

ISO/TC 211 Project 19122, Geographic Information / Geomatics – Qualifications and Certification of Personnel – Technical Report

Prof. Hans KNOOP, Germany

Key words: certification, geographic information, ISO/TC 211, personnel, standards.

ABSTRACT

In all fields, the importance of International Standards is steadily increasing. The authorized national, European, and International Standardization Organizations, e.g. ISO/TC211: Geographic Information/ Geomatics developed, partly in cooperation with organizations as OGC, FIG, ISPRS, ICA, DGIWG, a large number of standards. Until now, the work 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 consequence is the current effort to standardize qualifications and certification of personnel in Geographic Information / Geomatics, which is under worldwide discussion, and is a special project of ISO/TC 211 by Canadian proposal. In 1998 the Project team 19122 “Qualifications and Certification of Personnel”, where the author is a member from, has been established.

An interesting new aspect of this task is, according to the interdisciplinary character of GIS and the involved professions, that not just one profession is covering all the tasks of the GIS anymore. There is no overview and analysis of the existing systems of qualifications and respective certification for guaranteeing the quality of the products and personnel. So the PT 19122 collected, enlarged and intensified the requested information about the national situation in the meantime by more than 20 case-studies contributed by members of ISO/TC 211.

Because of the special frame-conditions and character of this subject the result of project 19211 will not be an ISO-Standard but an ISO-Technical Report, which describes a system for the qualification and certification of personnel in the field of Geographic Information Science / Geomatics by a central independent body.

The case-studies allow synthesis and development of recommendations of ISO/TC 211 for information and basis for the respective work interested organizations on national and international level. The author reports about status and development of the project and Technical Report.

CONTACT

Prof. Hans Knoop
Head of Department "Surveying, Geoinformation"
of German Institute for Standardization (DIN), Berlin
Technical University of Braunschweig
Hannover
GERMANY
Tel. + 49 511 57 19 73
Fax + 49 511 1 61 21 30
E-mail: hans.knoop@t-online.de and hans.knoop@gmx.de

ISO/TC 211 Project 19122, Geographic Information / Geomatics – Qualifications and Certification of Personnel – Technical Report

Prof. Hans KNOOP, Germany

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 world wide. 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 Comitee Europeen de Normalisation (CEN). In its TC287 has developed since 1990 about 20 standards and CEN/TC278 'Road Transport Telematics' developed the GDF – Standard (Geographic Data File). World-wide, International Standardization Organization (ISO) has established several Technical Committees e.g. TC211: Geographic Information / Geomatics in 1994.

Besides the ISO global activity, many organizations and institutions are working on this subject e.g. OGC, DGIWG, FIG, ISPRS, ICA, government 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 is 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/TC211 under the Project team 19122.

2. STANDARDIZATION OF GEOGRAPHIC INFORMATION

2.1 Worldwide Standardization

Standardization at the international level is the responsibility of the International Standards Organisation (ISO), the Technical Electrotechnical Commission (IEC), and the Telephone Consultative Committee (CCITT), all located in Geneva.

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 have entered into a cooperative agreement with ISO/TC211, and have a significant impact on the standards developing process. The results of this effective cooperation are ISO standards.

FIG takes special note of the ISO activities in order that it can transfer knowledge about ISO/TC211 standards to its members for practical use. A survey conducted by FIG showed that there is a general lack of knowledge and practice of the official standardization. By a special Task Force on Standards, established at the Brighton, FIG Congress 1998, many other useful links to ISO have been started.

Since ISO/TC211 was established, in 1994 (Secretariat NTS, Norway) this committee has steadily increased. There are now 33 P-(participating) members and 18 O-(observer) members.

There has been a close co-operation between ISO/TC 211 and CEN/TC 287. All CEN/TC 287 documents are published as pre-standards

There are 11 'Internal' liaisons to other ISO-committees and 18 'External' (A-) Liaisons.

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/SC4 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 Centre 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
 United Nations Geographic Information Working Group (UNGIWG).

