Aeronautical Metadata Profile based on Geographic International Standards

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Abstract — **The aeronautical information plays an essential role in air safety, chief objective of the aeronautical industry. Community policies and projects are being currently developed for the adequate management of a single European air space. To make this possible, an appropriate information management and a set of tools that allow sharing and exchanging this information, ensuring its interoperability and integrity, are necessary. This paper presents the development and implementation of a metadata profile for description of the aeronautical information based on international regulations and recommendations applied within the geographic scope. The elements taken into account for its development are described, as well as the implementation process and the results obtained.**

Metadata Profile; ISO 19115; NEM; INSPIRE; Aeronautical Information; Metadata Catalogue; AIS

I. INTRODUCTION

One of the essential aspects for the air navigation process to be successful is the availability of an adequate cartography guiding pilots during the development of every phase of the flight. This type of cartography –aeronautical cartography– is specifically conceived to graphically synthesize the operative needs of aviation. As a result, it contains a large bulk of information represented in each of the different types of aeronautical charts that are published. There are elements in them as relevant as the representation of the minimum altitudes of safe flight, the restricted air spaces or the frequencies associated to each one of the radio aids deployed throughout the territory. Up to now the traditional way of accessing that cartography involved acquiring hardcopy cartography or using different digital systems of private providers that frequently implied costly periodic updates. The development of diverse initiatives [31] [32] tending towards the interoperability of the aeronautical databases aims at the establishment of other more usable and accessible means of dissemination of the aeronautical information, most of them oriented to distribution of cartography through the Web. Here the technologies associated to the Spatial Data Infrastructures (SDI) take over; their application serve as a conceptual and technological base to the specific development of new methods of distribution and visualization of the Aeronautical Geographic Information.

Every set of geographic data should have a set of metadata univocally defining the product. The ISO 19115 standard defines the necessary items for any geographic dataset to get identified. The metadata describe and identify the datasets for the information associated to them to be located, extracted, evaluated and used [1]. Since the standard is made up of over 400 different elements, "profiles" or sets of minimum elements are usually created to define datasets within the different knowledge fields. Besides, if it is required to make searches and locate the dataset describing these metadata, it is necessary to have catalogues available for searching. Thus one of the key elements to locate and share geographic information is the metadata catalogues.

With these premises, a proposal for the generation of a metadata profile of the Aeronautical Geographic Information is being developed within the framework of the collaboration agreement between the Division of Aeronautics of AENA[1] and the Technical University of Madrid (UPM). This profile is being developed taking into account the standards and regulations of the current geographic information metadata and the distinctive characteristics of the aeronautical geographic information as well as the rules regulating it [16].

This paper presents some features of the aeronautical information; it defines the SDI's and analyzes the benefits they provide as technological support for data distribution and aeronautical information.

The problems encountered regarding the generation of the aeronautical information metadata and the adopted solution are indicated. Finally, the methodology used for the definition of the metadata profile and the outcome and conclusions of that process are specified presenting as a chief contribution an aeronautical metadata profile that may be applicable in any setting related to aeronautical geographic information, especially the Aeronautical Information Services (AIS).

[1] Aeropuertos Españoles y Navegación Aérea. AENA's Division of Information is in charge of publishing and distributing the aeronautical information necessary for the safety, regularity and efficiency of air navigation in Spain.

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II. Characteristics of the Aeronautical Geographic Information

The nature of the geographic information is complex due to its particularities and to the intrinsic character that, as a localization variable, has any aeronautical type of data. Nevertheless it is essential information to accomplish the chief objective of air navigation: *to complete a predetermined route complying with the established air traffic regulations, always guaranteeing the safety of the aircraft.* For this purpose that information must be complete, accurate and up-to-date and be available at any time everywhere.

The aeronautical cartography is aimed at the management of a transportation means presenting important differences when compared to its equivalent in earth transportation. Specifically it should model a representation in two dimensions of the air transit systems (air ways, control and transit areas and zones, etc) that should allow adequately guiding the aircraft in a three-dimensional space, thus being different from the cartography conceived for the remainder of earth transportation means where basically it is only necessary to represent two-dimensional information. Another differing aspect is that in general the majority of available data on this cartography are attributes of the actual symbolized features. For these reasons the volume and density of data that a chart may contain are considerable and not always easily understandable.

