

# ISO/TC 211 PROJECT 19122, GEOGRAPHIC INFORMATION / GEOMATICS - QUALIFICATIONS AND CERTIFICATION OF PERSONNEL - STATUS AND DEVELOPMENT

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## 1. INTRODUCTION

The necessity for worldwide standardization of Geographic Information is well known. Standardization is important for the production and use of geographic data, the GIS industry and the application of their products. The development of national and international Geographic Information Systems has been proceeding rapidly for many years. In the meantime in many countries, experience in establishing and maintaining and especially using them is available. Additionally other problems must be solved; e.g. coordination, quality management and currently economic management instruments become more and more important. Many activities are focused on these tasks worldwide. In all fields, the importance of International Standards is steadily increasing. The authorities to develop standards are the official standardization bodies at the national level (e.g. AFNOR, BSI, DIN, NTS, SCC, ANSI, SABS,SA). On the European level, the CEN/TC 287 'Geographic Information' of the Comité Européen de Normalisation (CEN), has developed 20 standards since 1990 about 20 standards and CEN/TC 278 'Road Transport Telematics' developed the GDF – Standard (Geographic Data File). Worldwide, the International Standardization Organization (ISO) has established several Technical Committees, e.g. ISO/TC 211: 'Geographic Information / Geomatics' in 1994.

Besides the global activities at ISO, many organizations and institutions are working on this subject, e.g. OGC, DGIWG, FIG, ISPRS, ICA, governmental administrations (de-facto standards). Until now, the focus has been based mainly on the data, interfaces and their technical and organizational structures. To optimize the production of geospatial data and to improve the GIS quality of the output, one of the most important criteria is the qualification and certification of personnel. Technology transfer through human resources becomes increasingly important from a global economic perspective. The result is the current effort to standardize qualification and certification of personnel in Geographic Information / Geomatics, which is under worldwide discussion, and is a special work item of ISO/TC 211 under the Project team 19122.

## **2. STANDARDIZATION OF GEOGRAPHIC INFORMATION**

### **2.1 Worldwide Standardization**

The International Standards Organization (ISO), the Technical Electrotechnical Commission (IEC), and the Telephone Consultative Committee (CCITT), all located in Geneva, are responsible for the standardization at the international level.

In ISO, the national standards bodies of some 120 countries cooperate in activities that aim to facilitate the international exchange of goods and services by creating uniform standards with global validity, and to stimulate cooperation in the scientific, technical and economic fields across national frontiers.

Since 1994, DGIWG and IHO have played a special role in the development of geo-spatial standards. More recently the OGC, which has now entered into a cooperative agreement with ISO/TC211, has a significant impact on the standards formulating process. The results of this effective cooperation are ISO Standards.

FIG takes special note of the ISO activities in order to transfer knowledge about ISO/TC211 standards to its members for practical use. A survey conducted by FIG shows that there is a general lack of knowledge and practice of the official standardization. Many other useful links to ISO have been started by a special task force on standards, established at the FIG congress in 1998 in Brighton.

Since ISO/TC211 was established, in 1994 (Secretariat NTS, Norway) this committee has been steadily increasing. There are now 33 P-(participating) members and 19 O-(observer) members.

A close co-operation has been set up between ISO/TC 211 and CEN/TC 287. All CEN/TC 287 documents are now published as pre-standards. Most of the pre-standards have been sent out for review in 2001.

11 'Internal' liaisons to other ISO-committees and 17 'External' (A-) Liaisons exist.

#### *Internal Liaisons*

- ISO/IEC JTC 1/SC 2 Coded character sets
- ISO/IEC JTC 1/SC 24 Computer graphics and image processing
- ISO/IEC JTC 1/SC 32 Data Management and Interchange
- ISO/IEC JTC 1/SC 35 User Interface
- ISO/TC 204 Transport Information and Control Systems
- ISO/TC 20/SC 13 Space data and information transfer systems
- ISO/TC 23/SC 19 Agricultural electronics
- ISO/TC 184/SC 4 Industrial Data
- ISO/TC 82 Mining
- ISO/TC 46/WG 2 Coding of country names and related entities
- ISO/TC 130 Graphic Technology

## *External Liaisons*

- Digital Geographic Information Working Group, DGIWG
- European Petroleum Survey Group, EPSG
- IEEE Geoscience and Remote Sensing Society
- International Association of Geodesy, IAG
- International Cartographic Association, ICA
- International Federation of Surveyors, FIG
- International Hydrographic Bureau, IHB (IHO -International Hydrographic Organization)
- International Society for Photogrammetry and Remote Sensing, ISPRS
- International Steering Committee for Global Mapping, ISCGM
- Joint Research Center of the European Union, JRC
- Open GIS Consortium, Incorporated, OGC
- The Committee on Earth Observation Satellites/Working group on Information Systems and Services, CEOS/WGISS
- The Permanent Committee on GIS Infrastructure for Asia and the Pacific, PCGIAP
- UN ECE Statistical Division
- World Meteorological Organization
- Global Spatial Data Infrastructure, GSDI
- International Civil Aviation, ICAO

## **2.2 ISO/TC211 Working Groups and Projects**

There are 31 projects handled by 5 working groups and 2 project teams work directly under ISO/TC211 (ISO/TC211-N1042, 2001).

### *Working group 1 – Framework and reference model*

*Convenor: USA*

Project No.	Title	Stage
19101	Geographic information – Reference model	DIS
19102	Geographic information – Overview Final	2.CD
19103	Geographic information – Conceptual schema language	CD
19104	Geographic information – Terminology	2.CD
19105	Geographic information – Conformance and testing	IS
19121	Geographic information – Imagery and gridded data	TR
19124	Geographic information – Imagery and gridded data components	Stage 0

### *Working group 2 – Geospatial data models and operators*

*Convenor: South Africa*

19107	Geographic information – Spatial schema	3.CD
19108	Geographic information – Temporal schema	DIS
19109	Geographic information – Rules for application schema	3.CD
19123	Geographic information – Schema for coverage geometry and functions	CD

*Working group 3 – Geospatial data administration*  
*Convenor: United Kingdom*

19110	Geographic information – Feature cataloguing methodology	DIS
19111	Geographic information – Spatial referencing by coordinates	DIS
19112	Geographic information – Spatial referencing by geographic identifiers	DIS
19113	Geographic information – Quality principles	DIS
19114	Geographic information – Quality evaluation procedures	DIS
19115	Geographic information – Metadata ~	DIS
19126	Geographic information – Profile – FACC Data Dictionary	NP
19127	Geographic information – Geodetic codes and parameters	NP

*Working group 4 – Geospatial services*  
*Convenor: Norway*

19116	Geographic information – Positioning services	2.CD
19117	Geographic information – Portrayal ~	3.CD
19118	Geographic information – Encoding ~	2.CD
19119	Geographic information – Services	2.CD
19125	Geographic information – Simple feature access – Part 1: Common architecture	DIS
19125-2	Geographic information – Simple feature access – Part 2: SQL options	DIS
19125-3	Geographic information – Simple feature access – Part 3: COM/OLE options	2.CD

*Working group 5 – Profiles and functional standards*  
*Convenor: Canada*

19106	Geographic information – Profiles Final	2.CD
19120	Geographic information – Functional standards	2.CD
19120	Amd. 1 Geographic information – Functional standards – Technical amendment	NP

*Project directly under the ISO/TC211*

19122	Geographic information/Geomatics –Qualification and Certification of personnel	NP
19128	Geographic information - Web Map server interface	CD

### **3. PROJECT 19122**

Project 19122 was proposed as a new work item in 1998 (ISO/TC 211 - N573, 1998) and accepted by vote in 1999 (ISO/TC 211 – N639, 1999) and it is scheduled to be delivered a Technical Report, Type 3 in due time.

