D4.3 Governance Recommendations for the use of semantic technologies in SWIM

D4.3
BEST
Grant: 699298
Call: H2020-SESAR-2015-1
Topic: Sesar-03-2015
Information Management in ATM
Consortium coordinator: SINTEF
Dissemination Level: PU
Edition date: 30 April 2018
Edition: 00.01.00

Founding Members

ACHIEVING THE BENEFITS OF SWIM BY MAKING SMART USE OF SEMANTIC TECHNOLOGIES

Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Joe Gorman, SINTEF	Project Coordinator	2018-01-09
Scott Wilson, EUROCONTROL	Project Participant	2018-02-12

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Audun Vennesland, SINTEF	WP1 leader	2018-04-19

Approved for submission to the SJU By — Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
Approved by consortium in accordance with procedures defined in Project Handbook.	All partners	2018-04-30

Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

Document History

Edition	Date	Status	Author	Justification
00.00.50	2018-01-11	PCOS Proposed	J. Gorman	
00.00.60	2018-04-12	For input/review by co-author	J. Gorman	Completed all sections in accordance with experiences and discussions in the project
	2018-04-17		S. Wilson	Minor updates
00.01.00	2018-04-30	Released	J. Gorman	Incorporated minor changes in accordance with internal review. Updated administrative information.

Founding Members

EUROPEAN UNION   EUROCONTROL

BEST

Achieving the BEnefits of SWIM by making smart use of Semantic Technologies

Abstract/Executive Summary

"Governance" is about defining the processes by which decisions are made about proposed changes to an entity of common interest. In the context of ATM, and the information management role of the BEST project, this relates to information models for ATM. Compliance assessment can be considered to be part of governance, and the effectiveness of procedures and tool support for this can have a major impact on the successful widespread adoption of a model under governance.

The AIRM that was developed in the SESAR project has now been adopted as the "European AIRM", Its custodian is EUROCONTROL and a CCB (Change Control Board) has been established for it. It will be kept aligned with separate activities by ICAO to develop a "Global AIRM". The AIRM is a large model, expressed in UML, and provides a common reference for ATM information. In addition, data exchange models such as AIXM co-exist with AIRM and should be compliant with it.

The overall issue of governance in SWIM is currently the subject of an on-going project, but it is too early to take that into account in BEST. The results of BEST may be a useful input to the SWIM Governance project.

There are currently some issues with ATM information governance: (1) While having a single model (AIRM) makes it relatively easy to ensure internal consistency, its wide scope means that CCB members may often lack expertise on specific domains; (2) The wide scope can also lead to long release cycles; (3) Compliance assessment and consistency checking are currently manual and time-consuming processes.

Technical results in BEST include tools for automatic transformation of UML models to ontological representations, partially automated compliance checking, and partially automated decomposition of large models into smaller modules.   All of them depend on use of ontologies rather than UML for describing information models. Use of BEST results can offer advantages for governance by making it feasible to modularise the AIRM and so have smaller, more expert CCBs, and by helping to automate compliance assessment.

BEST recommends that people responsible for ATM information governance should read the observations made in this deliverable and consider whether use of semantic technologies could enhance governance strategies. If semantic technologies are adopted, and modules created, the AIRM should still remain as a global reference, governance processes should officially "approve" modules and consistency between them should be ensured.

Table of Contents

Founding Members

EUROPEAN UNION   EUROCONTROL

1 Introduction: About this document[1]

1.1 Purpose

The Grant Agreement describes the content of this deliverable as follows:

> *This deliverable will describe an overall approach to governance that deals with the emergence and evolution of semantic technologies in ATM. An emphasis will be put on how ontologies can co-exist and co-evolve and how to manage their dependencies with AIRM and other relevant information exchange models and standards.*

Note that while the title of the deliverable is about governance in "SWIM", the text above about the role of the deliverable selects a focus on issues related to AIRM i.e. related to *information*. SWIM as a whole has a wider scope (e.g. it also includes service descriptions), but it is not within the scope of this deliverable to address *all* aspects of SWIM governance. Thus, the purpose of the deliverable is to derive recommendations about SWIM governance – specifically *information* governance – exploiting the possibilities offered by semantic technologies, based on experiments and tools developed in BEST, and observations on the operation of governance processes.

