Avitech's experiences with the implementation of the AIXM

- People
- Processes
- Tools





## Guidelines for AIXM 5.1 Implementation

- Understand the AIXM Conceptual Model
- Identify the data sources
- Establish internal workflow
- Create/Purchase an AIXM Database
- Populate the database
- Publish electronic publications
- Get International



## Avitech's experiences with the implementation of the eAIP with Customers:

- Dubai
- Abu Dhabi Airports
- NATS/Avinor
- Slovakia
- Slovenia
- Taiwan
- Mongolia
- German Armed Forces

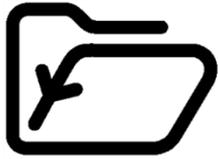


Avitech's experiences with the implementation of the AIXM 5.1 based projects with Customers:

- Mongolia (operational)
- Bahrain (migrated, in OPS from AUG 2015)
- Malaysia (migrated)
- Dubai
- Uganda (project running)
- UK (project running)
- Norway/UK (project running)
- Slovenia Control (eADP implemented, eSDO AIXM 5.1 project running)
- Slovakia LPS (



### Avitech's AIM SW Tools



e**ADP**.wiz@rd



e**SDO**.wiz@rd



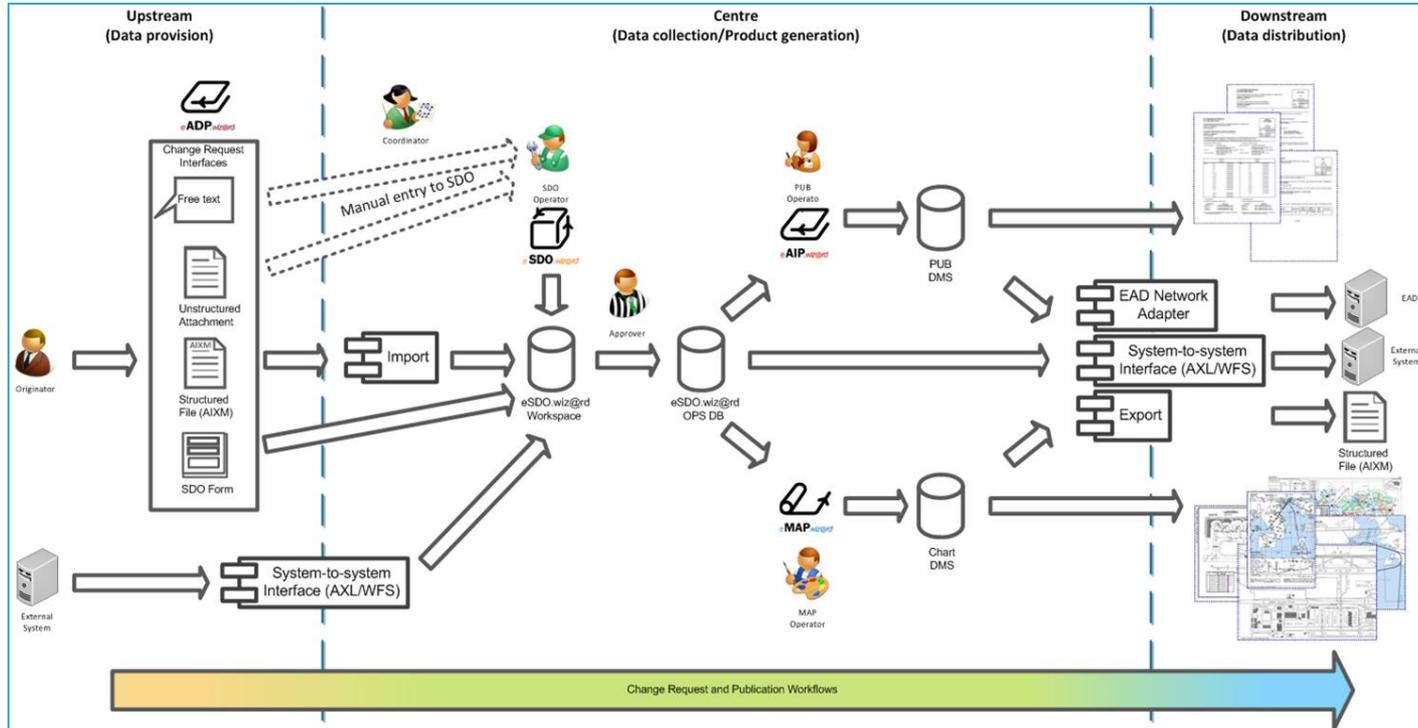
e**AIP**.wiz@rd



e**MAP**.wiz@rd

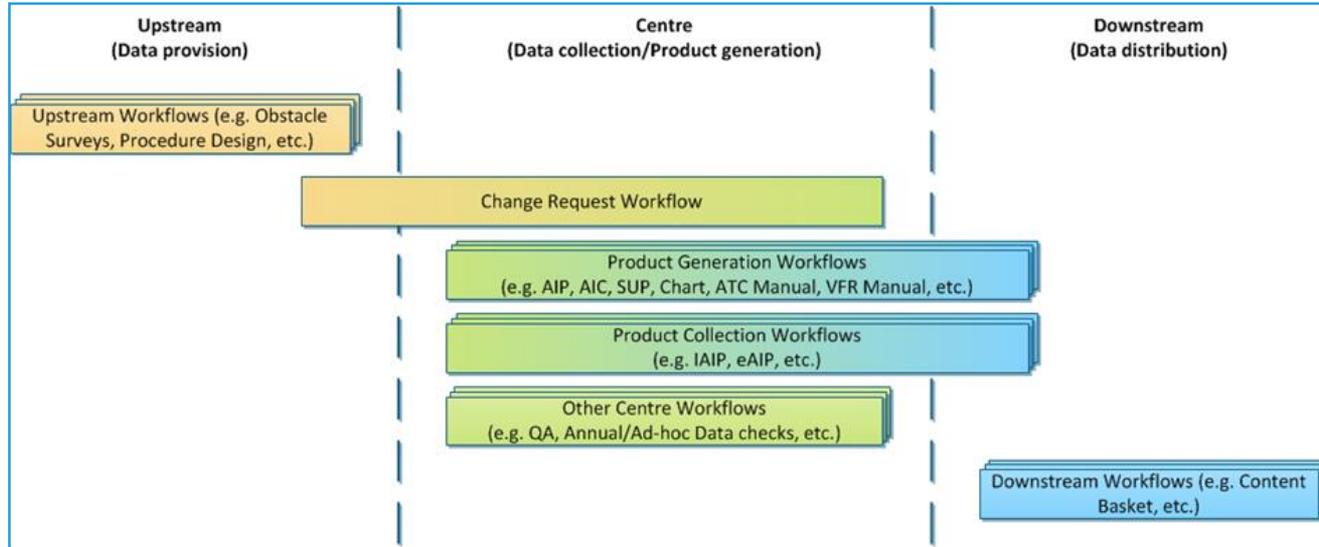
- eSDO.wiz@rd - AIXM 5.1+ static database, including eTOD (excluding GIS Viewer & Geo Calculator)
- eAIP.wiz@rd - Aeronautical Information Publication
- eMAP.wiz@rd - Charting
- eADP.wiz@rd - Workflow Management
- System Tools (System Management, User Management, Common Services, LDAP)
  - *eSDO.wiz@rd – Automated Validation*

