



Network Manager
nominated by
the European Commission



Integrated Aeronautical Information database

Workshop for the development of Operational skills for the transition
from AIS to AIM for Civil Aviation Authorities (CAA) and Air Navigation
Service Providers

2 – 6 July 2018

Nairobi

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AIXM

Why necessary?

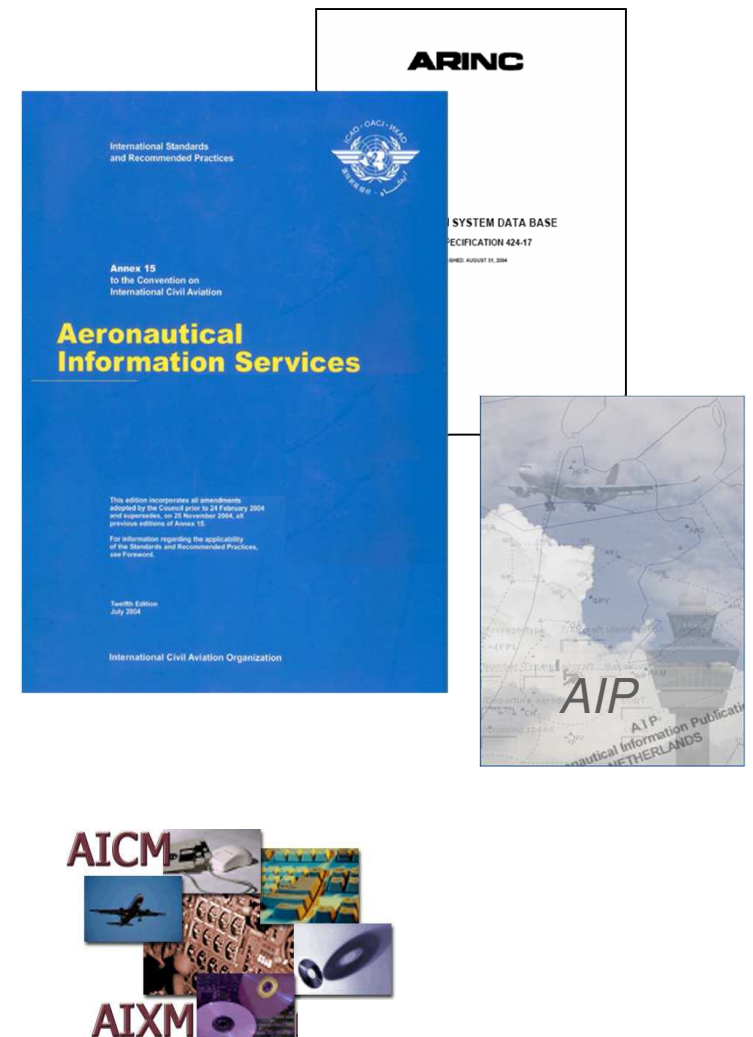
- EAD Feasibility Study (by “CAPdebis”) - 1993
 - *“The exchange of static data in an electronic format is rare for ground based systems. Other than ARINC 424 format, which was developed according to the demands of FMS, a state of the art, commonly used standard format for the exchange of static data information [...] is not available.”*



AIXM

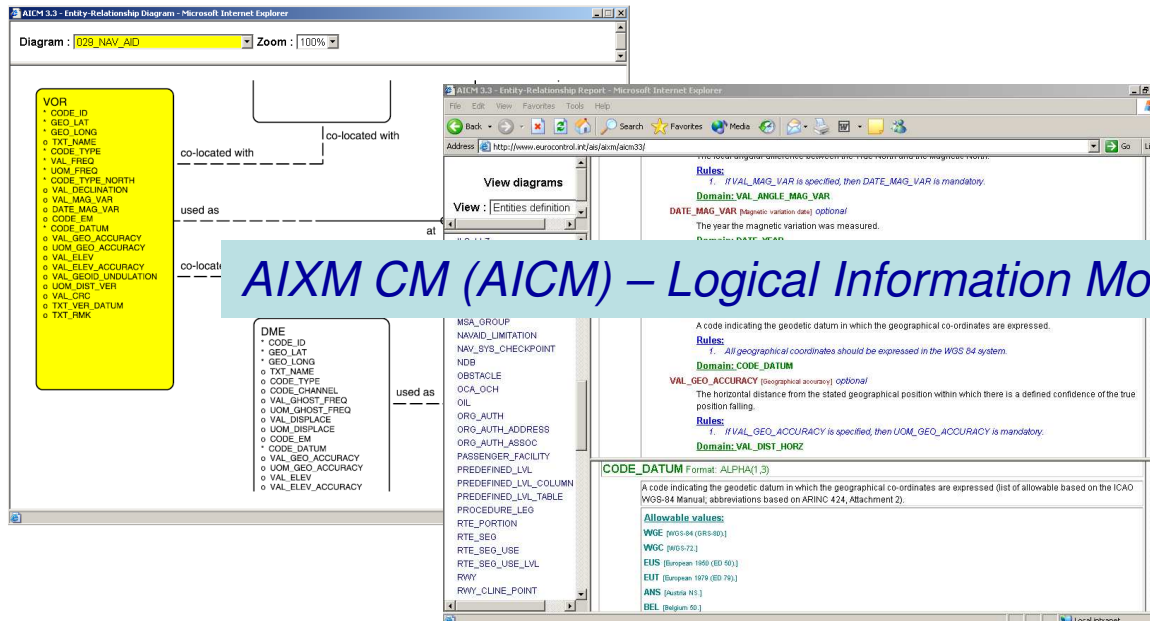
Development

- Standard for aeronautical information encoding and digital dissemination
- Based on:
 - ICAO Annex 15
 - Industry standards such as ARINC 424
 - Other standards, best practices, AIP
- Development started in 1997
 - Initially developed for the European AIS Database (EAD)
- The latest version of the model is 5.1 (Feb 2010)
 - Cover both static and dynamic data
 - Means of Compliance for EU Aeronautical Data Quality (ADQ) regulation (73/2010)
 - Basis for eAIP, Digital NOTAM
 - Contribution to ICAO
 - Available for industry implementations



AIXM

Two main components



AIXM CM (AICM) – Logical Information Model

- Description of the data independent from the data storage and exchange specifications
- AICM describes the aeronautical entities, their attributes and relationships

<AIXM-Snapshot>

<Vor>

<VorUid>

<codeID>AML</codeID>

<geoLat>34.3928N</geoLat>

<geoLon>123.4333W</geoLon>

</VorUid>

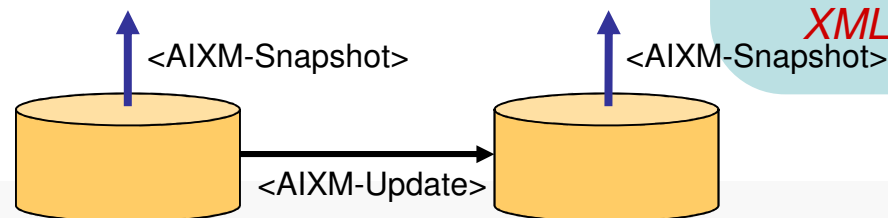
...

</AIXM-Snapshot>

AIXM – Data Exchange Format (XML)

- Enable systems to exchange aeronautical information in the form of XML encoded data

AIXM is an implementation of the AICM in the form of an XML schema



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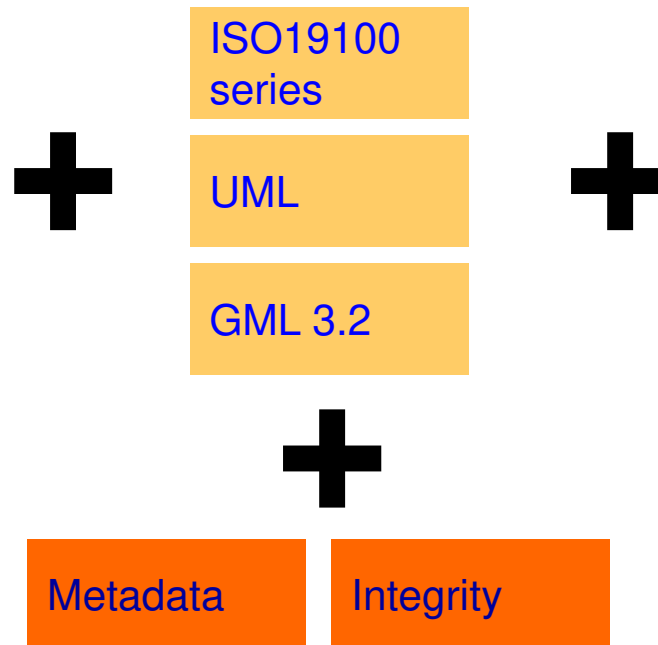
AIXM

AIXM 5 Design Objectives

New capabilities

- Modularity
- Extensibility
- Flexible Exchange
- Flexible Messages
- Static and Dynamic

Technical Design Decisions



Expand/Refresh Domain Model

- Aerodrome Mapping
- Terminal Procedures
- Obstacles

AIXM

AIXM 5 Design Objectives

- Adoption of a number of international standards that maximize the chances for interoperability while also reducing the implementation costs:
 - UML (Unified Modeling Language) for developing AIXM 5 logical information model
 - GML - Geography Markup Language, a specialization of XML for geographical data - for data encoding
 - ISO19100 series of geospatial information standards as data modelling framework
- Equal coverage for static and dynamic data; be able to communicate both 'permanent' changes, such as those that occur at AIRAC cycles and temporary situations, typically promulgated through NOTAM; this requires the introduction of an exhaustive temporality concept in the model;
- Modularity and extensibility: offer the possibility to easily re-use a part of the exchange specification for a particular domain, which might be interested only by a limited number of features without dealing with the complexity of the whole AIXM; offer the possibility for third parties to expand the model – additional features, additional properties or domain values – for local application; Place names in local language are a typical example.
- Flexibility of messages and exchange scenarios: the AIXM 4.5 model version is limited to two standard messages: Snapshot and Update – which have been proven sufficient for a central AIS database concept such as the EAD, but insufficient for a few other kinds of applications. User communities and applications should have the possibility to decide on the types of messages that they want to compose using the AIXM pool of features and also on the scenarios in which these messages are used.
- Exhaustive metadata incorporation into the model has been identified
- Update of some concepts (aerodrome mapping, terminal procedures and obstacle data - eTOD)

AIXM

Typical Implementation of the model

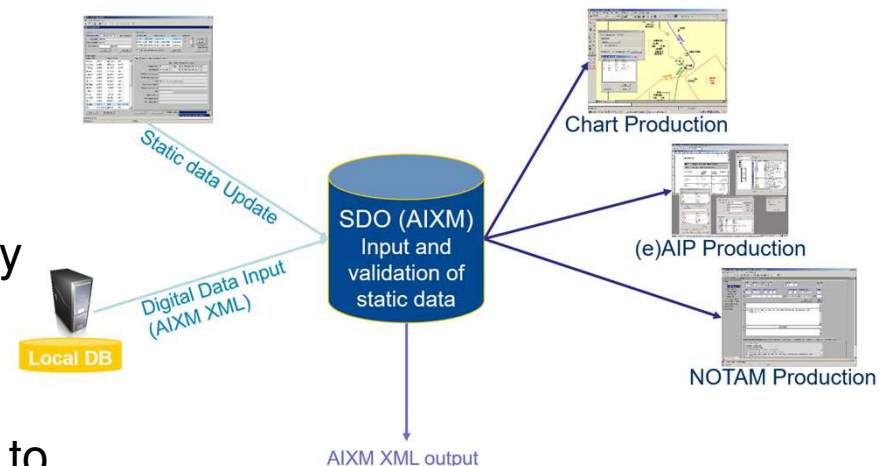
- AIXM-based database is implemented in tools for the management of aeronautical information

- Input

- Data may be input either:
 - Through input screens or
 - Ingested automatically, if already available in digital format