1.2 Intended Readership

The document would be of interest to:

1. AIRM CCB (Change Control Board) members
2. Eurocontrol as maintainer of the AIRM
3. SWIM Governance project members
4. Participants in SESAR projects with activities where the AIRM is relevant (principally project PJ19.03)
5. Anyone with an interest in governance of information models, particularly (but not exclusively) in the ATM domain

1.3 Relationship to other deliverables

The deliverable is related to:

- D1.1 Experimental Ontologies formalising aspects of ATM data and metadata [7]
- D1.2 AIRM Compliance Validator ensuring compliance between ontology modules and the AIRM ontology [8]
- D5.2 Ontology Modularisation Guidelines [9]

---

[1] The opinions expressed herein reflect the author's view only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein.

Together, these deliverables describe techniques for using ontologies to define ATM data in a modular way, how tool support can be used to check consistency, and the steps/tools needed to split an ontology into separate modules. D5.2 is of particular relevance, as the tool support described in the deliverable makes it feasible to modularise a large ontology in a practical setting. The techniques presented in these deliverables represent a radical approach compared to current practice, and it is this background that implies the need to consider implications for governance – the topic of this deliverable.

1.4 Structure of this deliverable

The document follows a simple structure, the logic of which can be easily understood from a quick review of the "Table Contents". Readers who are in a hurry and not interested in details of background are advised to read only sections 3.2, 4 and 5.

Founding Members

EUROPEAN UNION   EUROCONTROL

2 "Governance" and "Compliance" in an ATM context

2.1 What is Governance?

The word "governance" is typically used in the context of countries, societies or companies and is therefore often associated with politics, power and authority. In such contexts, "governance" relates to countries/organisations *as a whole*, encompassing decisions about all sorts of things about how they operate.

In the context of ATM, we are not talking about power and politics or the way organisations should be run. The subject that is being "governed" is not an organisation but rather a set of technical specifications. For the purposes of this deliverable, we provide the following definition:

Definition: **Governance**:   A description of the procedures used to manage the development of an entity of common interest to a community, including definition of the individuals/organisations authorised to make changes, and the processes by which they arrive at decisions.

Specifically, for ATM:

- An "entity of common interest" is a standard intended to provide a reference for information exchange in ATM systems (e.g. AIRM, AIXM).
- A "community" consists of the organisations and individuals working on development of software and processes for ATM (and who will therefore be users of the "entity of common interest").
- "Individuals/organisations authorised to make changes" are the people actively involved in making changes to an "entity of common interest" (e.g. members of Change Control Boards), within a context where members of "the community" are satisfied that their interests are properly taken into account.

Thus: governance in ATM is essentially about how to maintain standards in such a way that there is acceptance and "buy-in" within the ATM community.

Note that, in ATM, there are multiple standards that are subject to governance, potentially by different organisations.

In the original SESAR project, project number 8.1.3 provided an AIRM Governance Handbook [1].   It was successfully used as the basis for governance procedures related to development of the AIRM for

the duration of the SESAR project. The handbook defines key things considered to be within the scope of governance, including[2]:

1. Detailed procedures to be followed to submit new information requirements and models for integration in the AIRM;
2. Details of the process to be followed (i.e. what actions to take at what time);
3. The manner in which assessments will be made of whether submitted models need to be modified in order to achieve integration with other models (e.g. to deal with overlaps with other domains);
4. The manner in which models that have *already* been integrated in the AIRM can submit CRs to make modifications to the AIRM, and how these will be dealt with.

The handbook also defines things that are explicitly not considered to be in the scope of governance, including:

1. Judgements, based on detailed expert knowledge of domains, about what information requirements need to be modelled in the AIRM;
2. Scheduling of work and quality control processes.

The clarification about the scope of governance provided by [1] remains relevant, and will be adopted by this deliverable.

2.2 Is "Compliance Assessment" part of Governance?

Given that ATM governance is about maintaining a standard, the question arises about *compliance* to that standard. The benefits of a standard are only achieved if members of the community adhere to the standard and can provide evidence that they do so. *Compliance assessment* is the process used to determine whether a given product does indeed adhere to a standard.

Section 4.3.3 of the AIRM Governance Handbook [1] takes the view that governance is about dealing with changes to the AIRM itself, and about compliance assessment – but does not cover tools and mechanism for carrying out the assessment.