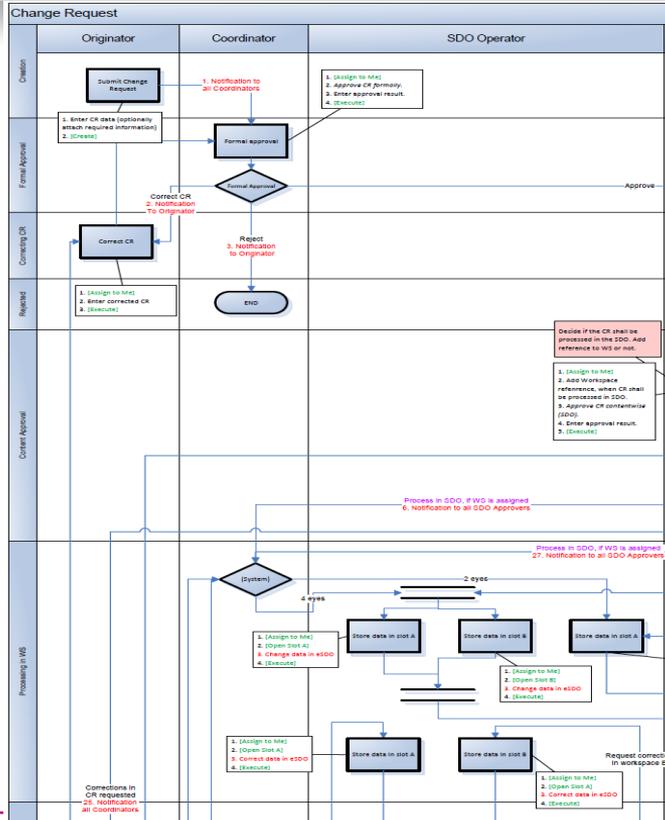
## Avitech's Tools and AIXM 5.1 DB processing





## Avitech's Tool – the web-eADP Portal (Workflow Management)





## Modelling the Work-Flow

**Change Request**

Title:

ID:

Originator:  Authority:

Evidence NR:  Orig. Ref. NR:

Suggested Publication:  Date Received:

Suggested Type:

Effective from:  Valid to:

Text of Change:

Quality of Raw Data:

Attachments:

AFTN:

Approvers:

Data Changes:

Entity Name	Attribute Name	Old Value	New Value
Aerodrome / Heliport - EADD DONLONINTERNATIONAL	ARP longitude	0315700W	0315700.1W

No records for selected criteria Page 1 of 1 Generated: 2013-04-18 10:04:06 Records per page: 10

## eADP Direct AIP Maintenance & Scheduler

The screenshot displays a web browser window titled "Change Request - Wizard Portal" showing the "HTML AIP Changes" interface. The main content area displays the text for "ENR 1.3 INSTRUMENT FLIGHT RULES" under the heading "1. RULES APPLICABLE TO ALL IFR FLIGHTS". The text includes sections for "1.1 Aircraft equipment" and "1.2 Minimum levels". A pop-up window titled "Edit..." is open over the "1.2 Minimum levels" section, showing the text: "Except when necessary for take-off or landing or when specifically authorized by the appropriate authority, an IFR flight shall be flown at a level which is not below the minimum flight altitude established by the State whose territory is overflown, or, where no such minimum flight altitude has been established. a. over high terrain or in mountainous areas, at a level which is at least 600 M (2 000 FT) above the highest obstacle located within 8 KM of the estimated position of the aircraft. b. elsewhere than as specified in a), at a level which is at least 300 M (1 000 FT) above the highest obstacle located within 8 KM of the estimated position of the aircraft. Note: The estimated position of the aircraft will take account of the navigational accuracy which can be achieved on the relevant route segment, having regard to the navigational facilities available on the ground and in the aircraft." The interface also shows a left-hand navigation menu with categories like "PART 1 - GENERAL (GEN)", "PART 2 - ENROUTE (ENR)", and "PART 3 - INSTRUMENT FLIGHT RULES".