The structure and content of an aeronautical chart vary substantially due mainly to the type of flight rules to which they are destined (visual or instrumental) and the flight phase or phases that are to be covered with it (taxi, takeoff, en route, etc) [3]. For this reason it is necessary to analyze these distinctive characteristics defining the typology of the aeronautical charts normally published by the AIS.

A. *Flight rules*

The operative rules under which in-flight aircraft can operate are classified in two groups: visual and instrumental. The visual flight rules (VFR) are those under which the flight is carried out with autonomous navigation techniques, with the pilot being capable of getting oriented in space by its own means, without external aids. Within these techniques visual navigation is the basic one; in addition there are other complementary techniques such as position estimation having as a reference maintained speed and course and the different times of flight over known points. The cartography used to support this type of navigation should represent the geographic characteristics of the surrounding area that could be easily recognized from the air, in addition to the accurate position of obstacles, terrain elevations and restricted zones of the air space.

On the other hand, under the instrumental flight rules (IFR) the control of the aircraft is carried out with the support of an external structure (radio aids, GPS, etc), paying attention to the reading of flight instruments and trusting in the Air Transit Services (ATS) in order to have an adequate reference of both the surrounding terrain obstacles and the position of other aircraft, thus preventing any possible collisions from occurring. Compared to visual flight cartography, the instrumental flight cartography looses the detailed representation of visible geographic elements and gets filled with intangible aspects related to both the structure of air space and the normalized navigation procedures: airways, courses, distances, altitude limits, frequencies, etc.

B. *Typology of aeronautical charts*

Depending on the phases of the aircraft operation, the aeronautical cartography for instrumental flights is basically specialized in airport and obstacle maps, charts of departure, route, arrival and approach.

a) The airport and obstacle maps provide an individual representation of airports and heliports. They enable the pilot to recognize the important characteristics and follow taxi instructions; they usually indicate, among others, the movement and parking areas, buildings and hangars and light signalling. The obstacle maps represent the airport surroundings and show the orography and the obstacles limiting takeoff and landing paths.

b) The departure charts are instrumental to adequately guide aircraft incorporation from the airports to the cruising routes through a series of regulated paths (called SID or Standard Instrument Departure) that have been set up taking into account possible obstacles and minimizing the possible environmental impact.

c) The charts supporting the en route phase represent the network of controlled spaces in the shape of corridors called airways which channel orderly the transit between far off points of the air space.

d) The aim of the arrival charts is to support the safe transit through a number of authorized ways called STAR –Standard Terminal Arrival Routes– from a significant point of the cruising phase to another point of initial approach, IAF –Initial Approach Fix– where the final descent to the airport is regulated.

e) Finally the approach charts provide the necessary information for safely manoeuvring from the IAF to the runway along an appropriate descent path, including additional information about the procedures to follow in the event of a frustrated approach.

Another group of essential aeronautical information is the documents to complete or modify the publishing of the above-mentioned charts with updated information, either temporally or permanently. Among them are the regular amendments, AIRAC –Aeronautical Information Regulation and Control– the NOTAM –Notice to Airmen– the circulars and the supplements. Same as with the charts, these additional elements should also be included in the proposed profile in view of their nature and relevance for aeronautical safety.

C. *Regulations*

Since aeronautical charts are essential instruments for air navigation, their characteristics have been standardized by different organizations in charge of controlling their content and format. The ICAO (International Civil Aviation Organization) [19] is the UN specialized agency for the study of international civil aviation issues; it promotes regulations for the safe, sustainable development of worldwide civil aviation through the cooperation of its member states. Created in 1944 by the Chicago Convention, its function is to regulate the international air transportation to make it safe, effective and economical.

At the European level, EUROCONTROL [21] is the organization in charge of watching over the control and safety of the air navigation of its 38 member states, securing a number of Pan European functions to ensure a free flow of air traffic between states [18]. One of its stated objectives is the speeding-up and management improvement of air traffic required by the constant increase in the number of flights, without detriment to the safety of operations and to the minimization of the environmental impact. For this purpose it defines specific criteria about data quality and aeronautical information in terms of accuracy, resolution and integrity. Its regulations apply to all processes concerning the generation, production, handling, transfer and distribution of data and aeronautical information.