The success of a standard depends on the practicality of being able to assess compliance with it. If compliance testing is time-consuming, error-prone, unreliable or costly (or a combination of these), this will act as a serious barrier to widespread adoption of the standard. Thus, our conclusion is that:

While it can be argued that tooling aspects of compliance testing, as discussed in [1], are not formally within the scope of ATM governance, compliance assessment itself is certainly within the scope of this deliverable.

---

[2] The list is based on the content of [1], but with some details omitted, and some simplifications compared to the original text.

Founding Members

EUROPEAN UNION   EUROCONTROL

3 Governance of ATM Models: Current Status and Issues

3.1 Current Status

3.1.1 AIRM

3.1.1.1 History and Background

AIRM stands for "ATM Information Reference Model". It was developed and refined in the SESAR project[3] and its role, as defined on the official website [2], is:

> "
>
> The ATM Information Reference Model (AIRM) is the common reference language for aviation information and data. The AIRM contains the civil and military information constructs relevant to ATM in support of information exchange via SWIM. The AIRM represents the ATM related aviation information constructs in a harmonised way. This facilitates the use, re-use and combining of information exchanged through SWIM and supports semantic interoperability within the context of the modernised European ATM network.
>
> The AIRM is used as a reference:
>
> - For the common understanding of information and data exchanged through SWIM.
> - To standardise SWIM information services.
> - To define ATM related information (e.g. Exchange Models)
>
> "

A Community webpage [3]has been set up to facilitate access to relevant documents and exchange of ideas.

The AIRM grew from detailed exchange models for different domains, with a lot of the early work involving harmonisation and consolidation of models for different domains.

Governance processes were put in place early on then refined during the project, based on feedback about practical use of the processes. The Governance processes were used effectively throughout the SESAR project.

---

[3] In this document "the SESAR project" refers to the original SESAR project, which ran from 2007 to 2016 and was called simply "SESAR". We refrain from usage of the name "SESAR 1" as there never was any project with that name. The new project that is currently running is called "SESAR 2020" and we use that name to refer to that project.

3.1.1.2 Status at the end of the SESAR project

By the end of the SESAR project:

- A single, large ATM-wide model emerged covering multiple domains: the AIRM.
- The AIRM was defined as a UML model.
- A single CCB (Change Control Board), established early in SESAR, operated successfully until the end of the project. Membership of the CCB was largely based on a one-representative-per-project structure.

3.1.1.3 Current status, in initial years of SESAR 2020 Project

- The AIRM produce in SESAR has now become the "European AIRM", and is maintained by Eurocontrol. It is described in [2].
- The European AIRM has its own CCB (Change Control Board), with membership open to stakeholders in the ATM domain. In addition to the formal membership structure, the European AIRM is establishing a wider community to be involved in detailed technical work associated with refinement and evolution of the AIRM. See: [3].
- ICAO is currently working on establishment of the Global AIRM. Its purpose and structure are analogous to the European AIRM. Moreover, its scope is similar (but not identical) to the European AIRM. The scope is different due to the fact that it incorporates inputs from other ICAO regions such as from the the Federal Aviation Administration's enterprise architecture level data modelling activities, and that it does not include concepts which are unique to Europe such as the extended arrival management concept.
- One of the tasks of the Eurocontrol AIRM CCB is to strive to achieve full alignment between the European AIRM and the Global AIRM.
- The inter-relationships between the European AIRM, the Global AIRM and SESAR projects are described in section 8, "Appendix B: European AIRM, Global AIRM and SESAR projects".

3.1.2 Information Exchange Models

- The AIRM covers multiple domains, and the relationships between these. It is complemented by domain-specific data exchange models: AIXM, IWXXM and FIXM. BEST deliverable D1.1 [7], section 2.5 provides more information about these.
- Semantic consistency between these exchange models and the AIRM is essential to successful, standardised information exchange.
- Each of the exchange models currently has its own governance process.

