

SINGLE-CLICK ELECTRONIC AIP

A fully automated electronic Aeronautical Information Publication system for AIM/SWIM environments

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The Aeronautical Information Publication (AIP) is the only official document offering all permanent aeronautical information related to a country. Its content is defined by the ICAO Annex 15 and has to be published by every state.

The ICAO State Letter for the adoption of Amendment 36 to Annex 15 proposed new ICAO recommended practices for the provision and on-screen consultation of the AIP, related amendments, supplements and aeronautical information circulars. Therefore ICAO's Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM) Study Group (AIS-AIMSG) has developed and published guidance material for electronic AIP (eAIP) in order to support States' efforts to comply with this recommendation. The idea of eAIP is to move away from paper-based document management and on to fully electronic publishing.

The next step towards AIM is to store all aeronautical information in a central database. Database items are then directly referenced from the electronic AIP documents instead of values being inserted via an error-prone copy/paste approach. The advantage of a centralised database is that there is only one single source of information, which can be checked for consistency and integrity. Many applications can make use of this centralised data store without the risk of rendering data inconsistent – as opposed to systems where data is stored in several places, usually with overlapping data sets.

The solution

As a leader in providing user-friendly turnkey solutions that are based on key-technology enabled user-friendly tools, COMSOFT released a new data-driven eAIP system fully in-line with upcoming international and European standards as a modular part of its integrated AIM solution.

Synclude's Group Verve AIS, a document management system for the AIM domain, and COMSOFT's Aeronautical Data Access System – Aeronautical Information Management Database (CADAS-AIM_{DB}), a database implementing the newest version of Aeronautical Information Exchange Model 5 (AIXM 5), are the core components of this completely new kind of publication system for eAIP as shown in Figure 1.

Developed as a COTS product, the eAIP publication system found its first customer in ECAC member Estonian Air Navigation Services (EANS), which uses it to manage and publish the national AIP in a fully electronic format. The system is in line with ICAO and European requirements, including the European Commission regulation No. 73/2010 about the quality of aeronautical data and aeronautical information for the Single European Sky.

The underlying CADAS-AIM_{DB} database is crucial for a complete AIM solution and offers open interfaces for the exchange of aeronautical data with other applications in AIXM 5 format. Based on this open interoperability, the system can be easily augmented by new applications such as Digital NOTAM