- Output

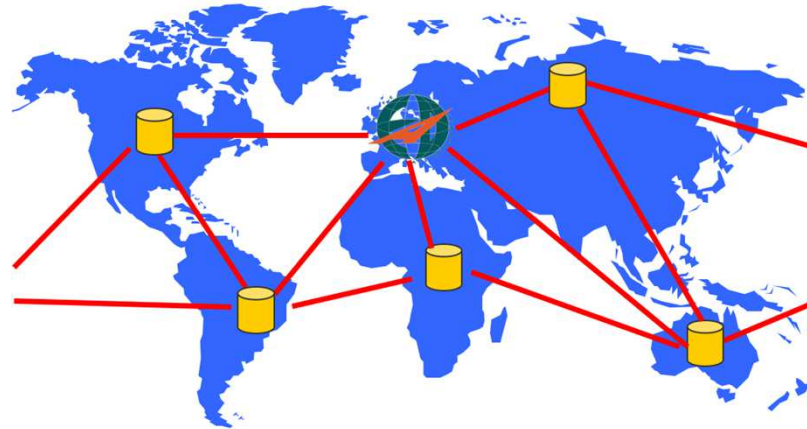
- Data stored in the database is used to support the creation of the (e)AIP, charts, NOTAM, etc.
- AIXM is then used as output format for transmitting the aeronautical information to other databases, systems



AIXM

Typical Implementation of the model

- Sharing of system and service implementation costs can be realized by establishing regional systems (e.g. European AIS Database (EAD))



*... Connecting
with
the world ...*

Important notes:

- AIXM XML expertise is not necessary for AIS/AIM operators!!!
→ *Only necessary for system developers and programmers*
- Operational staff is only required to understand the logical information model
→ *AIS tools available on the market could even hide some part of the complexity of the logical information model*

AIXM

Complementary Information

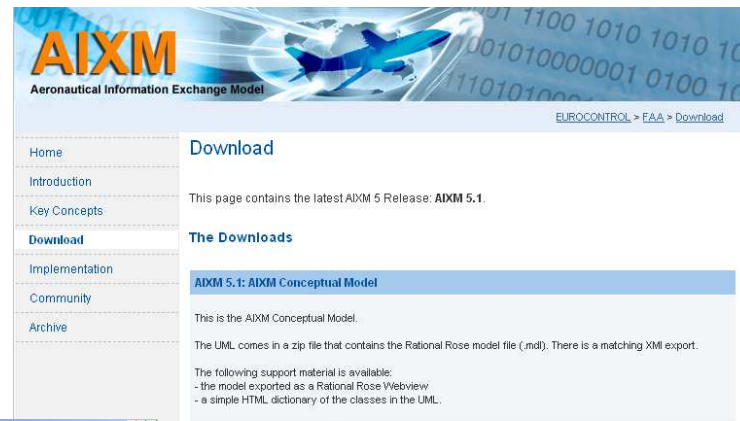
- Mapping AIP – AIXM 5
 - https://ext.eurocontrol.int/aixm_confluence/display/ACGAIP/Coding+Guidelines

- Mapping PANS AIM AIP datasets to AIXM 5
 - https://ext.eurocontrol.int/aixm_confluence/display/ACGAIP/Mapping+PANS-AIM+AIP+Data+Set+to+AIXM+5

AIXM

Complementary Information

- www.aixm.aero
- www.aixm.aero/wiki
- AIXM Forum



The screenshot shows the AIXM website with a header featuring the AIXM logo and a blue airplane. Below the header is a navigation menu with links: Home, Introduction, Key Concepts, Download, Implementation, Community, and Archive. The main content area is titled 'Download' and contains the text: 'This page contains the latest AXM 5 Release: **AIXM 5.1**.' Below this, there is a section titled 'The Downloads' which lists the following support material available:

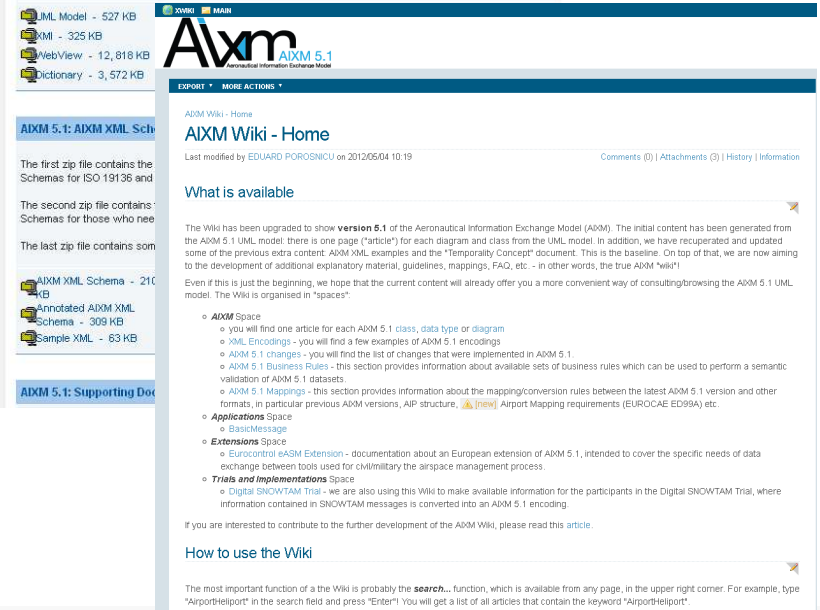
- the model exported as a Rational Rose Webview
- a simple HTML dictionary of the classes in the UML.

 A list of download links is provided:

- UML Model - 527 KB
- XML - 325 KB
- WebView - 12,818 KB
- Dictionary - 3,572 KB



The screenshot shows the AIXM Forum interface. At the top, it says 'Tuesday, Apr 24, 2012' and 'Members connected: 2'. There is a sidebar with navigation links: Home, Post a Message, Search, Guestbook, Tell a friend, Forum List, AIXM Forum, and AIXM Wiki. The main content area displays a forum post by 'MAROY, Acs (TYRELL CORPORATION, Hungary)' with the subject 'name collision in schema for element "name" for types extending AbstractOMLType?'. The post content discusses a name collision issue in the AIXM 5.1 schema. Below the first post, there is another post by 'NEODALLA Rishi (AERONAVDATA, United States of America)' with the same subject, also discussing the name collision issue.