It should be concluded that the aeronautical information is essential for planning and execution of air navigation processes, therefore it should be within reach of its users – pilots and institutions– in a straightforward, efficient and reliable manner. A way of providing users with that information is the use of the technology associated to the SDI's that offers services of processing, visualization, analysis, querying, data downloading, catalogue, and in general the tools necessary for publishing geographic and aeronautical information in the Internet. These services provide everything necessary and are the base for implementation of the proposed profile in this study, especially the catalogue service.

Since metadata are ultimately an inventory of the relevant information describing a resource, EUROCONTROL, in its data policy [25], grants them a relevant role in the process of information exchange, indicating that a critical factor for the successful information exchange is the quality of its metadata. In order to reach a good quality level, a clear methodology for the development and creation of metadata should be taken into account. This methodology is supported by a profile defining the elements that should make up that inventory. The chief objective of this work is the creation of the metadata profile appropriately describing aeronautical information.

After having identified the basic characteristics of the aeronautical information and the regulations that should be taken into account in its handling, the conceptual elements relative to the SDI's are described next.

III. The Spatial Data Infrastructure, a form of Managing Geographic Information

An SDI is a computer system made up of a number of resources –catalogues, servers, programmes, data, applications, websites– that allow Geographic Information sharing through the Internet, complying with a number of conditions of interoperability that allow a user with a simple browser to use and combine them according to need [15]. From a technological viewpoint, the basic components of an SDI are the data, the metadata and the services. The data are the set of geographic elements available, in this case aeronautical in nature. The metadata are the descriptors of the data; they are elements such as date of the data, publishing date, format, owner, and localization, price, etc making up the corpus of the metadata through which information may be searched and accessed. The services are the functionalities that enrich the infrastructure since, by being accessible through an Internet browser, they provide the users with tools for data interaction. Among the services offered are querying, visualization, downloading, etc.

Of all the components, the metadata are the one of interest for our work. The metadata are the descriptors of the geographic and aeronautical datasets that allow their localization, inventory and utilization [4]. As mentioned above, the SDI's must comply with certain conditions of interoperability that in the case of metadata are guaranteed by regulations and standards. The most relevant are the ISO 19115 Standard [5], the Rules of Implementation for Metadata of the INSPIRE Directive [4] and in the case of Spain, the Núcleo Español de Metadatos 2005 (Spanish Metadata Core) (NEM v1.0) [8] has been taken into account.

A. Metadata regulations and standards

ISO 19115-2003/Core 2006: Geographic Information – Metadata, is an international standard defining the required schema to describe geographic information and services and it provides information about identification, extent, quality, spatial and temporal models, spatial reference and distribution of digital geographic data. This standard is very complex and includes an extensive set of mandatory, optional and conditional metadata elements. The document consists of 140 pages and includes a total of 409 items, differentiating a group of elements called "Core Metadata" where those elements considered basic for data description are identified. It also defines 27 lists of controlled words by means of which the possible valid values of certain fields are defined.

Although this international standard is chiefly applied to digital geographic data, its principles may be extended to other forms of geographic data such as maps, charts and text documents as well as non-geographic data.

Given the setting of implementation and application, it is necessary to adopt the existing European regulations in the matter of metadata; for this reason the INSPIRE Directive (2007/2/CE) [4] is taken into account; Rules of Implementation for Metadata in Europe are included therein. INSPIRE is based on the SDI's created by the member states. These infrastructures must be designed to make sure that the spatial data are stored, made available and maintained at the most appropriate level, so as to enable combining spatial data of different sources consistently and sharing them among different users and applications. Same as the general geographic information is shared; it is also possible to do it with the aeronautical information in particular. In order to achieve these objectives, the Directive focuses on five key areas: (a) metadata; (b) interoperability and harmonization of spatial data and services of a selection of subjects (as described in Annexes I, II III of the Directive); (c) network services and technologies; (d) measures to be taken for the interchange of spatial data and services, and finally (e) measures of coordination and surveillance. For metadata standardization the Rules of Implementation for Metadata have been defined and published in the Official Journal of the European Union [29] and are presently mandatory. These rules define, among other criteria, the minimum number of elements metadata created within the European Union should contain.