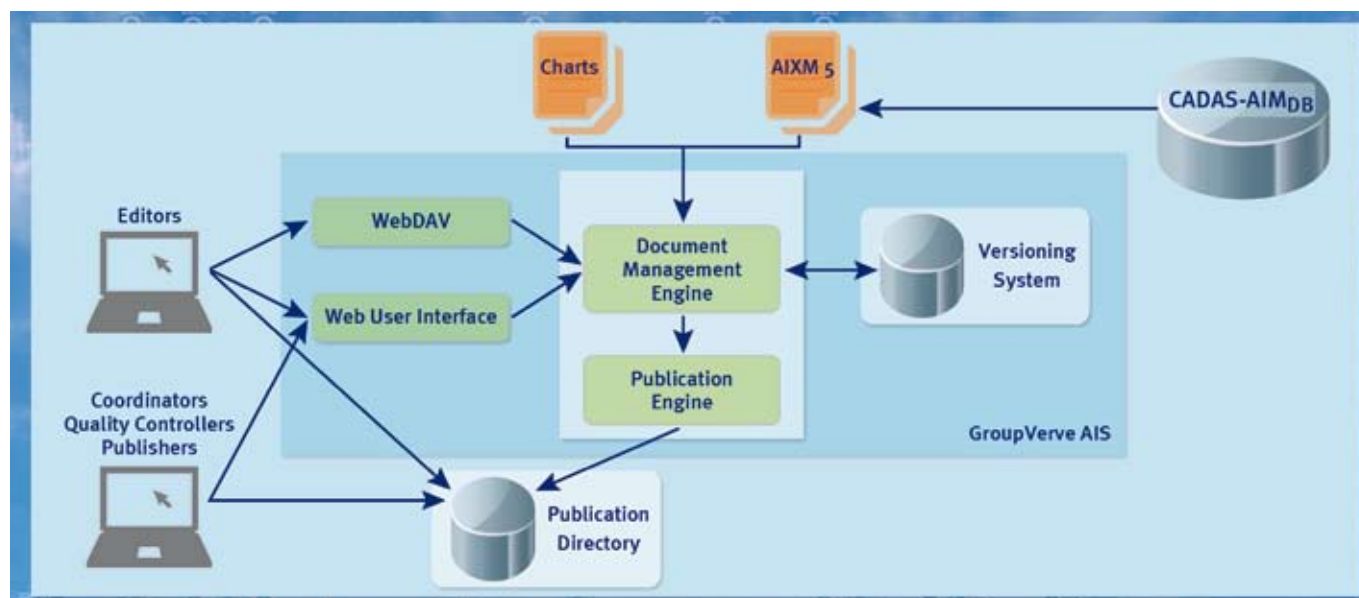


Figure 1: Architecture of the eAIP solution

and aeronautical charting and procedure design as shown in Figure 2, without replacement or modification of components already in operation. Building on CADAS-AIMDB enables EANS to follow the ICAO AIS to AIM roadmap and to fulfil the most recent regulations in a cost-effective way. Two other customers have selected COMSOFT's new eAIP solution as part of their AIM system procurement, and plan to go operational in 2011.

Excellence through innovation

What is so special about the COMSOFT eAIP solution? Not only does it combine best practice with modern concepts, it also has an inherent openness that bridges the gap to legacy systems. It guarantees that AIP publishers can benefit from the new AIM/SWIM concepts while remaining fully integrated and interoperable with their existing environment.

An innovative approach has been used throughout the system, resulting in a comfortable production environment for aeronautical information. The most striking features are:

Use of a WYSIWYG XML editor

The eAIP standard is based on the eXtensible Markup Language (XML), which is a fully computer-readable format. However most eAIP vendors still base their solutions on production tools that stem from the paper age. These standard text editors make it relatively easy to create an AIP document in the first place, but they all suffer from insufficient XML processing capabilities. Therefore standards-compliant management of an electronic AIP of several hundred pages quickly becomes a demanding task for editors, and a risk for users who rely on the quality of the published documents. Almost all airspace users or managers such as pilots, airlines and air traffic controllers, as well as value-adding companies, have to consult the AIP regularly. This makes it one of the most important sources of information in the air navigation domain.

Collaboration

The underlying document management system makes it easy to share work among a number of editors and therefore provides a first-class framework for managing large AIP documents. Concurrent editing and conflict resolution are just a few of the

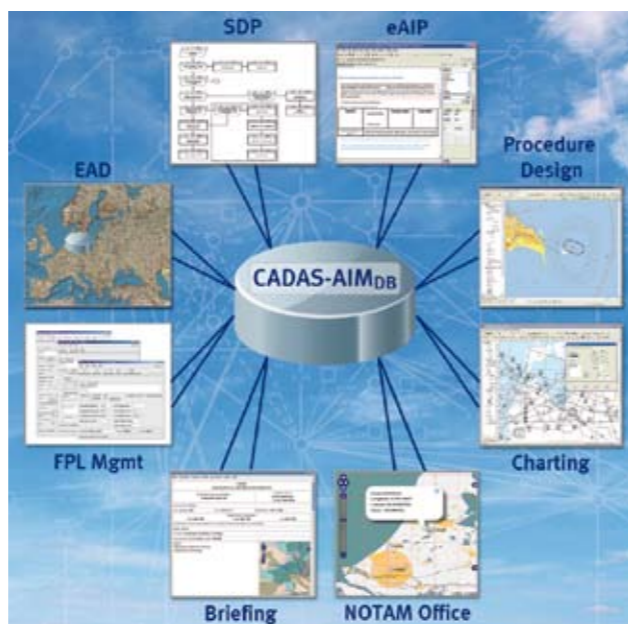


Figure 2: AIM solution overview

advantages that stand out in this specialised editing framework.