The screenshot shows the AIXM Wiki page. The header includes the AIXM logo and the title 'AIXM Wiki - Home'. Below the header, it says 'Last modified by EDUARD POROSNICU on 2012/05/04 10:19'. The main content area is titled 'What is available' and contains the following text:

The Wiki has been upgraded to show **version 5.1** of the Aeronautical Information Exchange Model (AIXM). The initial content has been generated from the AIXM 5.1 UML model; there is one page ("article") for each diagram and class from the UML model. In addition, we have recuperated and updated some of the previous extra content: AIXM-XML examples and the "Temporality Concept" document. This is the baseline. On top of that, we are now aiming to the development of additional explanatory material, guidelines, mappings, FAQ, etc. - in other words, the true AIXM "wiki"!

Even if this is just the beginning, we hope that the current content will already offer you a more convenient way of consulting/browsing the AIXM 5.1 UML model. The Wiki is organised in "spaces":

- **AIXM Space**
 - you will find one article for each AIXM 5.1 class, data type or diagram
 - XML Encodings - you will find a few examples of AIXM 5.1 encodings
 - AIXM 5.1 changes - you will find the list of changes that were implemented in AIXM 5.1
 - AIXM 5.1 Business Rules - this section provides information about available sets of business rules which can be used to perform a semantic validation of AIXM 5.1 datasets
 - AIXM 5.1 Mappings - this section provides information about the mapping/conversion rules between the latest AIXM 5.1 version and other formats, in particular previous AIXM versions, AIP structure, (new) Airport Mapping requirements (EUROCAE ED99A) etc.
- **Applications Space**
 - e-ASIS Message
- **Extensions Space**
 - Eurocontrol eAIXM Extension - documentation about an European extension of AIXM 5.1, intended to cover the specific needs of data exchange between tools used for civil/military the airspace management process.
- **Trials and Implementations Space**
 - Digital SNOWTAM Trial - we are also using this Wiki to make available information for the participants in the Digital SNOWTAM Trial, where information contained in SNOWTAM messages is converted into an AIXM 5.1 encoding

If you are interested to contribute to the further development of the AIXM Wiki, please read this [article](#).

How to use the Wiki

The most important function of a the Wiki is probably the **search...** function, which is available from any page, in the upper right corner. For example, type "AirportReport" in the search field and press "Enter". You will get a list of all articles that contain the keyword "AirportReport".

SWIM

System Wide Information Management

- SWIM consists of **standards**, **infrastructure** and **governance** enabling the management of ATM information and its exchange between qualified parties via interoperable services
- Global interoperability and standardization are essential to:

Share information about:

- Aeronautical
- Flight trajectory
- Aerodrome operations
- Meteorological
- Air traffic Flow
- Surveillance
- Capacity

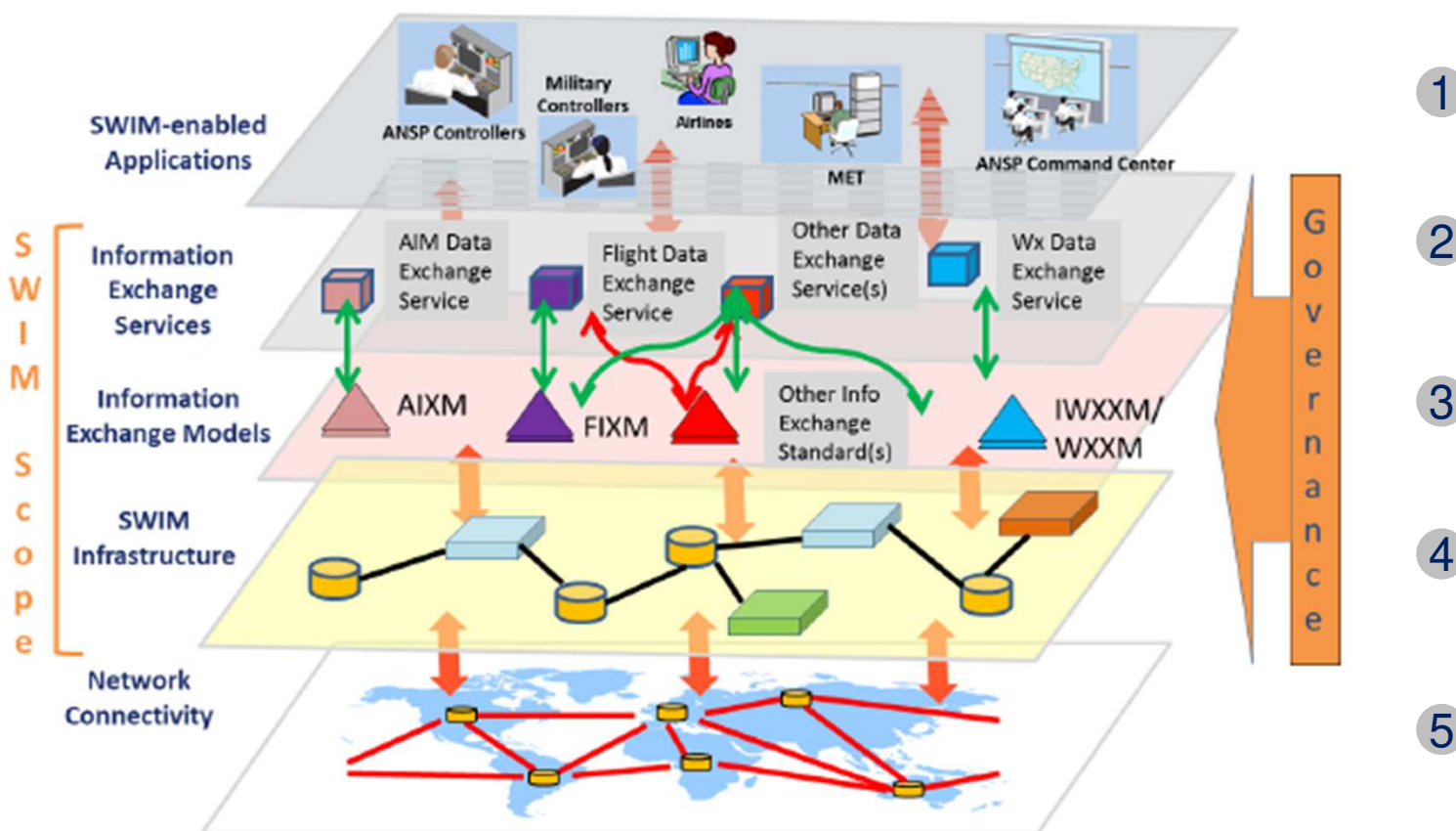


Between ATM actors:

- Pilots
- Airport operations centres
- Airline operations centers
- ANSP
- MET
- Military

SWIM

Global Interoperability framework – 5 layers



The scope of SWIM is limited to the three middle and to the governance of these layers

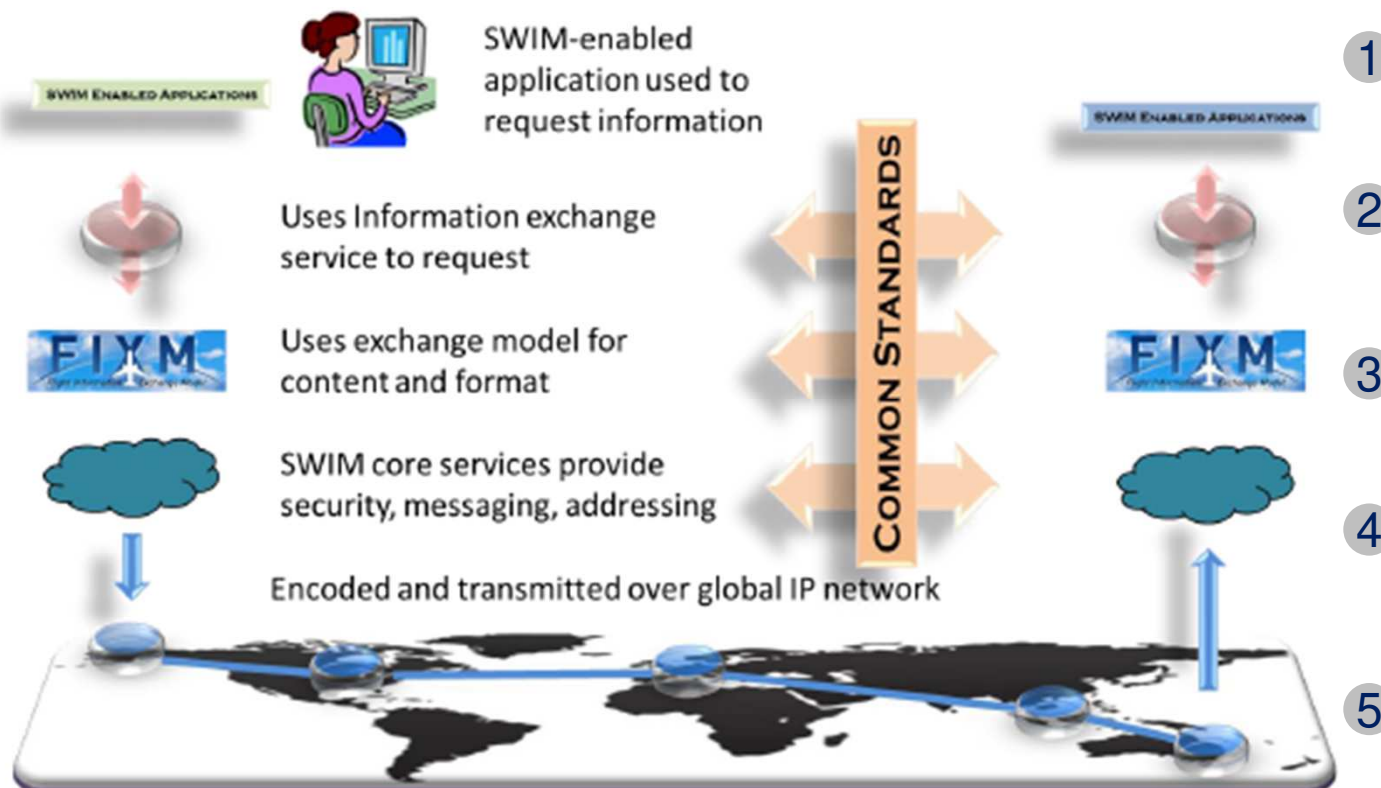
SWIM

Global Interoperability framework – 5 layers

1. **SWIM-enabled Applications:** Providers and users of information using applications that interoperate through SWIM;
2. **Information Exchange Services:** Set of information exchange services defined for each ATM information domain that can be used by SWIM-enabled applications according to governance specifications, and agreed upon by SWIM stakeholders.
3. **Information Exchange Models:** Information exchange models defining the syntax and semantics of the data exchanged by applications
4. **SWIM Infrastructure:** Core services such as interface management, request-reply and publish-subscribe messaging, service security, etc.
5. **Network Connectivity:** Consolidated telecommunications services composed of a collection of the interconnected network infrastructures of the different stakeholders