### 3.1 Scope

Every new work item is formally defined by the scope and purpose of the work. They are subject to modification, according to the rate of change in the technology and the increased depth of understanding as the work progresses. The formal scope of the project is given below:

- *To develop a Type 3 report, which describes a system for the qualifications and certification, of personnel in the field of Geographic Information Science / Geomatics, by a central independent body.*
- *To define the boundaries between Geographic Information Science/ Geomatics and other related disciplines and professions.*
- *To specify the technologies and tasks pertaining to Geographic Information Science / Geomatics.*
- *To establish skill sets and competency levels for technologists, professional staff and management in the field.*
- *To research the relationship between this initiative and other similar certification processes performed by existing professional associations.*
- *To develop a plan for the accreditation of candidate institutions and programs, for the certification of individuals in the workforce, and for collaboration with other professional bodies. (ISO/TC 211-N573 1998)*

Likewise the preliminary purpose and justification is open to revision. The initial description has a strong North American bias. This will be addressed before the technical report stage.

### 3.2 Purpose and Justification

*Geomatics has evolved from the Surveying and Mapping profession in Canada (e.g. Canadian Institute for Surveying and Mapping (CISM) = Canadian Institute for Geomatics (CIG)). In the United States, Geographic Information Science stems from the technology, Geographic Information Systems (GIS) (e.g. University Consortium for Geographic Information Science UCGIS). Given the changing technology, changing problem definition (science), government and industry requires a set of standards for the certification of personnel. This task concerns ISO/TC211 Geographic Information. The skills of technologists, professionals and managers have to be specified to meet the tasks within the new conceptual and technology context.*

*The purpose of the new work item is to reach agreement on the bounds of Geographic Information / Geomatics through collaboration with other professional associations and appropriate accredited standardization bodies. For each broad work task, the background education and work experience will be identified for the individual to receive certification. This effort will be complemented by a survey of staff in existing government agencies and private industries holding a position defined in terms of Geographic Information Science (GIS) / Geomatics. Part of the first phase will be a listing of all educational institutions which offer GIS/Geomatics education and training.*

*A second phase, if accepted, would be an accreditation process for those institutions who require their graduates to be eligible for certification.*

*A number of national (international) organizations are independently working towards certification e.g. URISA, AGI, ACSM, ASPRS, UCGIS. ISO/TC 211 can provide a co-ordination function.(ISO/TC 211-N573, 1998)*

### **3.3 Definition of Technical Report, Type 3**

Besides the development of ISO-Standards, it is also possible to produce 3 types of Technical Reports, Type 3 as products of ISO/TC 211. The definition of a type 3 report is given below.

When a technical committee or subcommittee has collected data of a different kind from that which is normally published as an International Standard (this may include, for example, data obtained from a survey carried out by the national bodies, data on work in other international organizations or data on the “state of the art” in relation to standards of national bodies on a particular subject), the technical committee or subcommittee may decide, by a simple majority vote of its P-members, to request the Chief Executive Officer to publish such data as a Technical Report. The document shall be entirely informative in nature and shall not contain matter implying that it is normative. It shall clearly explain its relationship to normative aspects of the subject which are, or will be dealt with in International Standards related to the subject. The Chief Executive Officer, if necessary in consultation with the Technical Management Board, shall decide whether to publish the document as a Technical Report.

*When the majority of P-members of a technical committee or subcommittee have agreed upon the publication of a technical report, the draft report shall be submitted in machine-readable form by the secretariat of the technical committee or subcommittee to the Chief Executive Officer within four months for publication.*

ISO/TC 211 can establish Working Groups which are formed to undertake the work needed to develop an International Standard. The organization, also, has Project Teams which can be formed to do the background research leading to the production of a technical report. This may be an intermediate step towards an International Standard. There are three types of technical report; in the case of Geographic Information / Geomatics: qualification and certification of personnel, the objective is a Type 3 report.