3.1.3 Wider SWIM Context

SWIM as a whole has a scope that is wider than information aspects. A large project is currently underway to look into all aspects of SWIM Governance. It will result in a set of recommendations on how Governance should be dealt with in SWIM, including what specifications, models etc. should be under governance, which bodies will be authorised to makes changes and the nature of the processes they will follow. This will include, for instance, governance of services and their descriptions. Work on this is currently on-going. The authors of this deliverable do not have formal access to any intermediate results from this work but have had some informal discussions with the SWIM Governance project, including a brief presentation of BEST results. It is too early for BEST to take account of the results of the SWIM Governance project, other than to say that the work here described

Founding Members

may be a useful input to the SWIM Governance Project and that decisions of the SWIM Governance Project will, ultimately, affect the extent to which semantic technologies can play a role in SWIM Governance.

It is also relevant to the wider context to mention that Eurocontrol has published a set of three Specifications, as official standards, related to the AIRM and Information Management, dealing with infrastructure, services and information. See: [4], [5], [6].

3.2 Governance Issues arising from current status

Given the current status as described above, and experiences and lessons learned about AIRM Governance in the SESAR project, we have identified a set of governance issues that are relevant to the work of BEST. These are listed below, each identified with an ID and short title. Section 4.2 then takes each of these in turn and discusses how BEST results and lessons learned can impact these issues.

Area	Governance issue ID/Title	Strength/weakness	Issue
The AIRM is described by one large model, covering a range of multiple subject fields.	GI-01 Internal Consistency	Strength	Because there is only one model, subject to a single change control process by one group of people, maintaining internal consistency is concentrated in "one place" and is therefore relatively *straightforward*.
	GI-02 Domain Knowledge	Weakness	Decisions about CRs often require detailed domain knowledge. If the number of members of the CCB is small, the number of members of the CCB who have the required expert knowledge for a specific CR may be very low indeed. This may affect the *quality of decisions* and can also lead to *motivational problems* for CCB members who may consider that they are being asked to make decisions about things about which they have no solid basis for an opinion. The decision quality problem could be overcome by having a large CCB, to ensure that there are several members with detailed knowledge in all domain areas. But this would not address the motivational problem and could lead to decision making becoming cumbersome due to the high number of members.

Area	Governance issue ID/Title	Strength/weakness	Issue
	GI-03 Release Cycles	Weakness	Working on a large model requires a lot of effort. This is time-consuming and can lead to *long release cycles*.
Compliance Assessment	GI-04 Compliance Assessment	Weakness	Compliance assessment is a largely manual process and is therefore time consuming and labour intensive. This can act as a *barrier to uptake*, especially when new releases are made, implying the need for a new assessment.
Inter-model semantic consistency	GI-05 Exchange Model Consistency	Weakness	For the benefits of a standardised reference model to be achieved, each of the exchange models must be kept fully consistent with the AIRM. Indeed, this is part of its role as a "Reference Model". This creates inter-dependencies between the AIRM and the individual exchange models, and these must be managed carefully to ensure consistency. This imposes work on the separate governance processes that are applied for each model.

Founding Members
EUROPEAN UNION   EUROCONTROL

4 Possible implications of BEST for Governance

4.1 BEST results and lessons learned of relevance to governance

Work done in BEST in implementing and experimenting with ontologies, and tools for transforming and comparing ontologies has taught us some "lessons" that can be relevant for governance. The most important lessons are:

(L1) An information model can be expressed as an OWL ontology rather than as a UML model, without any loss in expressivity. (See D1.1 - [7]).

(L2) Many people have limited (if any) knowledge of ontologies, and need guidance/training to understand the nature and use of ontologies. (We do not have a deliverable on this topic, but learned this lesson when presenting BEST results to groups of people with limited knowledge of ontologies).

(L3) It is possible to automatically transform the AIRM, expressed in UML, to an equivalent ontological representation. (See D1.1 - [7]).

(L4) It is possible to transform exchange models to equivalent ontological representations, using a partially automated process. (See D1.1 - [7]).

(L5) If one or more information models have been expressed as ontologies, it is technically possible to partially automate the process of determining the degree of semantic matching between them. (See D1.2 - [8]).

(L6) An area of application of (L5) is to support the task of carrying out compliance assessment with respect to the AIRM. (See D1.2 - [8]).

(L7) If an information model has been expressed as an OWL ontology, it is technically possible to partially automate the process of splitting it into a coherent set of smaller modules. This can be done based on partitioning into modules of approximately equal size *or* based on extraction of groups of concepts related to a topic (domain). (See D5.2 - [9]).

4.2 Implications for Governance

For each of the governance issues identified in section 3.2, the table below shows the implications for governance of the lessons learned from BEST.