The generation of metadata has been growing, evolving and getting specialized during the past few years, especially thanks to the boost of the INSPIRE Directive. Standards such as ISO 19115, the Rules of Implementation of the INSPIRE Directive and the metadata profiles such as NEM appear to be very generic and they are insufficient for the description of products in certain subjects, e.g. in the case of the aeronautical data. For this reason people in charge of some very specific datasets are studying the creation of metadata suitable for their needs. This is the case of the metadata profile for postal addresses of EURADIN (EURopean ADdress INfrastructure) [23], designed to homogenize the metadata for postal addresses products in every country of the European Union. This same concept of personalized profile should be incorporated into the aeronautical geographic data. The proposed metadata profile complies with these regulations.

Due to the fact that the implementation of the proposed aeronautical metadata profile was carried out in the AIS of AENA and that it aspires to turn into a node of the Spanish Spatial Data Infrastructure (IDEE) [15] in the future, it was necessary to consider the Spanish Metadata Core (NEM v1.0) [8] as the minimum set of metadata elements recommended in Spain. This core is formed by the union of the elements belonging to different standards such as the Core of ISO 19115 and the Dublin Core Metadata [30]. With the aeronautical metadata profile, interoperability with other layers and services of the IDEE is guaranteed.

IV. FORMULATION OF THE PROBLEM AND ADOPTED SOLUTION

When establishing the objective of developing new forms for the deployment and distribution of the aeronautical geographic information using the conventional technology on which a standard SDI is based, we ran into the first obstacle, the lack of a clear, unique standard for aeronautical information metadata; for this reason, number one objective was the creation of an aeronautical geographic metadata profile.

Two main causes prompted the creation of this profile. First, the characteristics typical of the aeronautical geographic information are not contemplated by any metadata profile; thus the current profiles, thought exclusively for the creation of geographic information metadata in general, or very specific for other subjects, do not have elements for the correct documentation of the aeronautical geographic information. Second, the current aeronautical regulations (ICAO, EUROCONTROL) do not define in depth the metadata elements that should accompany the aeronautical documents and charts. This may lead to different interpretations by the developers of metadata and affect interoperability.

For this reason we have proceeded to carry out an analysis allowing standardization of metadata related to the aeronautical geographic information, taking as a basis the ISO 19115 International Standard and as a reference the documentation supplied by the AIS of AENA, aeronautical institution that verified and validated the process in all its instances, ensuring its quality. For the creation of this analysis, a minimum number of metadata elements have been defined allowing the full description of the aeronautical geographic information, taking into account that each element should be compatible with the regulation presented so far.

V. DEVELOPMENT OF THE AERONAUTICAL METADATA PROFILE

For the correct definition of the Aeronautical Information Metadata Profile, a study in four stages was drafted. The first stage was focussed on the study and analysis of the aeronautical information itself, of the regulations of that information and the experiences of other countries in the creation of metadata. Subsequently, in the second stage a comparative analysis of the gathered information in the AIS was carried out. In the third stage the metadata items to be included within the metadata profile specific of the aeronautical information were selected and finally the specific features of every metadata item were detailed.

A. Study and analysis prior to the definition of the profile

In this stage the need for analysis of three groups of information was detected. The first group corresponds to the products the AIS of AENA counts on. Since every type of aeronautical chart represents information of different nature, it is necessary to analyze the whole information to be described and queried, observing both the way in which it is stored and its structure, all of it with the purpose of identifying the main metadata elements of each element and be able to sort the information in series and query units in the catalogue.

In the second group the regulations applicable to the aeronautical information were analyzed. This analysis was carried out on the ICAO and EUROCONTROL regulations, actually on the specifications related to metadata or aeronautical chart characteristics. Regarding the regulations of EUROCONTROL, the Single European Sky (SES) Regulations document [10] contains a specific section on metadata in Annex 3 Part C consisting of 9 points to be taken into account for the creation of metadata as described in TABLE I. Regarding the ICAO specifications, the analysis is focussed on Annex 4 [20] that contains the regulations and recommendations for the creation of aeronautical charts Some of the most relevant requirements that should include the aeronautical charts according to this annex are described in TABLE II.

The third and last group of information is focussed on the experience of other organizations in the generation of aeronautical geographic information metadata. To this end it has been necessary to set up search methods to locate specific profiles or profiles applicable to the aeronautical information. Eight profiles have been analyzed including NEM, as described in TABLE III. They have been obtained by two selection criteria: (i) instances of metadata within the aeronautical sphere. A search of instances of aeronautical chart metadata was made to detect the profile used and the metadata elements used. Under this criterion, 3 profiles were detected: Minnesota Geographic Metadata [27], Guidelines MSRM [28] and ESRI Metadata Profile [11]. (ii) The profile subjects. A search was made to locate the metadata profiles that included among their thematic categories the ones related to aeronautical charts and airports. In this case, 4 profiles were found: National System for Geospatial Intelligence (NSG) Geospatial Core Metadata Profile [12], GEMINI [26], UK Academic Geospatial Metadata Application Profile (UK AGMAP) [14] and New Zealand NZGLS [13].

TABLE I. EUROCONTROL METADATA RECOMMENDATIONS

No.	Description
1	Author of the data.
2	Amendments made on the data.
3	Persons or organizations interacting with data; when?
4	Details about any validation and verification carried out on the data.
5	Starting date and effective time of data
6	For geospatial data:
	• Earth reference model.
	• Coordinate system used.
7	For numerical data:
	• Statistical accuracy of the calculation technique used .
	• Resolution.
	• Confidence level according to ICAO. Annex III (1) and (12).
8	Details about any function applied if data have been subjected to conversion/transformation.
9	Details of any limitations in the use of data.

It should be highlighted that of the analyzed profiles, four of them are based on the ISO 19115 Standard (NEM, GEMINI, UK AGMAP, MSRM) while the remainder are based on the Dublin Core and FGDC. Knowing that the ISO Standard has more weight within the geographic scope and that at the present time there are ongoing projects of development of migration gateways from the Dublin Core to this standard, we have favoured the 4 standards based on ISO 19115, without failing to admit the importance of the others and the details they offer for the study.

TABLE II. ICAO METADATA RECOMMENDATIONS

No.	Description
1	Use of a common projection.
2	Ease of understanding scales
3	Ease of transition from one chart to another during the flight by means of an adequate altitude selection, constructions or any other feature relative to the ground.
4	Concurrent publishing of the charts that are interconnected, either new charts or their revisions.

TABLE III. PROFILES USED IN THE COMPARISON MATRIX

	Profile	Country	Underlying standards
	NEM – Spanish Metadata Core	Spain	ISO 19115
Profiles applied to the aeronautical information	National System for Geospatial Intelligence (NSG) Geo-Core-MD Profile. Geospatial Core Metadata Profile	USA	Dublin Core ISO-19115 ISO-19115 (2) DRMS
	Minnesota Geographic Metadata Guidelines	MN (USA)	FGDC
	GEMINI	UK	ISO 19115
	(GO-GEO) UK Academic Geospatial Metadata Application Profile (UK AGMAP)	UK	ISO 19115
	NZGLS- Geospatial Metadata Standard	New Zealand	ISO 19115 Standard NZ
	ESRI Metadata Profile	USA	FGDC
	MSRM	Canada	ISO 19115

B. Treatment and comparative analysis of the collected information

After having detected and analyzed the metadata profiles related to the aeronautical information, a homogenization process was carried out, necessary to be able to make a comparative analysis between them. The homogenization was needed since certain profiles (e.g. Minnesota Geographic Metadata Guidelines) are based on a metadata standard different than the selected one, namely ISO 19115. For this reason it was necessary to analyze every item of metadata described in the selected profiles and locate the corresponding profile on the ISO 19115. The process was complex since correspondence did not have to be one-to-one; elements without a clear correspondence were detected, the names of the elements varied between the profiles and the standard, etc.

Once the metadata items of the different profiles were homogenized, the next step was to include them in a comparative matrix taking again as a base the ISO 19115 International Standard to make the correspondence between the elements of the actual ISO 19115 Core, the Rules of Implementation of the INSPIRE Directive and the Spanish Metadata Core (NEM). The columns of the matrix correspond to the different standards, profiles and examples of metadata and the rows correspond to the analogous metadata items.

With the remainder of the information analyzed, the aeronautical regulations (ICAO, EUROCONTROL) and the information detected from the analysis of the aeronautical charts, a process of identification of those metadata elements belonging to the ISO 19115 International Standard that define this information was undertaken.

Those elements were included in a column within the comparative matrix, giving them a priority treatment in relation to the other columns. Thus the identified aeronautical items were compared with the regulations that should be fulfilled and with the characteristics of the charts.

From the results of the matrix it appeared necessary to carry out a survey in which the users and producers of aeronautical information were asked what distinctive characteristics they considered relevant for the description of the aeronautical information. The aims of the survey were (i) to identify the information the aeronautical information metadata should describe, (ii) to compile the necessary information to generate a metadata profile for the aeronautical subject matter based on a concept generated by specialty professionals and (iii) to determine the degree of importance of the attributes.

From the results obtained we should emphasize that the most relevant elements for the description of the aeronautical charts selected by the users and producers of aeronautical information are the ones related to temporal references and the least relevant are surprisingly the dataset summary, the data distributor and the legal aspects of the charts. Figure 1 shows the degree of importance given by the users for elements describing aeronautical data.

C. Choice of metadata items for the aeronautical geographic information metadata profile

As a result of this analysis the process of choosing the items to be included in the aeronautical information metadata profile has been carried out considering three factors. The first one is the need to comply with the international standards and existing metadata regulations; hence the following were included as fixed items: (i) items belonging to the Rules of Implementation of the INSPIRE Directive, (ii) the Spanish Metadata Core (NEM) and (iii) the ISO 19115 Core.

The second factor has been the need to comply with the basic metadata specifications indicated in the regulations of the aeronautical information. The third factor is the recurrence of elements in the matrix, so those metadata items getting over 65% coincidence in the columns were selected [23], provided these fields would not belong to the mentioned standards or regulations. It should be noted that this percentage may vary depending on the subject matter and the developed specialization level of the profile.

D. Choice of the characteristics of each element

Other aspects to be described in detail in the definition of the profile are the distinctive characteristics of each metadata item, e.g. definition, source, ISO 19139 route, mandatory / conditional nature, multiplicity, data type, value domain, implementation instructions, example, etc. Initially the characteristics described in the already mentioned regulations were inherited; in the event of a contradiction, the INSPIRE Directive –the most restrictive– prevailed. The items have been specified for the subjects of air navigation.

VI. RESULTS AND CONCLUSIONS

A specific metadata profile has been obtained for the description of the aeronautical geographic information conformant with the ISO 19115/139 International Standard, the Rules of Implementation of the European Directive INSPIRE and the Núcleo Español de Metadatos (Spanish Metadata Core – NEM), thereby ensuring full data interoperability.