## **4. DELIVERABLES**

The first formal meeting of the project team at the ISO/TC 211-Meeting in Cape Town, March 2000. At that time, it was clear that there was a need to obtain a broad overview of the status of certification across the P-member countries. The project team developed a questionnaire to obtain a snapshot of the national variation on this topic. The results from the questionnaire formed the basis of the first deliverable. At the second meeting of the project team in Reston, September 2000, as the result of the preliminary analysis of the questionnaire, the project team developed the template for its Technical Report, Type 3 and made the decision to adopt a case study approach. A case study approach allows for more detailed national descriptions, which may prove useful to other P-member countries. This approach permits cross-comparison of the different instruments

for classifying personnel which are available within the international community. This set of case studies will represent the second deliverable.

These case studies, their analysis and subsequent recommendations, together, will form the context of the third deliverable, namely, the Technical Report, Type 3.

#### 4.1 Questionnaire

The project team recognized that it would not be possible to get a global view of national qualification and certification activities from the existing members. Instead, it was decided that a questionnaire should be developed and sent out to all ISO/TC 211 P-members and class A-liaison members (ISO/TC 211-N 902, 2000) in April 2000. This questionnaire contained nine questions. Together, these questions addressed issues of guidelines for qualification and certification, legislated certification, accreditation and model curriculum.

##### Question 1

Does your country have a set of guidelines for the certification and qualification of personnel in the field of geographic information/geomatics ?

Yes – 10      No - 8

##### Question 2

If no to question 1, are you planning to initiate this activity in the near future?

Yes – 11      No – 8

##### Question 3

Do you have national legislation for certification of personnel ?

Yes – 11      No – 8

##### Question 4

Do you have legislation for certification at regional level ? (e.g. Province, state, municipal)

Yes – 3      No – 13

##### Question 5

Do you have any industrial standards (i.e. not by legislation) for the qualification of personnel ?

Yes – 4      No – 12

##### Question 6

Is there a national/ international group which has defined a model curriculum ?

Yes – 3      No – 10

##### Question 7

Do you have a mechanism for program accreditation in the field of geographic information/geomatics ?

Yes – 7      No – 8

Questions 8 and 9 were open ended and concerned the status of Geographic Information and Geomatics in the educational system.

The response to the survey shows significant variability in the interpretation of qualification and certification terminology, considerable variation in the involvement of different stakeholders, and wide differences in the definition of the subject domain. In some cases, there was a narrow definition of Geomatics; in other cases, there was a broad definition of Geographic Information. The lack of consistency, in the definition of the subject domain and also in the application of instruments for qualifications and certification of personnel, resulted in the adoption of a case study approach. This approach allows individual countries to provide a more elaborate context. Without this contextual elaboration, it can be impossible to make meaningful comparisons.

## **4.2 Case Studies**

At the ISO/TC 211 meeting in Reston, Virginia, the project team defined the template for a preliminary draft Type 3 technical report (PDTR). From the analysis of the questionnaire (see 4.1), given the broad definition of Geomatics and the variation in the implementation of qualification and certification of personnel across the P-member countries, it was determined that a set of case studies was needed to provide the necessary background research on the subject.

Selection of case studies was based upon those countries having appointed a representative to the project team or having made a presentation at one of the project team meetings in Cape Town or Reston. Case studies have been requested at least from Australia, Canada, Germany, Iran, Japan, Saudi Arabia, South Africa, United Kingdom and the United States. To assist in the process, the project team leader from Canada established a template and also provided the Canadian case study for review at Lisbon. The table of contents for the case study includes national specifications of the subject domain, education and training systems; national professional associations active in the qualifications and certification of personnel; the current status of these activities in that country; and anticipated future directions, given the current level of activity.