Governance Issue (from section 3.2)	Relevant BEST Lessons	Possibilities arising from use of BEST	Assessment/Discussion
GI-01 Internal Consistency	(L1) (L3) (L7)	If we transform the AIRM into separate modules corresponding to different domains, we can move away from having one large model to having many smaller models (separate modules), and each of these could be governed separately.	• We would still need a single reference model, to integrate the modules and act as an overall common reference. • It would be necessary to check for consistency between the modules and the AIRM; the Compliance Validator could be used for this. • With the potential for the modules to evolve separately and in parallel, and for the AIRM to also evolve in parallel, procedures would need to be incorporated in the separate governance processes to regularly check for consistency with other modules and the AIRM. Even with some tool support in place, this could potentially generate a significant administrative and/or technical workload.

Founding Members

EUROPEAN UNION   EUROCONTROL

Governance Issue (from section 3.2)	Relevant BEST Lessons	Possibilities arising from use of BEST	Assessment/Discussion
GI-02 Domain Knowledge	(L2) (L7)	Each module would have its own "CCB" – consisting of experts with specific expertise in the domain.	The potential problem of lack of expertise on the specific domain would be largely solved, as the separate CCBs would be composed of experts in the domain. However, there would potentially be a different "expertise" problem: CCB members would need to understand ontologies and the language(s) used to express them. This is probably not the case today for people who would typically be candidates for membership of CCBs, but is something that could easily be overcome with some basic introductory documentation and simple training materials. Furthermore, it might be possible to provide tool interfaces mimicking UML or some other lightweight modelling approach.
GI-03 Release Cycles	(L3) (L7)	Each module can have its own release cycle.	Release cycles could potentially be much shorter for individual modules as they are smaller and simpler than the AIRM as a whole. However: there is still a requirement for overall consistency (see GI-01), and that would need to be taken into account in the release cycles of the individual modules.

Governance Issue (from section 3.2)	Relevant BEST Lessons	Possibilities arising from use of BEST	Assessment/Discussion
GI-04 Compliance Assessment	(L5)	In principle, compliance assessment could be partially automated and time-consuming, labour intensive procedures could be avoided.	Automated compliance assessment could not normally be used for testing whether a given software application is compliant with the AIRM or an exchange model. However, with the AIRM Compliance Validator [8] developed in BEST this could change. The AIRM Compliance Validator identifies various semantic relations between an object under assessment and the AIRM using ontology matching techniques. That means that we would need an ontology description of the AIRM (that is something we already have from deliverable D1.1 [7]), but we would also need an ontology description of the application. More precisely: we would need an ontology description of the information model used by the application. Currently it is not common to use ontologies as part of the development process for software in ATM; other techniques such as UML diagrams or more informal methods are used in most cases. That is, however, something that may change in future as it is starting to become more commonplace to use ontologies for expressing detailed domain knowledge and for supporting data integration. Furthermore, with transformation tools such as the UML to OWL transformation developed in D1.1, information models expressed in UML can be transformed to an ontological representation.

Founding Members

EUROPEAN UNION   EUROCONTROL

Governance Issue (from section 3.2)	Relevant BEST Lessons	Possibilities arising from use of BEST	Assessment/Discussion
GI-05 Exchange Model Consistency	(L4) (L6)	Consistency between AIRM modules and Exchange model modules can be partially automated, significantly reducing the need for manual work.	As ontologies exist for both the AIRM and the exchange modules, consistency management between the exchange models and the AIRM can be performed (partially) automatically using the BEST AIRM Compliance Validator tool. It should also be pointed out that the Compliance Validator could be adapted to use other input model formats, such as XML schemas.

5 Recommendations

Based on the observations in the previous chapters, we have developed a set of recommendations regarding SWIM Governance in the area of information management. The recommendations are addressed to anyone potentially involved in ATM information governance. The recommendations are split into two groups. The first group is primarily aimed at assisting decisions about whether semantic technologies should be used in governance:

(R1) Before considering strategies for "governance", be sure to adopt a clear definition of exactly what you mean by this term and, in particular, the role of compliance assessment, and tool support for compliance assessment. We suggest adoption of the definitions provided in Chapter 2 of this document. If you prefer some other definition: that is also fine; the key thing is to have a clear definition that clarifies the scope of what you are considering.