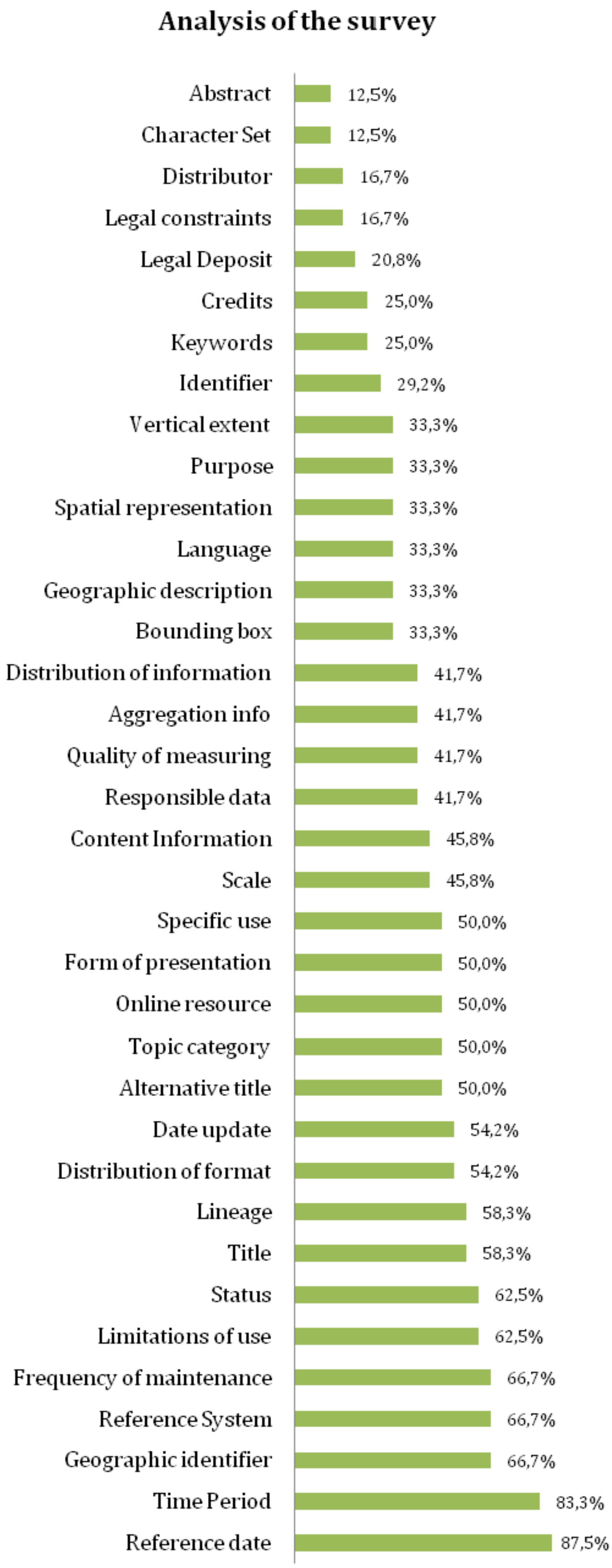

Figure 1. Degree of importance of the elements describing the metadata

The profile consists of a total of 48 items that (a) match the ISO 19115 elements; (b) include all the elements of the ISO 19115 Core; (c) represent all the elements of the Rules of Implementation of the INSPIRE European Directive and the Spanish Metadata Core and finally (d) include 5 intrinsic items of the aeronautical profile, absolutely indispensable for description of the aeronautical geographic information. TABLE IV. describes the items making up the proposed profile (Annex 1).

It should be remarked that this document has not been approved by any standard organization; it has just been approved by the members of the Department of Air Navigation of AENA and by the work team of the Technical University of Madrid. Nevertheless its implementation and performance show its validity and quality.

So far the results of the application of the profile in AENA have been satisfactory. The profile has provided a starting point for the creation of the metadata for the AIS products, cutting down the time the workers in charge of the aeronautical information used to spend in the study of metadata-related aeronautical and geographic regulations. Counting on a unique document collecting, explaining and presenting those regulations through some common instances they can use as a reference, supports the work of cataloguing [16].

This profile is the first step to assure aeronautical data interoperability. So far AENA has catalogued about 25% of its aeronautical data and they are being implemented in a metadata catalogue [17] that may be queried.

The scope of the profile is the AIS managed by organizations and institutions in charge of the aeronautical information. The metadata profile should fulfil the needs of the users of the information (answer the most frequent questions) and the institutions managing it. For the metadata profile to reach a wider –read international– scope and to integrate the metadata in a catalogue network, their interoperability must be guaranteed; this objective will be reached when the use of international standards is agreed on and a metadata profile is defined on which the member states should be based.

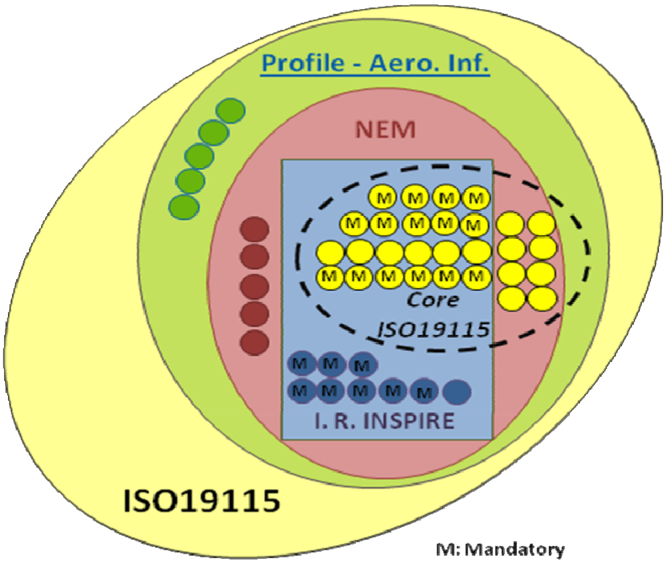

Figure 2. Relationship between the aeronautical metadata profile and the underlying standards

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Annex 1.

TABLE IV. AERONAUTICAL METADATA PROFILE ITEMS

Name	**Definition**	**ID**
Title	Name by which the cited resource is known.	**M**
Alternative title	Acronym or name in another language by which the cited resource is known.	
Abstract	Brief narrative summary of the resource contents.	**M**
Hierarchy level	Subset of data relating to this metadata.	**M**
Online resource	Location (address) for online access using a Uniform Resource Locator (URL) or a similar addressing scheme.	
Unique Resource Identifier	Unique value that identifies an object in a namespace.	
Language resource	Language or languages used in the dataset.	**M**
Way of presentation	Way in which the resource is presented.	
Aggregation info	Provides information on the aggregations defined in the dataset.	
Credits	Recognition of those who contributed to the creation of the resource.	
Purpose	Summary of purpose or intent with which the resource was created.	
Specific use	Provides information about specific applications for which the action has been or is being used by users.	
Status	Resource Status	
Maintenance and update frequency	Frequency with which changes are made or additions after the first version of the resource is complete.	
Char set of the dataset	Name of the character set used for coding or encoding	
Spatial representation type	Method used for spatial representation of geographic information	
Reference System Identifier	Description of the spatial and temporal reference system used in dataset.	
Topic category	Main subject(s) of dataset	**M**

Keywords	Keyword(s) or formalized word(s) or phrase(s) commonly used to describe the subject	M
Thesaurus	Name formally registered word list or a similar authoritative source of keywords.	
Geographic extent description	Description of the spatial and temporal extent for the current object.	
Geographic Bounding Box, west longitude	Western-most coordinate of the limit of the dataset, longitude in degrees (positive east).	M
Geographic Bounding Box, east longitude	Eastern-most coordinate limit of the dataset, longitude in degrees (positive east).	M
Geographic Bounding Box, north latitude	Southern-most coordinate limit of the dataset, longitude in degrees (positive north).	M
Geographic Bounding Box, south latitude	Northern-most coordinate limit of the dataset, expressed in longitude in degrees (positive north).	M
Vertical extent	It provides the vertical component of the extension of the resource concerned.	
Temporal reference	Period of time covered by the contents of the dataset.	
Publication date	Reference date for the cited resource - publication.	
Last review date	Reference date for the cited resource - last review.	
Creation date	Reference date for the cited resource - creation.	
Lineage	General explanation of the data producer's knowledge of the lineage of a dataset.	M
Spatial resolution	Level of detail expressed as a scale factor of analogical or digital map.	
Conformity, specification	Product specification or user requirements against which the data are being evaluated.	M
Conformity, degree	Indication of result of conformity. Más comunmente se usa conformance	M
Limitations on public access: access constraints	Access constraints applied to assure the protection of privacy or intellectual property and any restrictions on using the resource.	M
Limitations on public access: other restrictions	Other restrictions and legal prerequisites for accessing and using the resource.	M
Limitations on public access: classification	Name of restrictions on resource management.	M
Constraints related to access and use	Constraints affecting the capacity for resource use.	M
Person in charge	Person or persons and organizations related to the resource (s).	M
Role of the person in charge	Function performed by the responsible party.	M
Distribution format	Provides a description of the data format to be distributed.	
Metadata file identifier	Unique identifier for this metadata file.	M
Point of contact for the metadata	Party in charge of metadata information	M
Metadata Date	Creation date of metadata.	M
Metadata Language	Language used for documenting metadata.	M
Char set of the metadata	Full name of character encoding standard used for the metadata set.	
Metadata standard name	Metadata standard name (including the profile name) used.	
Metadata standard version	Version (profile) of the metadata standard used.	

Colour indicates the relationship between the aeronautical metadata profile and the underlying standards as shown in Fig. 2