In Lisbon, the other P-member countries were requested, by their Heads of Delegation, to prepare similar case studies for presentation at a follow up project team meeting. At this meeting, the individual country studies will be subject to internal scrutiny by the project team, leading to the development of a comparison matrix and as input to a set of recommendations, as part of the Technical Report Type 3 to be delivered to ISO/TC 211 at its next meeting.

## **4.3 Technical Report, Type 3**

A Technical report Type 3 provides the results of the background research on a topic of interest to ISO/TC 211. In this case, the subject is Geographic Information / Geomatics; qualifications and certification of personnel. At this stage, the objective is not to publish an International Standard but rather to present the results and recommendations to ISO/TC 211 for decision on the appropriate process which may lead, eventually, to standardization.



The template for this Technical Report Type 3 includes the background to the Project 19122; the common ISO/TC 211 definitions; individual P-member case studies including their national definitions; a synthesis of the different instruments in place for qualifications and certification of personnel in each country; and a set of recommendations. These recommendations will address the scope of the report, the role of ISO/TC 211, P-member countries, International Professional Associations in the qualification and certification process, and any requirements on further work.

The development of national case studies, their synthesis and recommendations within the framework of ISO/TC 211 Technical Report Type 3 represents work in progress. International Professional Associations, whether Class A-liaison members or other interested professional groups will have the opportunity to provide feedback on the preliminary draft Technical Report (PDTR) Type 3 as part of the normal, inclusive ISO/TC 211 procedures.

## **5. CURRENT STATUS**

During the meeting in Lisbon, to make valid comparisons between different initiatives in the P-member countries, it was imperative to obtain active participation for the case studies. The task of assembling an accurate picture is made particularly difficult because of the broad definition of the subject domain, the rapid changes in information technology and the differences between this activity and other ISO/TC 211 activities. For each case study, the project team member must contact a number of stakeholders in their country: private industry, government agencies, professional associations and several academic communities. This challenge is inherent in the scope and purpose of the work item. It is exacerbated by the challenge to ISO/TC 211 management which had to expand its activity from data standards to embrace the human dimension.

## **6. CONCLUSIONS**

The establishment of standards for the qualifications and certification of personnel in Geographic Information / Geomatics is a complex task. There are a wide range of academic disciplines and professional associations with an interest in the supply of qualified personnel, with the proper conceptual and practical skills sets. The traditional culture of ISO/TC 211 has focused upon data standards; adding the human dimension, has required the inclusion of a new set of experts and expertise.

The project team has followed a basic research model. After an initial survey of the topic by questionnaire, it expanded its work to develop a number of national case studies. These case studies will be essential background work, leading to a set of recommendations to ISO/TC 211 on the respective role of ISO/TC 211, its P-member countries, its class A-liaison members and other international professional associations. These recommendations will be delivered in the form of a preliminary draft Technical Report (PDTR) Type 3.

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**Hans Knoop** studied Geodesy at Hannover University and finished the respective administrative preparatory exams in Germany. He was a member of the Cadastral- and Surveying Administration of the State of Lower Saxony in different directing positions in State Survey Office, Cadastral Office of Hannover and the Ministry of Interior (1964-2000). His main activities have been concentrated in developing new technologies (e.g. Dissertation 'Electronic Tacheometry; Dr.-Ing. 1970) especially in LIS and GIS including legal and administrative aspects. Professor at Technical University of Braunschweig (since 1976).

Since 1975 Head of Division ‘Surveying, Geoinformation’ of German Institute for Standardization (DIN), Berlin, and Head of the German delegation CEN/TC 287 (since 1990) and ISO/TC 211 (since 1994). Member of ISO/TC 211 –PT19122. Representative of ISPRS to ISO/TC 211. Many activities in FIG on international and national level ( Com.3, Task Force on Standards). International expert for GIS and Land Management for several organizations and governments. Appointed Honorary Professor of Wuhan Technical University of Surveying and Mapping (WTUSM), China. Numerous international and national publications.