(R2) Regardless of whether you consider that compliance is or is not formally part of "governance", take account of the fact that the time and effort required to carry out compliance assessment may be of crucial importance in bringing about widespread uptake of standards/models under governance. Any judgements made about approaches to governance should carefully consider any implications for compliance assessment.

(R3) If you are involved in the planning or execution of SWIM governance, or in other governance activities related to ATM information, be sure to read at least sections 3.2, 4 and 5 of this deliverable, in order to be made aware of the possible impact of use of semantic technologies for governance. If you are particularly interested, also read the other project deliverables that are referred to from this one, and/or contact the people who worked in the project. (See http://www.project-best.eu/).

(R4) For the specific governance role in which you are involved, systematically consider each of the "Issues" listed in section 3.2 (GI-01 to GI-05). Decide for each one how important/relevant it is to your particular case. Where the importance/relevance is high, read the corresponding text in the table in section 4.2 in order to gain insight into what scope for improvement may be offered by use of semantic technologies.

(R5) When designing the membership structure of a CCB (Change Control Board), make sure that: (a) It provides balanced representation of all relevant stakeholder roles; (b) It contains people with appropriate detailed knowledge of technical issues related to the information model being governed; (3) Its size is not so large as to be cumbersome for practical day-to-day operation. In trying to balance these factors, consider whether the information model that is within the scope of governance is perhaps too large to allow an appropriate balance, and whether splitting it into separate modules would be beneficial.

(R6) If, perhaps as a result of (R5), you decide that it would be useful to split a model into separate modules, be aware that this can be a large and complex job, and that it may not be feasible without some kind of tool support.

(R7) If you are considering using semantic technologies, be aware that this implies that users of models, and people involved in their governance, need some understanding of the idea of "ontologies" and the languages used to express them. Such knowledge is not currently

widespread in the ATM community. It is likely that this possible obstacle can be overcome by provision of introductory documentation and simple training materials.

The second group of recommendations assume that some decision has been taken to start using semantic technologies in governance of ATM information:

(R8)   The AIRM should remain as a single reference, expressed in UML, for the foreseeable future. However, it could co-exist with modules derived from it and expressed using other means such as ontologies.

(R9)   If semantic technologies (produced by BEST or some other source) are used to create an ontology-based description of the AIRM, the AIRM community (or CCB) should provide some "official" approval of it, stating it to be fully consistent with the AIRM as expressed in UML.

(R10) If semantic technologies (produced by BEST or some other source) are used to create a set of ontology modules of domain-specific subsets of AIRM, the AIRM community (or CCB) should provide some "official" approval of these, stating that they are consistent with the AIRM and provide full coverage of it.

(R11) Even if "official" modules are defined, people should feel free to develop other "personalised" modules for specific, specialist purposes. Any such derived modules would be owned by the person or organisation who produced them, and they would be free to implement their own change control process.

(R12) Any modules derived from the AIRM should be checked for correctness with respect to the AIRM (see [9]).

(R13) Any deficiencies observed in the single reference AIRM in UML can be addressed using existing AIRM governance mechanisms (CCB). Observed deficiencies might arise from independent sources but could also arise from changes made in modules derived from the AIRM.

(R14) A mechanism needs to be implemented whereby changes to the single reference AIRM trigger updates to relevant derived modules. This would not be strictly necessary for "personalised" modules as described in (R11).

(R15) Governance procedures should take account of the fact that the AIRM is used to derive XML schemas, exchange models etc., not just ontology modules.

(R16) Information Exchange models must carefully ensure that their semantics (including concept names, natural language definitions, and structure) are closely aligned with AIRM, to prevent semantic interoperability barriers, now and in the future.[4]

---

[4] This recommendation is based on observations/experience reported in D.1 [8], showing that – in their current versions – AIXM is terminologically close to AIRM, but IWXXM is not.