SWIM

Global Interoperability framework – 5 layers

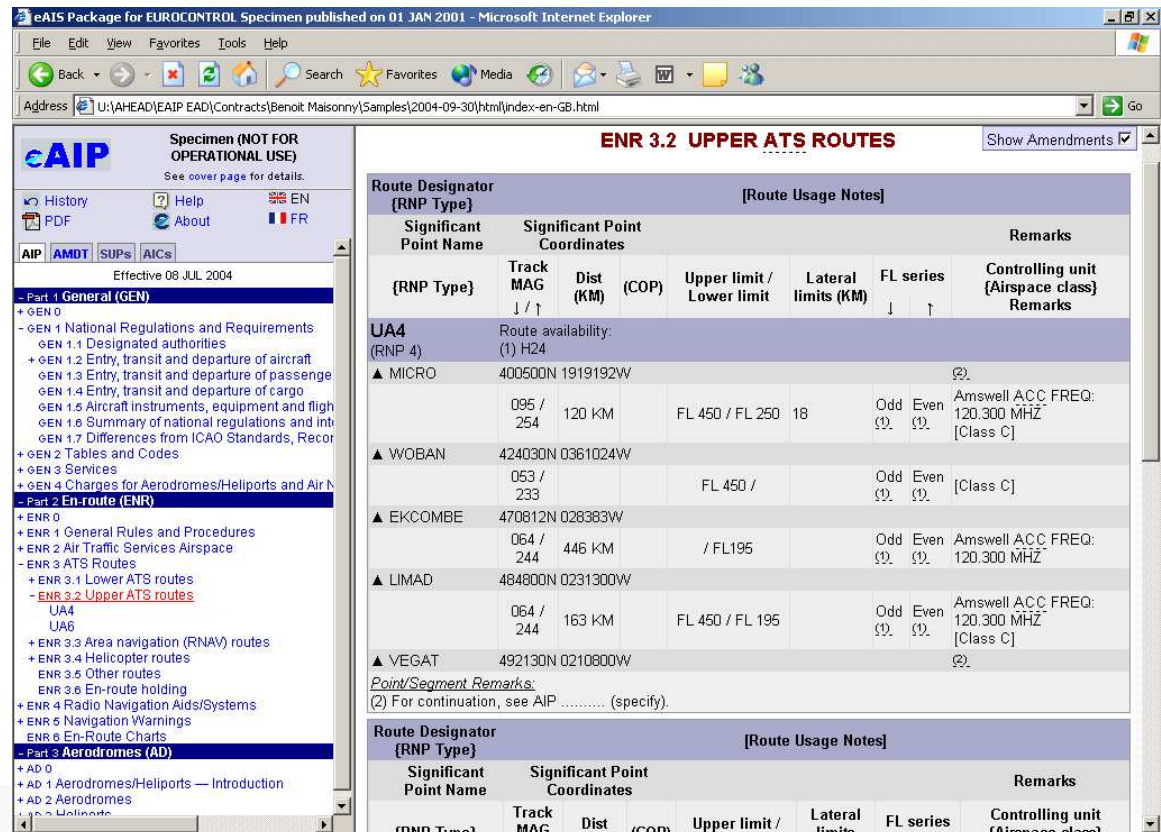


More information is available in the ICAO Manual on SWIM concept (Doc 10039)

eAIP Principles

Publish the content of an AIP, AIP AMDT, SUP and AIC in a structured electronic format, which is optimized for visualizing on a computer screen, using Web technology.

- Easily accessible from a terminal
- Ease of browsing, facilitated by the HTML technology
- Ability to visualise changes
- No maintenance effort (page replacement at every amendment)
- No postal delays (if distributed through the Internet)
- Improved AIP product, with increased consistency, integrity and usability



ENR 3.2 UPPER ATS ROUTES

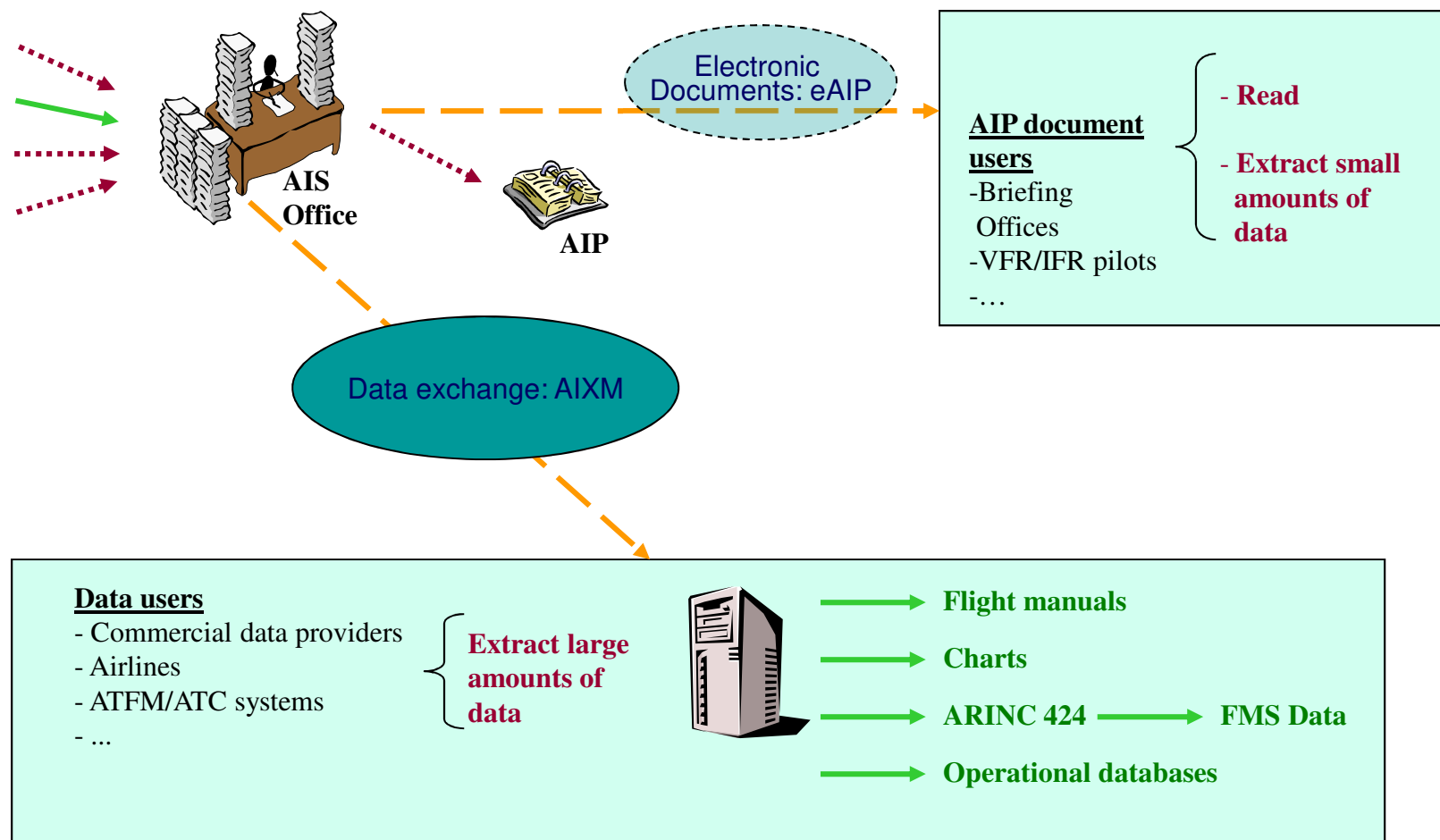
Route Designator {RNP Type}	Significant Point Point Name	Coordinates	Track MAG	Dist (KM)	(COP)	Upper limit / Lower limit	Lateral limits (KM)	FL series	Controlling unit {Airspace class}	Remarks
UA4 (RNP 4)	Route availability: (1) H24									
▲ MICRO	400500N 1919192W									Amwell ACC FREQ: 120.300 MHz [Class C]
	095 / 254	120 KM				FL 450 / FL 250	18	Odd (1)	Even (1)	
▲ WOBAN	424030N 0361024W							Odd (1)	Even (1)	[Class C]
	053 / 233					FL 450 /				
▲ EKCOMBE	470812N 028383W							Odd (1)	Even (1)	Amwell ACC FREQ: 120.300 MHz
	064 / 244	446 KM				/ FL195				
▲ LIMAD	484800N 0231300W							Odd (1)	Even (1)	Amwell ACC FREQ: 120.300 MHz [Class C]
	064 / 244	163 KM				FL 450 / FL 195				
▲ VEGAT	492130N 0210800W									