2.2 ISO/TC211 Working Groups and Projects

Originally 5 working groups started working on more than 20 Standards, which are nearly finished. New work items came up, so new tasks came up. A new structure of organization was necessary and has been established at last Plenary in October 2001.

There are now 14 projects handled by 5 working groups, and 2 groups work directly under TC211.

Working group 4: Geospatial services

TITLE	STAGE
19128 Geographic information - Web Map server interface	CD

Working group 6: Imagery

19129 – Geographic Information – Imagery Gridded and Coverage Data	WD
19130 – Geographic Information - Sensor and Data Models for Imagery and Gridded Data	WD

Working group 7: Information communities

19120 Geographic information – Functional standards	2. CD
19120 Amd. 1 Geographic information – Functional standards – Technical amendment	NP
19122 Geographic information / Geomatics –Qualifications and Certification of personnel	NP
19126 Geographic information – Profile – FACC Data Dictionary	NP

Working group 8: Location based services

19132 Geographic information – Location based services possible standards	NP
19133 Geographic information – Location based services tracking and navigation	NP

19134 Geographic information – Multimodal location based services for routing and navigation NP

Working group 9: Information management

19127 Geographic information – Geodetic codes and parameters NP

19131 Geographic information – Data product specification NP

19135 Geographic information – Procedures for registration of geographical information items NP

Advisory group on outreach

Terminology maintenance group (TMG)

3. PROJECT 19122

Project 19122 was proposed as a new work item in 1998 (ISO/TC211 - N573 1998) and accepted by vote in 1999 (ISO/TC211 – N639 1999) and it is scheduled to deliver the final draft of the Technical Report in June 2002.

3.1 Scope

Every new work item is formally defined by the scope and purpose of the work. They are subject to modification, given 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 Technical Report - former “Type 3”-Report - which describes a system for the qualification and certification, by a central independent body, of personnel in the field of Geographic Information Science / Geomatics.*
- *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/TC211-N573 1998)*

Likewise the preliminary purpose and justification is open to revision. The scope of the work has been developed by Canada. This will be addressed before the technical report stage.

3.2 Purpose and Justification

Geomatics has evolved in Canada from the Surveying and Mapping profession (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 falls within the ISO/TC211 Geographic Information. The skills of technologists, professionals and managers have to be defined 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 standards 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 industry who hold 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 wish 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/TC211 can provide a co-ordination function (ISO/TC211-N573 1998).

3.3 Definition of Technical Report

Besides the development of ISO-Standards, until 2001 it has been also possible to produce 3 types of Technical Reports as products of ISO/TC211. In 2001 the ISO/IEC Directives have been changed concerning the definitions of the of the 3 types of Technical Report. The type 1 and 2 are combined under the new name of Technical Specification (TS), and type 3 in now so-called Technical Report, according to the following definition:

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 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 in the form of 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 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/TC211 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. Concerning Geographic Information / Geomatics: qualifications and certification of personnel, the objective is a Technical Report.

4. DELIVERABLES

The first formal meeting of the project team was 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 Type 3 Technical Report 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 who have not had the time to explore the issues of qualifications and certification of personnel. 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.

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/TC211 P-members and class A-liaison organizations (ISO/TC211-N902 2000) in April 2000. This questionnaire contained nine questions. Together, these questions addressed issues of guidelines for qualifications and certification, legislated certification, accreditation and model curriculum.

Given questions:

- Does your country have a set of guidelines for the certification and qualification of personnel in the field of geographic information/geomatics?
- If no to question 1, are you planning to initiate this activity in the near future?
- Do you have national legislation for certification of personnel?
- Do you have legislation for certification at regional level? (e.g. Province, state, municipal)
- Do you have any industrial standards (i.e. not by legislation) for the qualification of personnel?
- Is there a national/ international group which has defined a model curriculum?
- Do you have a mechanism for program accreditation in the field of geographic information/geomatics?

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 showed significant variability in the interpretation of 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/TC211 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, given the broad definition of Geomatics and the variation in the implementation of qualifications 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 who had appointed a representative to the project team or had made a presentation at one of the project team meetings in Cape Town or Reston. Case studies have been requested from Australia, Canada, