

## CREATION OF METADATA IN THE CHILEAN AERONAUTICS CARTOGRAPHY PRODUCTION

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### ABSTRACT

The generation and use of the geographic digital information has increased considerably this last decade, allowing applications in all ambits to get better the resources management, territory planning and the integration of all sectors that use geospatial information directly or indirectly, these are enough reasons to document the main features and the limitations which has the existing geographic data. The way more complete to give this information is through the geographic metadata, allowing the geospatial data users to find the necessary information to determine the way to use them.

The creation and maintenance of the metadata is a complex work, that implies a greater cost of time and human resources, but at the same time benefits both sides, producers and users in the data organizations and its maintenance, providing information that facilitate the search of data in catalogs and clearinghouses also supporting the data collection transference giving information for its interpretation and processing.

The Aerophotogrammetric Service is not exempt from these changes, for this it has contemplated the metadata creation as a part of the aeronautics cartography elaboration process in the national territory. Being demanding in the data sharing, it takes from the metadata management perspective the entry methodology through the maps production line and it doesn't restrict just a one operation level of this information. Below, it presents the implementation of this development, the factors what influenced in the determination in the creation tool and metadata management, the updates and projects in the long term in relation to this.

### BACKGROUND

Part of the Aerophotogrammetric Service (SAF) mission is the aeronautic cartography elaboration for the whole national territory to scale 1:250.000 for local navigation, 1:500.000 for piloting and 1:1.000.000 operational type, satisfying the visual navigation needs, in this sense it has as a one functions, to norm the production of the aeronautics information, with the purpose to contribute in the aeronautic safety, defense and the Republic of Chile development efficiently.

The SAF's aeronautic cartography production is developed using as a base the topographic cartography in 1:50.000 scale from the Chilean Army Geographic Institute (IGM), also the technical specifications from the Pan-American Institute of Geography and History (IPGH), the International Civil Aviation Organization (OACI), that includes norms and recommended methods to produce the aeronautics maps (Annex 4) and the "Elaboration and publication of Aeronautics Maps" from the Civil Aeronautic General Direction (DGAC).

The Aerophotogrammetric Service (SAF) has, from 2005, with a Management Quality System based in the ISO 9001:2000 norm, whose scope was the "Planning and Execution of Aerophotogrammetric Surveying", excluding of this initial implementation our aeronautics maps, due to establish one process control for its generation doesn't ensure the data validity and quality, neither the correct use of them, resorting to the specific norms implementation for geographical information like the Technical Committee 211 norms, during 2006 and 2007. At the end of 2007 it's achieved the elaboration process of aeronautic cartography certification, including in its procedures the quality evaluation implementation in agreement on ISO 19100 family norms, extending the importance of our Quality System Management to "Planning and Execution of Aerophotogrammetric Surveying and Aeronautic Cartography".

Inside of the implementation frame from the system that controls the aeronautics map quality, it's originated the concern the way to deliver the users this information and whole referred in the product elaboration, acquisition method, reference system, and others. It's developed in the same way, the implementation of one metadata norm, defining the requested structure to give this information and the additional incorporation of aeronautic information. The complexity of all of this, it's a part of storage and delivers this information to users, it's necessary to prepare the tools that allow to organize and validate the product elaboration levels, changing the data input to the metadata in a collaborative process, from each actors side who participate in the aeronautic map generation.

## **SCOPE**

The general scope is the generation and distribution of the aeronautic cartography metadata from the national territory. To reach this scope is necessary to accomplish the followings specifics goals:

- 1- Define a clear and documented methodology in the aeronautics cartography elaboration.
- 2- Establish the data quality control points during the elaboration process in each cartography.
- 3- Use a tool to input the metadata that adjust better at SAF needs.
- 4- Determine the way of metadata distribution to our users of aeronautics cartography.

## **APPROACH**

The work here exposed presents the metadata creation alongside the production line of aeronautic maps, which take a part different data producers and different processing software. This implies a metadata input during the all maps elaboration process and not in the finished work. The tool to use for this proposal it must be based in the metadata standard defined previously, it permits to add data which it is not contemplated in the norm, has a multiuser entry in the same metadata and approbation levels to validate the information added in that.