Eurocontrol SDP compliance

Full support of Eurocontrol static data procedures facilitates quality management not only at data level but also at AIP document level as shown in Figure 3. This guarantees the highest possible level of data quality.

Data referencing

Direct datalinks into the underlying AIXM 5 database CADAS-AIMDB enable a fully data-driven production process. This means that information such as a specific runway length is not simply copied into the eAIP document; rather, a unique ID key is stored instead. If, for instance, the length of a runway changes, this change needs only to be stored in the database. No further tasks have to be performed and a fully standards-compliant eAIP, including amendment, is generated through a single click in the eAIP production environment.

Native AIXM 5 data exchange

AIXM 5 has been adopted as the ATM information reference model (AIRM) in SESAR. This ensures the exchange of unambiguous ATM information in Europe, USA and beyond.

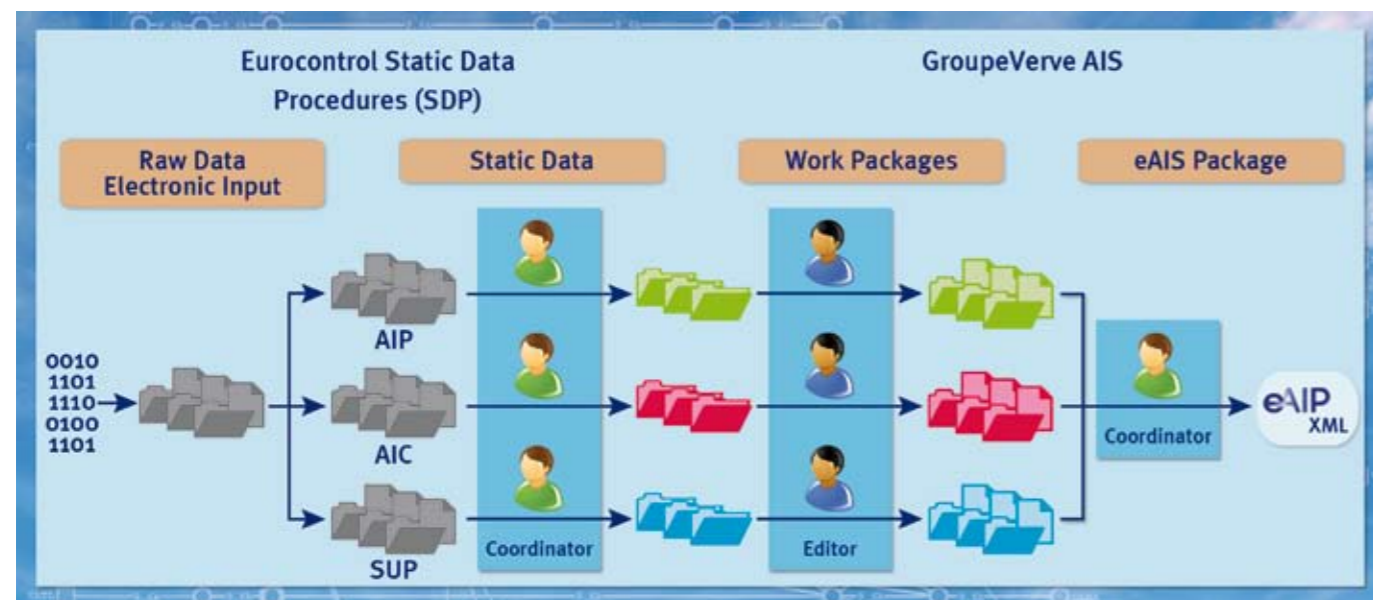


Figure 3: eAIP data procedures and parallel work packages

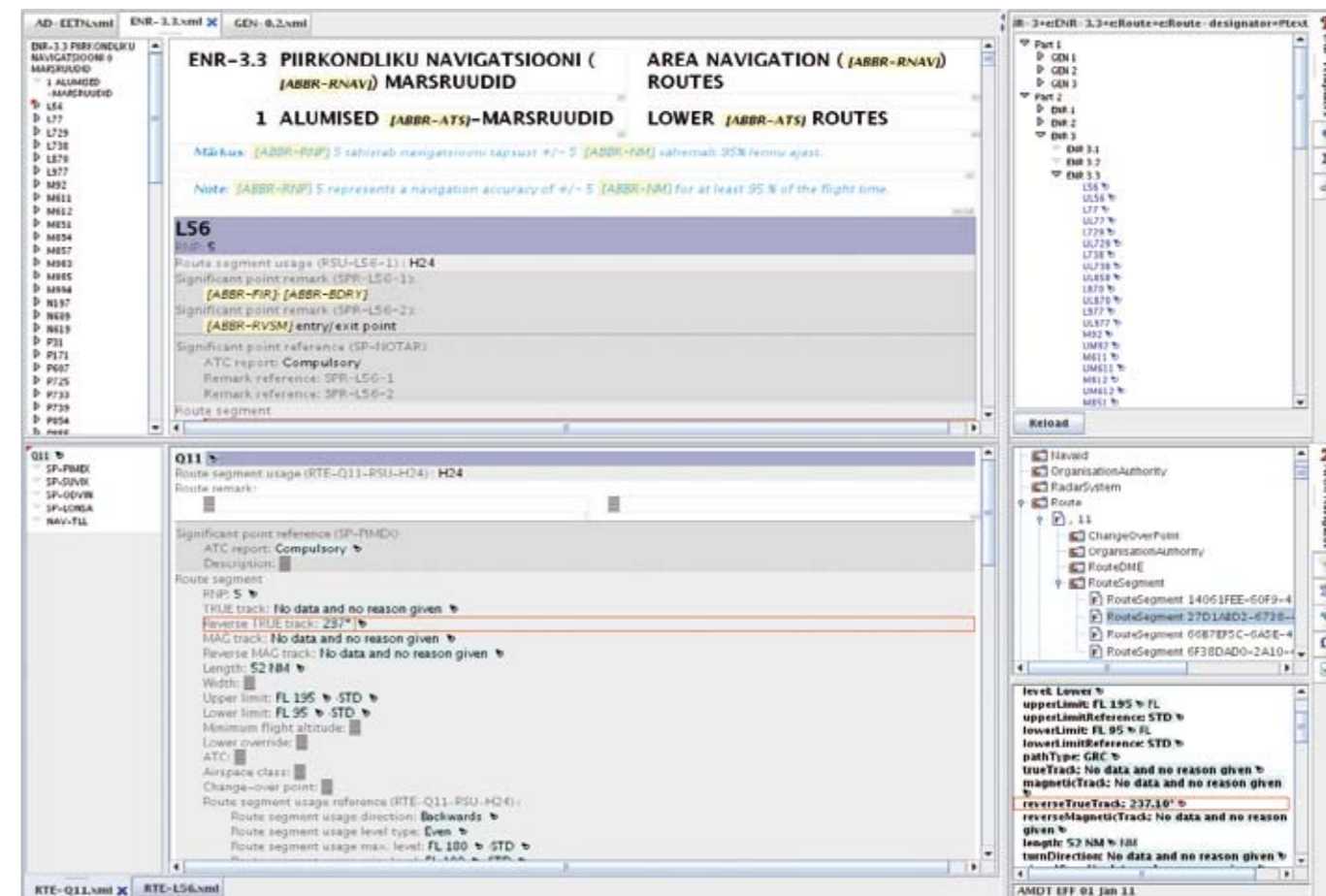


Figure 4: WYSIWYG eAIP editor with database references

Since all systems within the SWIM environment will eventually communicate with each other using AIXM 5, COMSOFT took the technological leadership and based all its AIM products on AIXM 5. Through research activities funded by Eurocontrol and FAA, the modular COMSOFT AIM system has been developed to comply with SESAR, SWIM and eventually IM requirements.