Point/Segment Remarks:
(2) For continuation, see AIP (specify).

eAIP

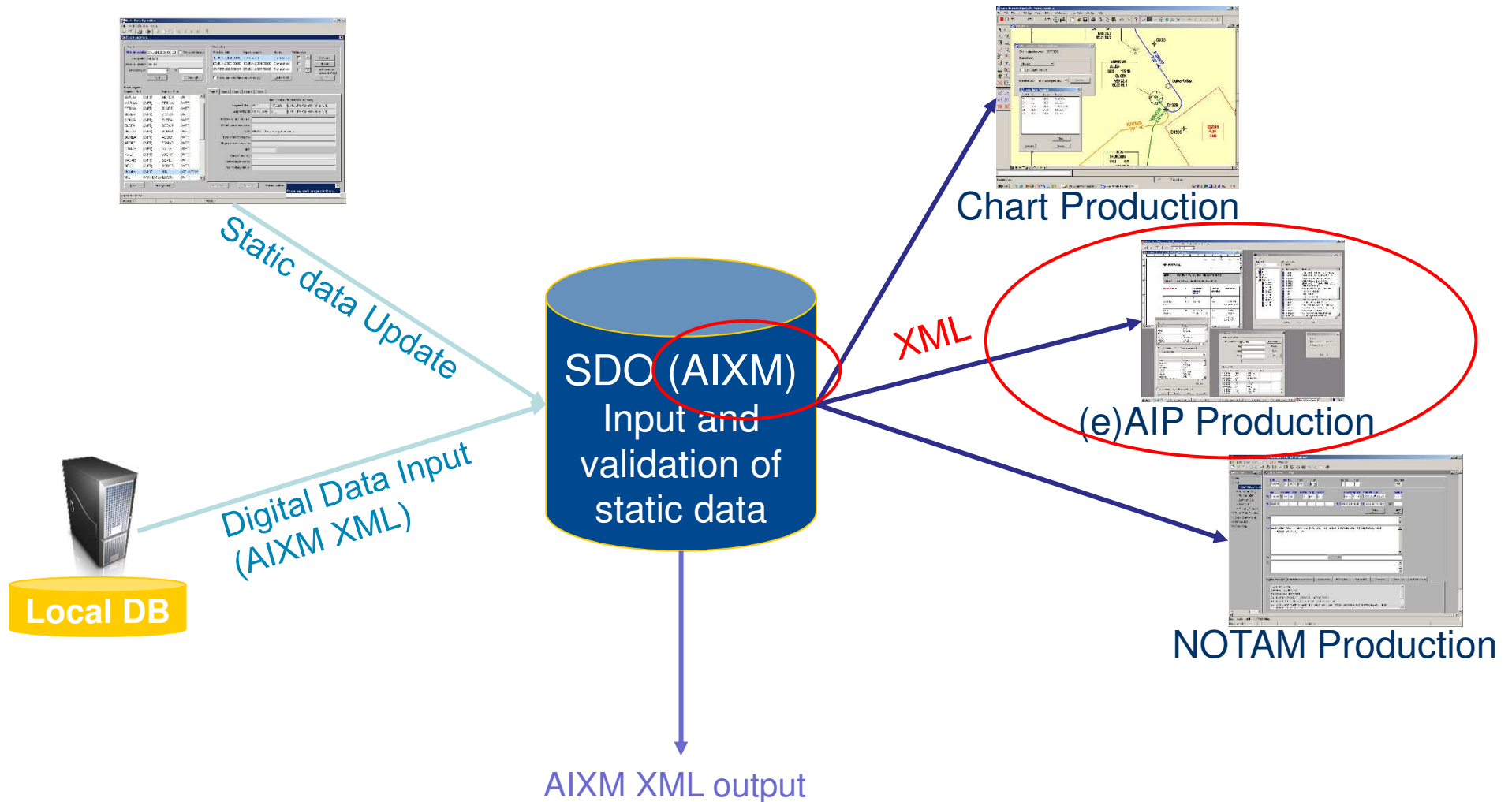
eAIP versus AIXM

There are two categories of AIP users



eAIP

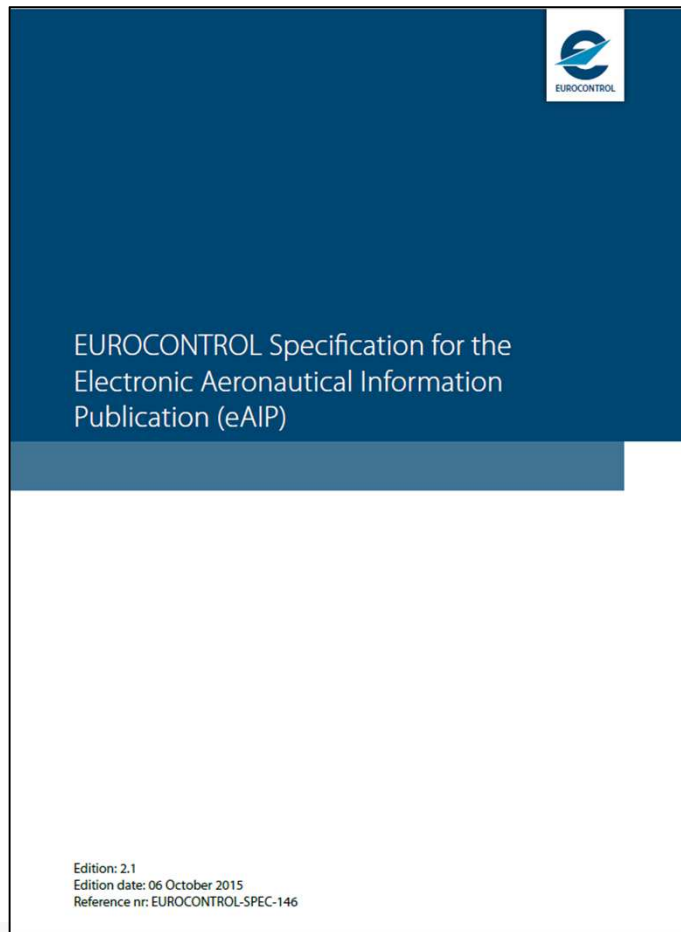
Relation between AIXM and eAIP



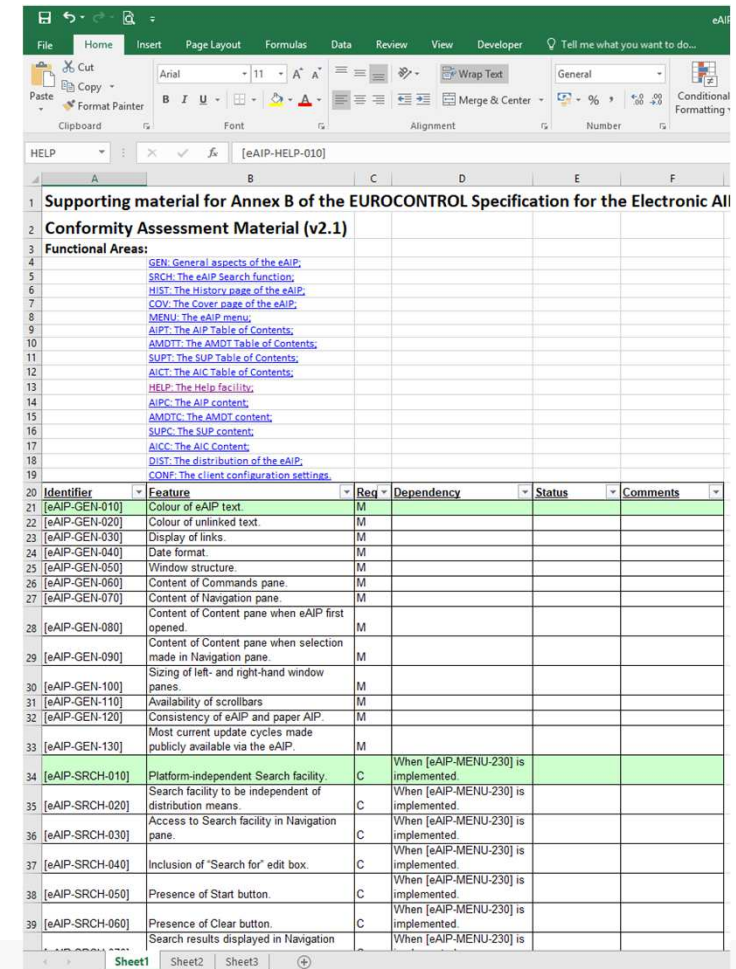
eAIP

Additional information

■ eAIP Specifications



■ eAIP Conformity Assessment Matrix



Identifier	Feature	Req	Dependency	Status	Comments
[eAIP-GEN-010]	Colour of eAIP text.	M			
[eAIP-GEN-020]	Colour of unlinked text.	M			
[eAIP-GEN-030]	Display of links.	M			
[eAIP-GEN-040]	Date format.	M			
[eAIP-GEN-050]	Window structure.	M			
[eAIP-GEN-060]	Content of Commands pane.	M			
[eAIP-GEN-070]	Content of Navigation pane.	M			
[eAIP-GEN-080]	Content of Content pane when eAIP first opened.	M			
[eAIP-GEN-090]	Content of Content pane when selection made in Navigation pane.	M			
[eAIP-GEN-100]	Sizing of left- and right-hand window panes.	M			
[eAIP-GEN-110]	Availability of scrollbars.	M			
[eAIP-GEN-120]	Consistency of eAIP and paper AIP.	M			
[eAIP-GEN-130]	Most current update cycles made publicly available via the eAIP.	M			
[eAIP-SRCH-010]	Platform-independent Search facility.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-020]	Search facility to be independent of distribution means.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-030]	Access to Search facility in Navigation pane.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-040]	Inclusion of "Search for" edit box.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-050]	Presence of Start button.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-060]	Presence of Clear button.	C	When [eAIP-MENU-230] is implemented.		
[eAIP-SRCH-070]	Search results displayed in Navigation	C	When [eAIP-MENU-230] is implemented.		

Integrated briefing

Principles