## **METHODOLOGY**

To reach the correct way to deliver this information of aeronautics map to the users, it was necessary to document the process that take a part in the generation of this cartography type, due to the ISO 9001 norm requisites. The Aeronautic Cartography Department had to establish a written methodology that detailed the different data processing stages, from the information sources, the adoption from IPGH, OACI, DGAC technical specifications, to the creation of the aeronautics database got from Chile AIP directly and the delivery of the final product. It's defined 7 main processes to incorporate in the Quality Management System, emphasizing between them information compilation process, edition and the attribute inputs in the database.

Although the Quality Management System allows controlling the process, deviations detections and making better of these permanently, it doesn't allow knowing the product quality, ensuring it, keep it or make it better that is reason why SAF decides to implement international norms that help of this purpose. The ISO 19113 defines quality principles, applicable quality elements in the geographic information, the qualitative and quantitative types; those were implemented due to its applicability based on the creation methodology of the aeronautic map, the software and processing platforms of the data used and the type of the final product. The ISO 19114 standard provides a quality evaluation procedure, which was adopted to evaluate the data quality elements of positional accuracy, completeness and logical consistency in our aeronautical maps, using the quality measures proposed by the ISO 19138 standard. But all this new information, of great importance for our users should be informed. We determined the use of metadata, defining a structure in accordance with ISO 19115.

The creation and maintenance of the metadata geographic type is considered a difficult process and laborious, it requires study time, a determination of the standard to use and human resources for its execution. The previous knowledge topic contributes the decision-taking in the use of the standard referred; in our case corresponds to 19115:2003 ISO, which forms part of the integrated management system that SAF actually has in the aeronautic cartography generation process. The figure N°1 schematizes the cartographic elaboration based on the management quality system according to 9001:2008 ISO; and standards from TC/211 to control the data quality (19113, 19114 and 19138 ISO).

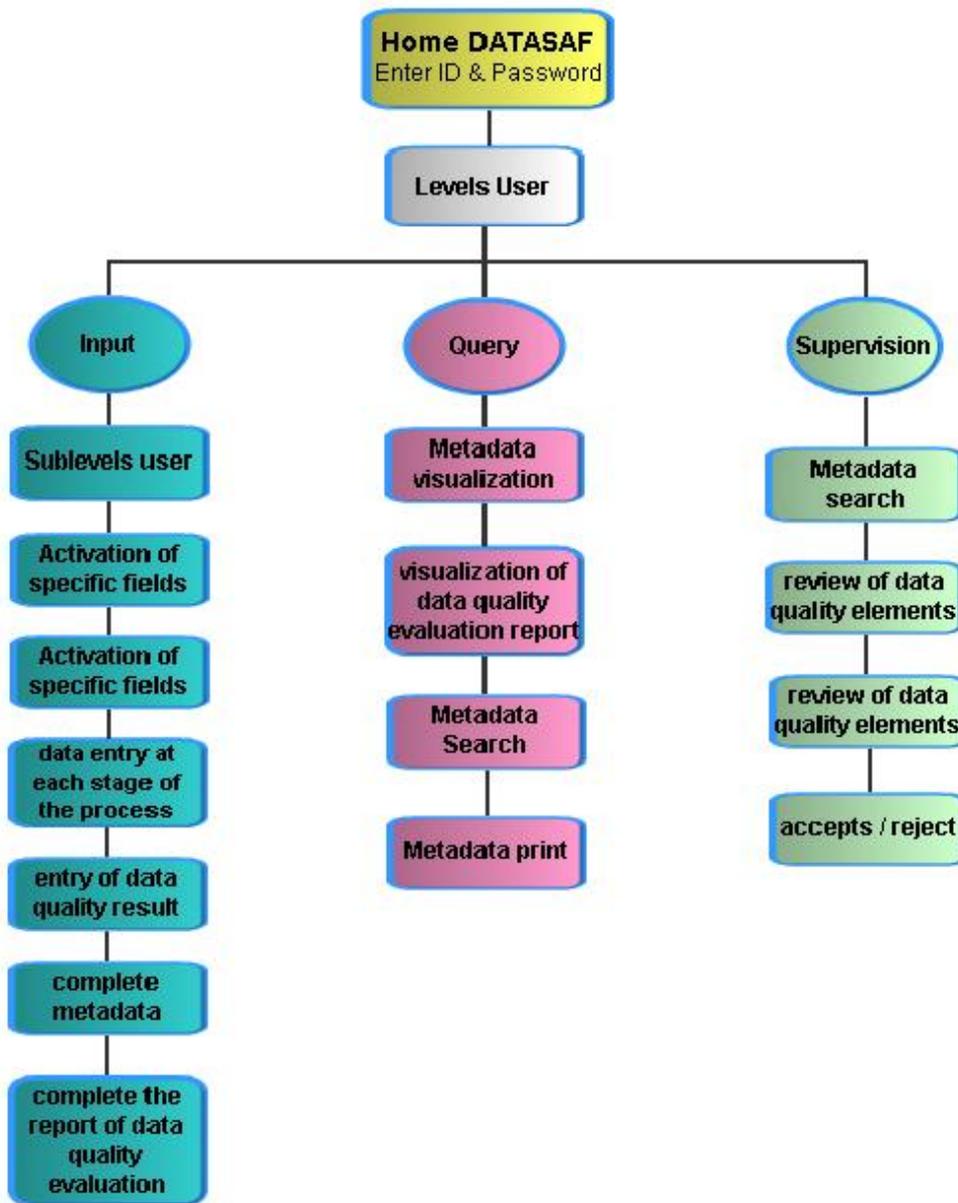


Figure N°1. The cartography elaboration schema

Once defined the elaboration process of the aeronautical map, should focus efforts on the generation of metadata. The elaboration process of this cartography implies the use of many software (in our case is used MicroStation and ArcGIS) and data manipulation is performed by 4 specialists at least, is for that to generate the metadata cannot use the incorporated tool inside of the GIS software, because it loses the information from the genealogy and the product stages. Considering this factor it determined to evaluate the entry metadata software available in this moment (for example CatMDEdit, CORPSMET, MetaLite) comparing the totality of the included metadata packages, the mechanism that give the management and entry metadata, environment work, and others. Then from the respective evaluation, in where executed a metadata input for aeronautical chart in each of these softwares, it detects the same constraint in all three: the entry of metadata is individual, being executed by a single specialist and independent of other process.

The entry requirements and metadata management has proposed a multi-user metadata input along the production line, metadata search systems and supervising quality controls implemented conformed with ISO 19113, so it determined to design a metadata structure to create a corporative software. The creation step of this software contemplated the following:

1.- Translation of ISO 19115: when the project's start, in May 2006, this standard was available in our country in only original version (English language), so it should be translated in its use previously. At the end of 2007 could purchase the UNE-EN ISO 19115, which was use to validate our translation.

2.- Metadata structure design: Once translated ISO 19115, this is organized in metadata packages according to the methodology of income by specialists to develop aeronautical charts.

3.- Metadata Scheme: This is a diagram showing the elaboration of this cartography, indicating the points of quality control at different stages, levels of users with their respective tasks and the means of access to information for each stage of the process (see Figure N°2).

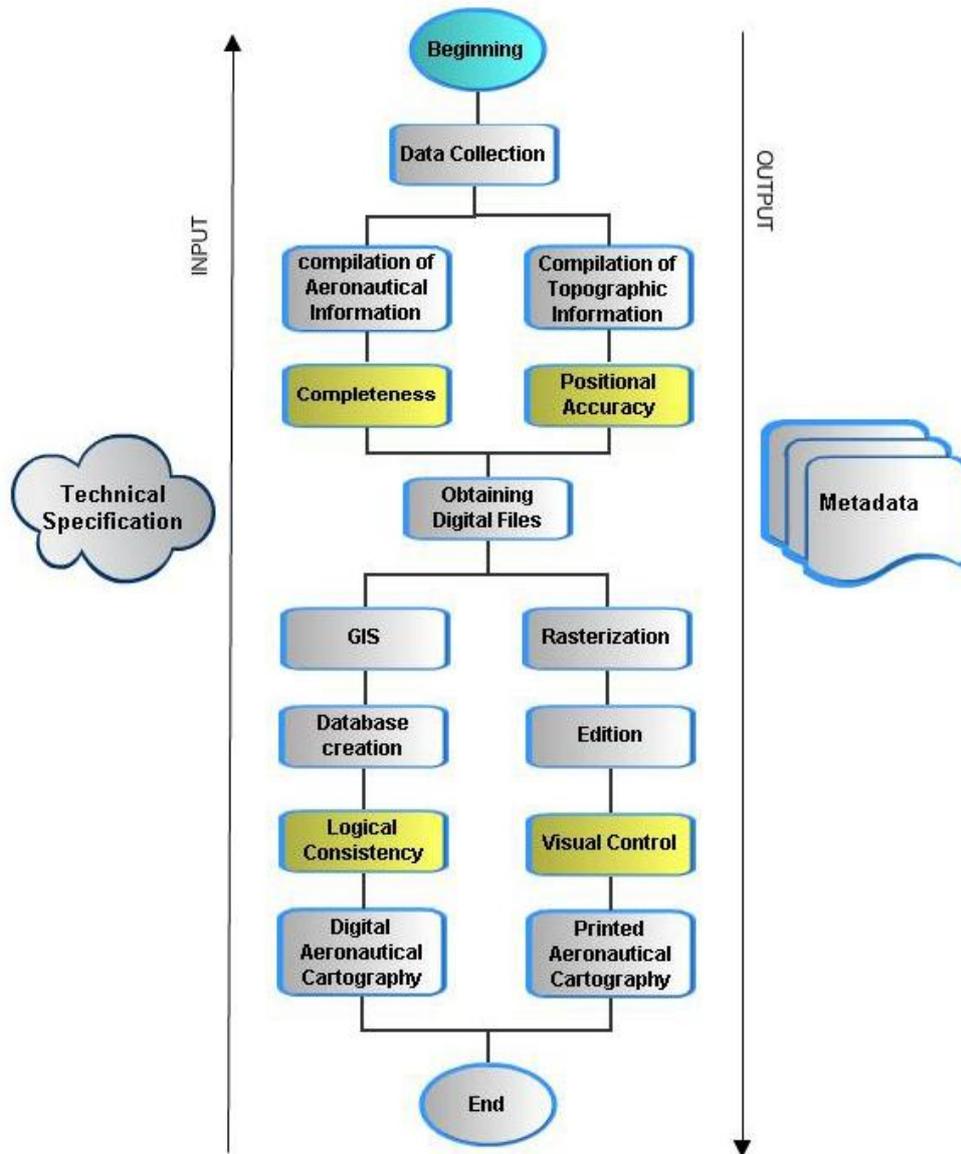


Figure N°2

This software has tools that not only considers the entry, storage and subsequent delivery of the metadata, but sees the clever income through the production line, with the objective of begin and end the metadata at the same time the aeronautical chart, this allows to supervise the production line on the state of the product and its quality as it moves the process, which involves management and timely decision making according to the results of evaluations of the quality of the product.

## RESULTS

The Aerophotogrammetric Service has a metadata structure according to 19115 ISO, which has served like a base in the DATASAF institutional software generation. This software contains the totality of the obligatory elements demanded by the standard; the conditionals and optional elements presented on it, as well as it has the necessary added data to complement the information base and specifics for this kind of products like it is the aeronautic information. All tools and commands from this software are in Spanish language only, because was the needs of our institution. The figure 3 presents the distribution details of the metadata sections included in the software.

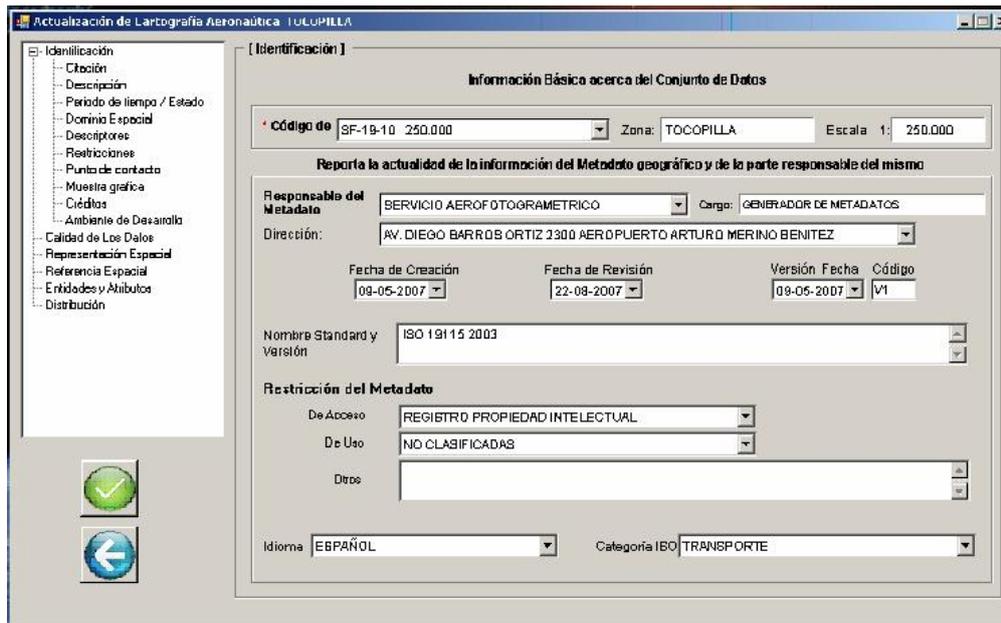


Figure N°3. Start window metadata entry

The software has considered the establishment of user levels to input the metadata, revision and supervision of these, establishing boundaries in the information input what avoids its duplicity and at the same time allows the validation to ensure the quality and veracity from the same metadata.

The software integrates a search system by name of the product, by geographic data (geographic localization) date of creation, revision or metadata publication, by data quality element and by data quality evaluation report (see the figure n°4).

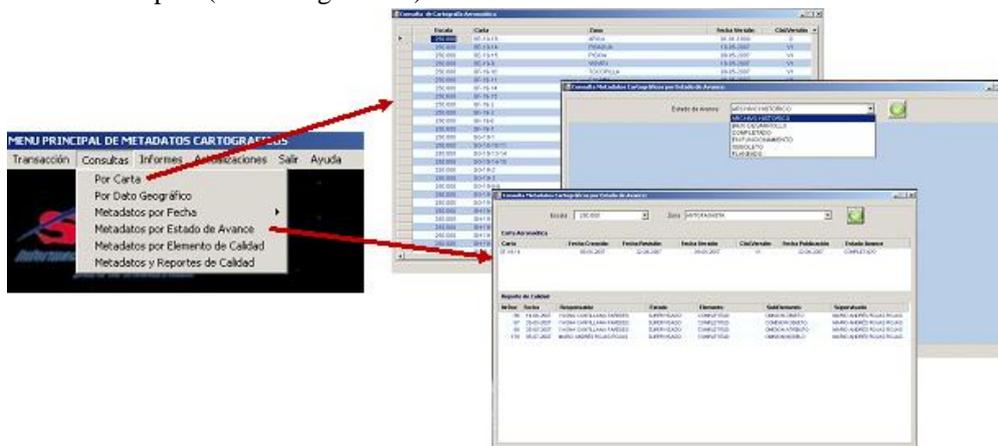


Figure N°4. Some examples of metadata search in the software

In addition to the metadata creation, the software integrates quality evaluation reports creation according to 19114 ISO dispositions, for the elaboration reports that detail the evaluation of each data quality elements applied in the product. These reports can be validated only by the supervisor from the stage process who verifies the results conformity of the evaluation.

Allows issue an individual metadata reports (different for each section of metadata) and reports of data quality evaluation to display or print (Figure N°5).