Figure 4 shows a screenshot of the eAIP editor front-end. In the upper half are, from left to right, the table of contents, bilingual edition area and the eAIP template navigator that allows easy access to the AIXM 5 database. At the lower half, from left to right, are the table of contents of the currently selected template, a detailed parameter list and the list of the template-specific AIXM 5 database properties. These frames support convenient navigation through the AIXM 5 database while retaining an overall WYSIWYG-like look and feel of the AIP content. Everything is controlled from within a single framework that efficiently supports editors in not losing their focus on high-quality production and publication.

The key to AIM

The new AIXM 5 paradigm manifests itself in any piece of the COMSOFT solution. For instance the eAIP production system receives data from the database not in a proprietary data format but in standardised AIXM 5. Since each feature in AIXM 5 carries a worldwide unique identifier, it is straightforward to reference database values from within electronic documents

using these IDs. Compared with this modern approach, other eAIP solutions base their data referencing either on proprietary exchange formats or AIXM 4.5. It is clear that these solutions have reached their end of life in light of AIXM 5, and need to be replaced in due time.

The simple explanation for why systems based on AIXM 4.5 are at their end of lifecycle is that AIXM 4.5 and AIXM 5.1 are incompatible. Although AIXM 4.5 can be treated as a subset of AIXM 5, conversion from AIXM 5.1 to 4.5 is ambiguous. Also, these models use different semantic encoding rules. But how can data integrity be guaranteed if you consider an AIP document that has been created using AIXM 4.5 and compare it with the same information transmitted through an AIXM 5 datalink? The bottom line is that data consistency and quality are jeopardised if the eAIP production is not based on exactly the same exchange model as the one being used for AIM.

The SESAR initiative has also found that the data exchange models need to be harmonised in favour of AIXM 5. The only solution to this dilemma is to base all information management on a native AIXM 5 database like CADAS-AIMDB.

Fear, uncertainty and doubt

There has been considerable debate about whether AIXM 5 is mature and ready for the market. Its detractors claim that it has too many shortcomings. However its predecessor AIXM 4.5 had many more problems – at least enough to justify a complete

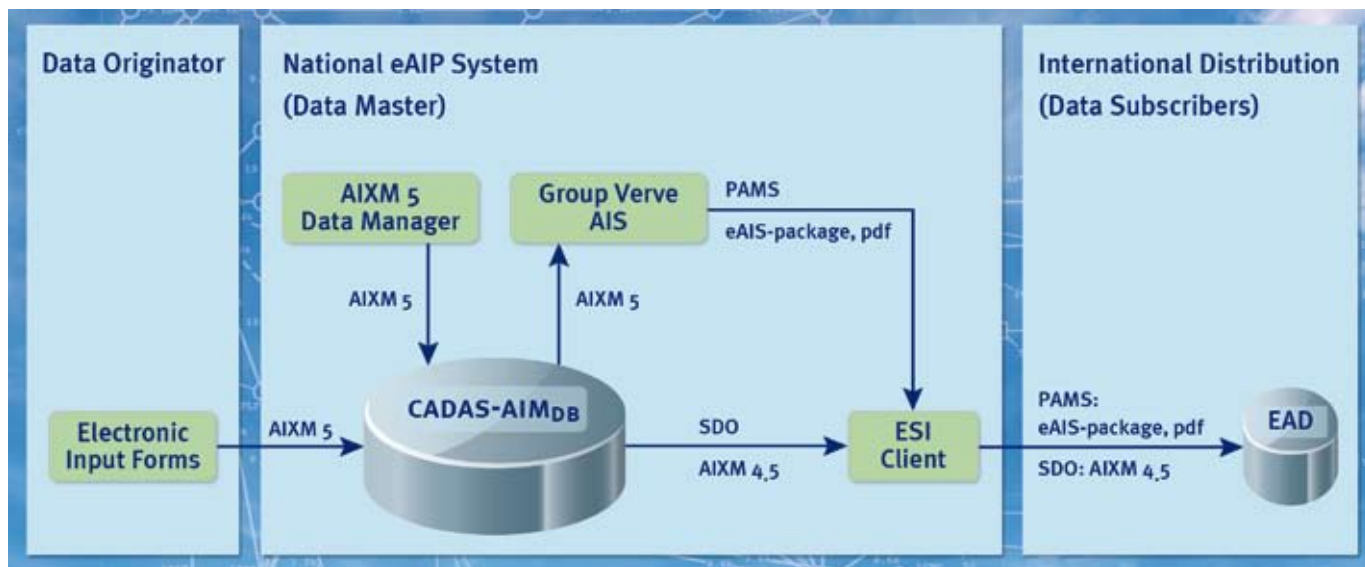


Figure 5: eAIP integration with data originator and external system

redesign of the exchange model, resulting in AIXM 5. Even Eurocontrol recommends adopting the latest aeronautical information exchange model, which, again, is AIXM 5.

Some of these detractors are providers of AIXM 4.5 solutions, to which they recently migrated from the much older AIXM 3.3. AIXM 5 now challenges them to completely redesign their software.

Connecting the world

The European AIS Database (EAD) is a huge data store that will eventually store all aeronautical information from all ECAC states. Not only AIP information is stored in EAD but also dynamic information such as international NOTAM messages. A large number of European states have already migrated to EAD and make intensive use of the upload and download facilities. Even non-European states are encouraged to connect to EAD in order to benefit from a global aeronautical data exchange.

The COMSOFT solution is fully compatible with European standards; therefore the eAIP production system can be connected to the EAD through the EAD system interface (ESI). The system allows upload of an eAIS package, which is the published AIP including all recent updates such as amendments, supplements and circulars. Uploaded documents can be accessed by all other EAD users. Moreover, aeronautical information from the local AIXM 5 database CADAS-AIMDB can be uploaded as static data to the EAD as shown in Figure 5. This is a very useful feature since the EAD is still based on AIXM 4.5 and is only slowly migrating to AIXM 5. CADAS-AIMDB performs an automatic conversion of the aeronautical information from AIXM 5 into AIXM 4.5 format during the upload process to EAD. Although the conversion limitations described above exist for this approach, it is the only viable one to bridge the gap until EAD fully supports AIXM 5 data. However since CADAS-AIMDB is the master database for the national aeronautical data, no bi-directional conversion is necessary. The uni-directional conversion from AIXM 5 to AIXM 4.5 avoids the risk of data inconsistencies in the databases. The data conversion feature also allows seamless interoperation with other legacy systems. In the scope of EAD connectivity this

concept results in a cost-effective approach. Each time the EAD is enhanced in order to support a larger set of AIXM 5 it requires just a small update to the CADAS-AIMDB conversion module. No application connected to the CADAS-AIMDB or the database itself needs to be updated in order to follow the EAD migration path, which results in considerable cost savings.

Although the publication of aeronautical information has been automated as much as possible, communication with data originators is usually still a labour-intensive task. Raw data received from data originators need to be validated, checked for integrity, approved, and finally committed to the database. Errors occurring in this data chain can result in wrong data and impose a high risk for all airspace users. Fortunately the system supports these tasks by automated workflows and convenient electronic input forms for data originators, as shown in Figure 5. Detailed audit trails of all transactions are stored with the data, providing full traceability from originator to the published electronic document.

AIP checklist

The following checklist summarises the most outstanding features of COMSOFT's eAIP system.

- Integrated and easy-to-manage eAIP production environment;
- Single-click publication;
- Compliant to ICAO and Eurocontrol standards and recommendations;
- Especially compliant to European regulation EN73/2010 about the quality of aeronautical data and aeronautical information for the Single European Sky (ADQ IR);
- SESAR/SWIM compliance;
- Based on AIXM 5;
- In-line with ICAO AIS to AIM roadmap;
- Interoperability through standard interfaces, e.g. EAD connectivity;
- Cost-effective solution because the modular system can be augmented in individual steps by further applications such as digital NOTAM, aeronautical charting, etc. ❖

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