6 References

[1] *AIRM Governance Handbook*: Document produced by SESAR project 8.1.3 Version 00.01.06, 25 July 2014, available from [3]

[2] AIRM Official Website: http://airm.aero/

[3] AIRM Community Area (Provides access to relevant documents and a forum for discussion): https://ost.eurocontrol.int/sites/airm/SitePages/Home.aspx (requires One Sky account for access)

[4] "EUROCONTROL Specification for SWIM Technical Infrastructure", Edition 1.0, 01/12/2017, Reference nr: EUROCONTROL-SPEC-170, available at http://www.eurocontrol.int/publications/eurocontrol-specifications-system-wide-information-management-swim

[5] "EUROCONTROL Specification for SWIM Service Description", Edition 1.0, 01/12/2017, Reference nr: EUROCONTROL-SPEC-168, available at http://www.eurocontrol.int/publications/eurocontrol-specifications-system-wide-information-management-swim

[6] "EUROCONTROL Specification for SWIM Information Definition", Edition 1.0, 01/12/2017, Reference nr: EUROCONTROL-SPEC-169, available at http://www.eurocontrol.int/publications/eurocontrol-specifications-system-wide-information-management-swim

[7] BEST Deliverable D1.1 "Experimental Ontologies formalising aspects of ATM data and metadata". Available on project website at: http://www.project-best.eu/

[8] BEST Deliverable D1.2 "AIRM Compliance Validator ensuring compliance between ontology modules and the AIRM ontology". Available on project website at: http://www.project-best.eu/

[9] BEST Deliverable D5.2 "Ontology Modularisation Guidelines". Available on project website at: http://www.project-best.eu/

Founding Members

EUROPEAN UNION   EUROCONTROL

7 Appendix A: Acronyms and Terminology

Term / Acronym	Definition
AIRM	ATM Information Reference Model
AIXM	Aeronautical Information Exchange Model
ATM	Air Traffic Management
CCB	Change Control Board. A group of people authorised (as part of a governance process) to make decisions about proposed changes in an object of common interest (e.g. a standard, an information model).
CR	Change Request
FIXM	Flight Information Exchange Model
Governance	A description of the procedures used to manage the development of an entity of common interest to a community, including definition of the individuals/organisations authorised to make changes, and the processes by which they arrive at decisions.
ICAO	International Civil Aviation Organization
IWXXM	ICAO Weather Information Exchange Model
OWL	Web Ontology Language
SESAR	Single European Sky ATM Research
SWIM	System Wide Information Management
UML	Unified Modelling Language

8 Appendix B: European AIRM, Global AIRM and SESAR projects

This appendix explains the relationship between the European AIRM, the Global AIRM and the SESAR project. It is copied exactly from section 2.3 of deliverable D3.1 of SESAR project 19.03, produced in 2017. Note that there have been some changes in names following production of D3.1. So:

- *References below to "Eurocontrol AIRM" should be replaced with "European AIRM"*
- *References below to "ICAO AIRM" should be replaced with "Global AIRM"*

In order to consider how best to deal with the needs of SESAR 2020 given the context of AIRM change management, we need to consider how SESAR 2020 is structured. SESAR 2020 is organised into a set of projects, each with a set of participating organisations. The same organisation may participate in more than one project. In addition, the SJU has overall responsibility for all projects.

Project PJ19 has a special role when it comes to the AIRM, as the project's overall role is Content Integration. As the AIRM is of relevance and interest to multiple projects, it is natural that coordination of work aiming to update and improve the AIRM should be channelled through project PJ19. It is Workpackage 3 within PJ19 (referred to as PJ19.03) that has been given this role, and other SESAR 2020 projects will submit CRs to PJ19.03.

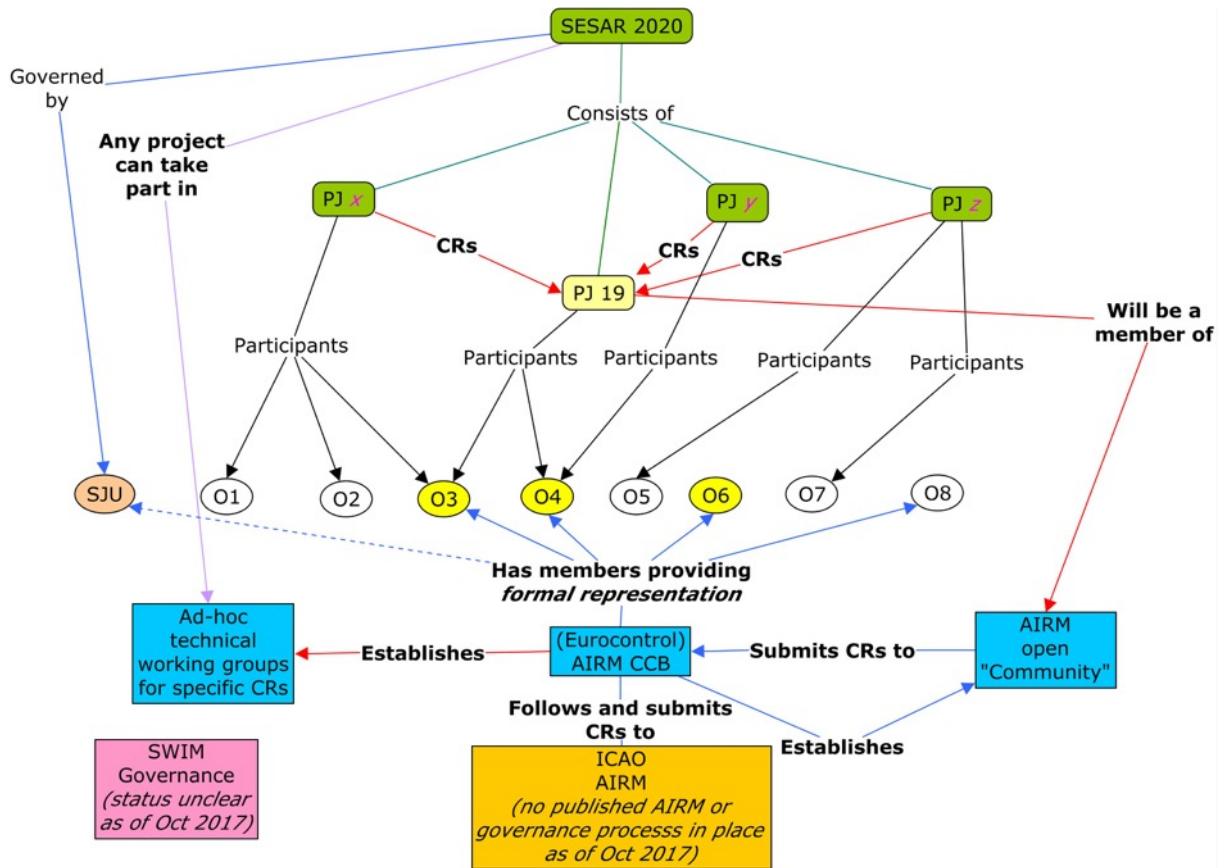The diagram below summarises the structure and inter-relationships.

Founding Members

Figure 1: AIRM CCB Formal Membership Structure, Open Community and Technical Working Groups - and how these align with SESAR 2020 project structure

In the figure above, Rounded rectangles (green) show project structure, straight rectangles (blue) show governance bodies & associated groups, and circles (white/orange/yellow) show organisations. Things to note:

1. The main hierarchical breakdown of SESAR 2020 is into *projects*, whereas the formal composition/representation structure of the AIRM CCB is by *organisation*.
2. In SESAR 2020, projects are typically staffed by multiple organisations, and the same organisation may take part in more than one project.
3. It may be that some organisations taking part in SESAR 2020 will not be represented in the AIRM CCB.
4. It may be that some organisations represented in the AIRM CCB will not be participants in SESAR 2020.
5. Some organisations will *both* be represented in the AIRM CCB *and* be participants in SESAR 2020 (shown in yellow).
6. SJU may choose to be a representative in the AIRM CCB.

7. In addition to its formal membership structure, the AIRM CCB will establish an open "Community", in which both *organisations* and *projects* can take part. Its exact form, and rules for participation, have not yet been formally defined. That will be done in a "Handbook" to be produced by EUROCONTROL. However, from discussions that have already taken place, we can be confident that SESAR 2020 will be able to be part of that community, and submit CRs as a project.

8. The AIRM CCB may also establish ad-hoc working groups; the idea is that technical experts will take part in these.

9. The AIRM CCB will work to make sure that the AIRM and the ICAO AIRM are closely aligned.

10. SWIM Governance has not yet been established.

Founding Members

EUROPEAN UNION   EUROCONTROL

The BEST consortium:

SINTEF	
Frequentis AG	
Johannes Kepler Universität (JKU) Linz	
SLOT Consulting	
EUROCONTROL	