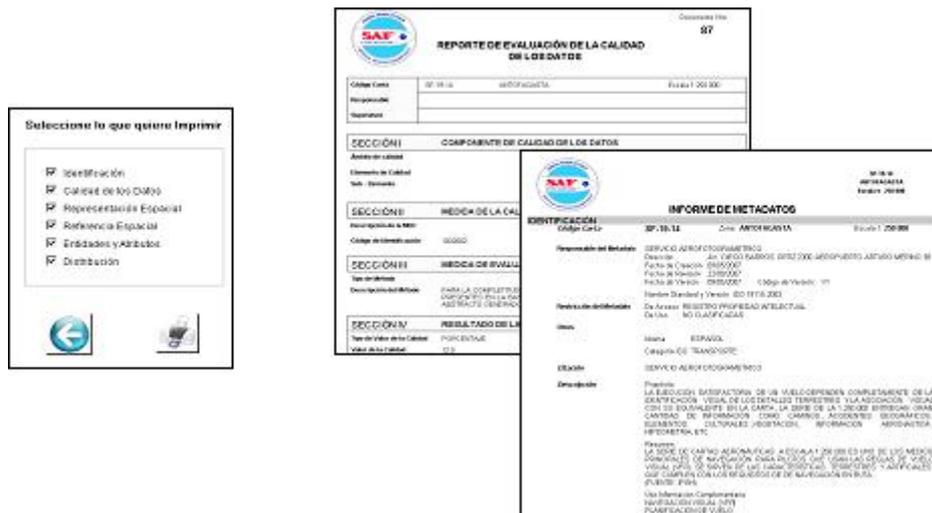


Figure N°5. Print Metadata or Report

The evaluation reports contain the information specified in ISO 19114. The report generated by this software has a supervising tool that accept or rejects the result of the data quality evaluation for the purpose of detecting deviations in the real time and can be corrected or assign substitutes if they are non-conformance results.

Finally it should be noted that the management of metadata used in this software is not currently in any other software on the market, because each production line is unique in each geographic organism, whether public or private. The Metadata creation must be customized to the each required, data quality and product types that are generated.

**CONCLUSION:**

With the technologic advance and the news exigency of the market, the geographic information has turned into a fundamental support in the taking decision task inside of many thematic, related to the geographic activities, economics and humans, and others, contributing the sustainable development of the nations. For this reason to count on antecedents of available geographic information and the use they converts into a need. To know the data origin, its update, handing, processing, quality and resultant product is fundamental to the correct planning.

The determination of the entry mechanism and the metadata management is not simple; it will depend on the resources destined for that, from the training level of the specialists and the producer requirements in agreement with the user requisites. The metadata has been turned into a fundamental tool in the new technologies related to map server, search system and data catalog. The decision to count personalized software in our service allows increasing the management and do not limit the labor of the simple data entry user, considering the constant revision of the data quality evaluation results as a fundamental support to take the user decisions in relation to the utility that give the delivered product. Although this demand a great effort, in the long term, it contributes to the productivity (efficient + efficacy) as the final cartography as its metadata, contributing the information quality in the taking decisions in matter of development and planning.

During the development of our initial project (2006 - 2008), we don't had any background of similar projects, based exclusive on the creation of metadata aeronautical information, nor was unveiled our work at international level until 2009 in a meeting of the Aeronautical Charts Committee from PAIGH. This are some of Reasons for developing a metadata profile for aeronautical information throughout Latin America has not materialized.

The lack of dissemination of this theme in our country hinders the development of new applications on standards for geographic information and metadata, making slowest the work of implementing such systems. For our organization, maintenance and constant updating of the system will allows expand the scope of this to other products generated by the Aerophotogrametric Service, obtaining an approved model for different types of geographic information generated by our country, and in collaboration with LatinAmerican organisms who generate aeronautical charts, can be establish a single model of generation and distribution of aeronautical information metadata.

**FUTURE PLANS**

In June this year has initiated the translation of ISO 19115-2 into Spanish for the expansion of the software structure aimed at creating metadata for images. Jointly runs a restructuring of the software design adapted to the production lines digital charts, mosaics, photogrammetric flight and all products generated in the SAF. This project is linked to the creation of a geo-portal that allows the query, download and manipulate data for both our internal and external users, thus becoming the use of metadata in a form of management of geographic information produced in the Aerophotogrammetric Service, within 2 years.

In our country, has initiated the creation of Chilean standards for geospatial information, based on some standards of the Technical Committee 211, and obtaining our own version of the ISO 19115 standard by the end of 2012. The Aerophotogrammetric Service is actively participating in each reviewing the proposed draft standard.

In Parallel we study metadata profile developed by AENA, to complement our own profile. For its part, the Aeronautical Charts Committee from PAIGH is coordinating a collaborative plan proposed by the Polytechnic University of Madrid (UPM), to define an aeronautic metadata profile for Latin American.

In addition, the Aerophotogrammetric Service is developing a proposal oriented training to members of PAIGH, for the generation of aeronautical charts with the implementation of quality control and metadata creation, according to our own system.

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