<b>Effective date</b>	
<b>Publication</b>	DONLON AIP
<b>Type</b>	AIRAC
<b>Cycle text</b>	AIRAC AIP AMDT
<b>Cycle number</b>	01/07
<b>Effective date</b>	2007-04-15
<b>Valid to</b>	PERM
<b>Publication date</b>	2007-04-15
<b>Cut-off date</b>	2007-04-15

## eSDO – Static Data Operations (Explorer Screenshots)



eSDO.wiz@rd

**SDO Explorer - Apron Element**

File View Filter Tasks Slots Metadata Impact Assessment GIS View Help

4/21/2011 Slot group: No slot selected Slot: Task: No task selected

**Apron Element**

Entity Search... Apron name: Apron element designator:

Airport/Heliport name: Designator:

AD/HP L...	AD/HP name	Name	Type	Jetway Availability	Composition	Class PCN	Pavement Type ...	Pavement S...
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer
EADH	DONLON/DOWNTOWN ...	APRON	Parking Stand Ar...	No	Concrete	80	[R] Rigid pavement	Medium strer

Valid From: 2009-11-19 Valid To: PERM Internal ID: 4

**AD/HP identifier:** EADH **AD/HP name:** DONLON/DOWNTOWN HELIPORT

**Apron name:** APRON

**Apron element id:** 5

General | Surface Characteristics | Gate/Stand | Geometry | History

Surface composition: Concrete

Surface preparation method:

Surface condition:

PCN

PCN Value: 80

PCN Pavement type: [R] Rigid pavement

PCN pavement subgrade: Medium strength sub-grade

PCN Max tire pressure code: High: No pressure limit

DONLON v3 Item 4 of 17



## eSDO Data Source Information Management

The screenshot displays the SDO Explorer interface for managing aerodrome/heliport data. The main window shows a tree view on the left with categories like Navigation aids, Procedures, and Airspaces. The central pane displays a table of aerodromes/heliports with columns for identification, name, and location indicator.

AD/HP identific...	AD/HP name	Location indicator
EADA	AKVIN/AKVIN	EADA
EADB	SIBY/BISTOCK	EADB
EADC	ESSENCE	EADC
EADD	DONLON/INTE...	EADD
EADE	DENGRON/DEL...	EADE

The 'Priority source overwrite Rule assignment' dialog box is open, showing configuration for the 'EADD' source. It includes fields for Feature type, Natural key, Property, Source, Rule validity, and Configuration. A 'Priority settings' table is also visible within the dialog.

Source	Priority
EADD	1
DONLON CAA	2

At the bottom of the main window, the 'ARP and Location' section shows details for the selected aerodrome: ARP latitude (522217N), ARP site at AD (119°/1 078M from THR 09L), and Served city (DONLON).



## eSDO Advanced Spatial and Full Text

The screenshot displays three overlapping dialog boxes in a GIS application:

- Full Text Search:** A search window with a search text field containing "DONLON", a feature type dropdown set to "All Features", and an attribute dropdown set to "All Attributes". Below is a table of search results.
- Advanced Filter - Aerodrome / Heliport:** A filter configuration window with a "Spatial filter" tab. It shows a property list on the left and filter criteria on the right, including "Length" with a "Greater Than" operator and a value of "2000".
- Advanced Filter - Aerodrome / Heliport:** A second filter configuration window with a "Spatial filter" tab. It shows options for "Fully inside" selection, with radio buttons for "Airspace", "Aerodrome/Heliport", "Significant Point", "Rectangular Area", "Circular area", and "Geometry".

Entity	Natural key	Attribute	Value
Aerodrome / Heliport	AD/HP identification: EADD DONLON/INTERNATIONAL	Served city	DONLON
	ence number: 20 r: EADH AD/HP name: OWN HELIPORT	Full address	Donlon Heliport Authority
	ence number: 40 r: EADH AD/HP name: OWN HELIPORT	Full address	Donlon
	ence number: 20 r: EADD AD/HP name: ATIONAL	Full address	Donlon Aitport
	ence number: 30 r: FADD AD/HP name:	Full address	Donlon 4 W
			DONLON
			DONLON
			DONLON
			DONLON HELIPORT ATZ