- Provision of relevant aeronautical information (AI) which is mainly available in the form of the Integrated Aeronautical Information Package (IAIP) allowing the pilot to prepare him/herself before conducting a flight
- The process where a user is supplied with or supplies himself with all relevant aeronautical information (AI) in order to plan or to execute a flight is known as briefing
- The typical system output of a briefing process is the 'Preflight Information Bulletin (PIB)'. Additionally, static data such as AIP, AIP SUP or AIC is either provided through consultation or in electronic form through briefing systems

Integrated briefing

Principles

- Integrated Briefing is a system or service meeting and fulfilling the generic briefing process and enhancing it by integrating access to and provision of additional data elements such as:
 - AIS (NOTAM, SNOWTAM, ASHTAM, Static data elements of AIP etc)
 - ARO (flight plan and all related entities)
 - MET (SIGMET, METAR, SPECI, TAF, Upper Wind and temperature, etc.),
 - ATFM (entities related to flight plan such as AIM, ANM, CRAM or flight plan updates influencing the flight intention)
 - Other information such as GPS availability, etc.

Integrated briefing

Self-Briefing

Facilitation of Self-Briefing

- “Self Briefing” refers to the ability for a pilot to make use of briefing equipment by himself/herself, entering the required information and obtaining the briefing
- “Self Briefing” is not intended to indicate the location of the briefing equipment. Whether the pilot uses equipment at a major airport, at a local airfield or uses the Internet to obtain the briefing can all be instances of “Self Briefing”.
- In an automated environment (Self-Briefing), AIS staff is often not personally present at service station and the provision of relevant data is assured through (self) briefing systems (PC Terminal, printer etc) supported by means of consultation.