## Feature history

**SDO Detail - Aerodrome / Heliport**

File View Metadata GIS View Help

2011-03-01 Slot group: No slot selected Slot: Task: No task selected

Valid From: 2009-11-19 Valid To: PERM Internal ID: 6

Identification: EADD

General Collocation Administration Geo Properties Ground Services Fuel & Oil Oxygen & Nitrogen Facilities Passenger Facilities Aprons & Taxiways  
 RWYs Ad/Hp Obstacles Services Ground Lights SID STAR IAP Nav aids TLOF & FATD Working HR Remarks History Deprecated

Feature	Valid From	Valid To	Inserted On	Inserted By	Task Id
Aerodrome / Heliport	2009-11-19	PERM	2009-09-24 09	Doe, John	115
Aerodrome / Heliport	2009-11-19	PERM	2009-09-17 15	Doe, John	115
Aerodrome / Heliport	2009-03-12	PERM	2009-09-16 09	Doe, John	112
Aerodrome / Heliport	2009-03-12	PERM	2009-09-16 09	Doe, John	112

**History Detail**

Feature: Aerodrome / Heliport

Valid From: 2009-03-12 Valid To: PERM

Changed by: Degel, Siegfried Changed on: 2009-02-17 16:47:30

Based on task: [ 112 ] ALL PARTS Corrections 2

Usage Conditions

Modified Property	New Value
Site description	045°, 5 NM from Donlon
Unit of measurement [vertical distance]	Feet
Elevation	99
Geoid undulation	40

Item 4 of 21



## Avitech's support to Transition to AIM Operations

- Package 1: Status Quo assessment and Setup
- Package 2: Tool Setup & Training & Migration
- Package 3: Implementation
- Package 4: QMS Set Up and Implementation
- (support the CAA in setting up a quality Management System (QMS) that meets the quality assurance requirements for AIM contained in the ICAO Annexes 4 and 15/ supporting ISO 9001 certification
- Package 5: Assisting CAA in the exchange of aeronautical data with other CAAs



## Status Quo Assessment

### Package 1:

- Status Quo assessment and Setup
- Awareness Workshop
- AIS Audit & Risk Assessment
- State/Analysis of differences with regards to ICAO Annex 4/15
- AIRAC adherence
- WGS-84 Implementation (evaluation of Non-WGS-84 coordinates)
- Check/monitor data quality against ADQ/ICAO requirements
- Assessment of Aeronautical Information Briefing
- Check the Communication Network
- Assess the AIM Documentation
- Check Interoperability with MET products



## Tool SETUP & TRAINING & MIGRATION

### Package 2:

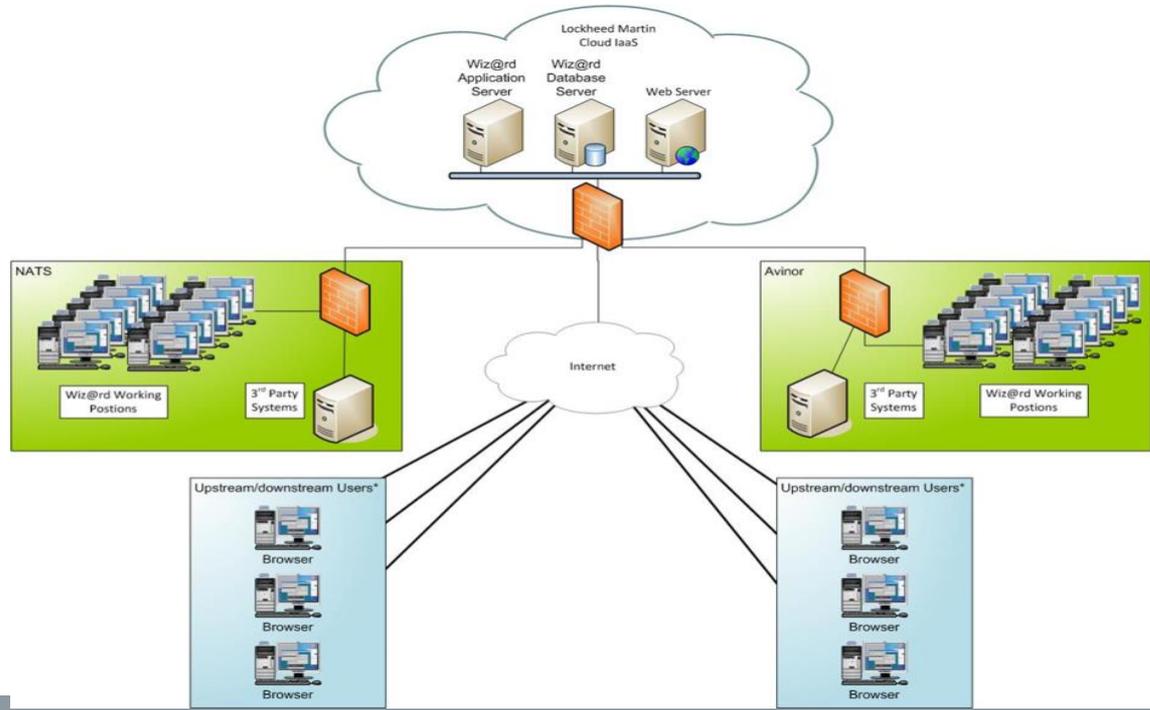
- Integrated Aeronautical Database – adjustment to Customer extensions and Format of Business Rules
- Provide Format and Business Rules Documentation according to the existing and intended future AIP publication
- AIXM 5.1 Rules/Specification (Documentation)
- Aerodrome Mapping
  
- Terrain Data Implementation
- Obstacles Data Implementation
- Electronic Aeronautical Charts



## Migration of Data

- Base on Migration Matrix (structured process)- frozen AIP as per Checklist;
- Organizing the original source of work (most current AIP in pdf)
- Migration Working Packages (Aeronautical Data Features, Attributes for SDO;
- Elaboration of Business rules and their documentation;
- Elaboration of Formatting rules (e.g. 01 JUL 16 vs. 01 07 2014 ect.)
- Provision of the necessary migration and production forms (towards originators, evaluation of errors, ICAO differences and incostistencies
- Identification and assistance in all infrastructure /IT matters (eg. For importing of Text files, xml files to html.....

## Example: Infrastructure as Service



*Hosting Services*

## AIM – Contributing to ATM Success



### Global

Some "Enablers"

- Development and enhancement of global data exchange formats
- Implementation of digital and integrated AIM systems
- Connection of digital AIM systems worldwide to assure global interoperability

AIM becomes the „Global Intranet“ for ATM

Organised by

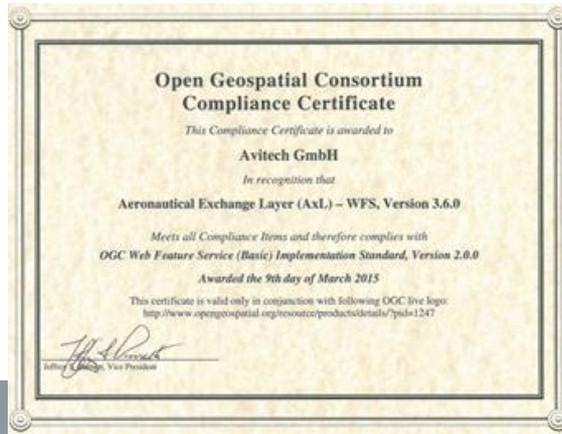


**Today**

**2020**

## Avitech's future proof and quality

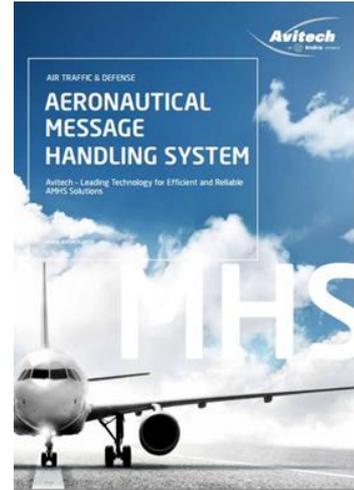
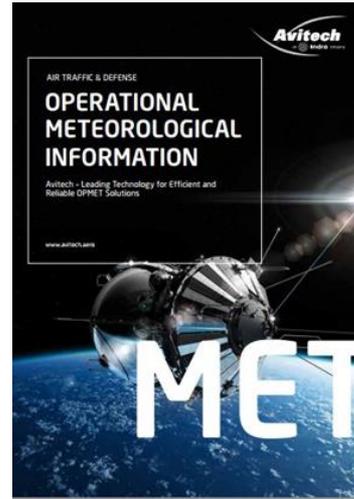
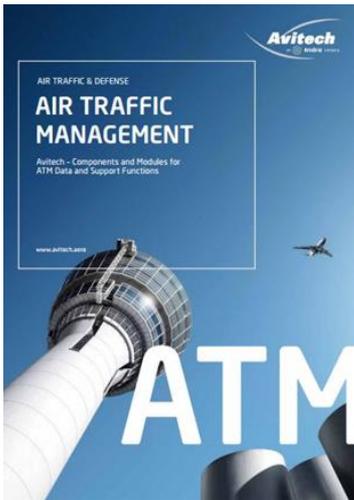
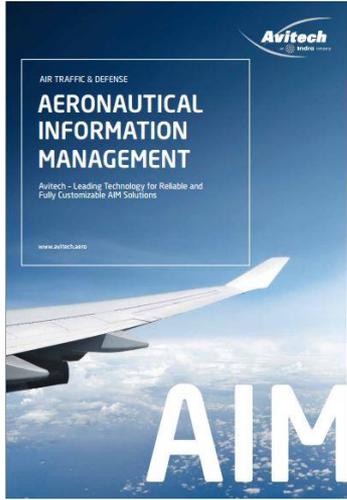
- WFS-T v2.0
  - Avitech is worldwide the first company to pass all tests in the OGC CITE WFS v2.0 test suite!
  - OGC officially announced on 20.11.2014 that Avitech is an early implementer.
  - [www.opengeospatial.org/resource/products/details/?pid=1247](http://www.opengeospatial.org/resource/products/details/?pid=1247)
  - AxL WFS-T service is now a reference implementation!



LETECKÝ ÚRAD SLOVENSKEJ REPUBLIKY	CIVIL AVIATION AUTHORITY of the SLOVAK REPUBLIC
SÚHLAS NA POUŽITIE LETECKÉHO POZEMNÉHO ZARIADENIA V CIVILNOM LETECTVE	
TYPE APPROVAL	
Č.: LPZ - S - 007/2009	
No. _____	
Toto dokument sa poskytuje, že nižšie uvedený výrobok sa môže použiť v civilnom letectve ako letecké pozemné zariadenie alebo jeho súčasť. This document certifies that the product described below may be used in civil aviation as an air traffic management equipment.	
Zusatz:	Avitech AG
Agilent:	Bahnhofplatz 1, 82041 Friedriehshafen, Nemecko
Výrobok:	Informačný systém leteckej informačnej služby
Produkt:	AIS Information System
Výrobca:	Avitech AG
Manufacturer:	Bahnhofplatz 1, 82041 Friedriehshafen, Nemecko
Typové označenie:	eW@rd Suite
Type Designation:	
Technická špecifikácia:	WZ08R1_TS_EN
Technical Specification:	
Použitý predpis:	ICAO Annex 4, 10 <sup>th</sup> Edition 2001
Certification Basis:	ICAO Annex 16, 12 <sup>th</sup> Edition 2004
Ohraničenia:	Bez obmedzenia
Restrictions:	No restriction
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Thank you 😊  
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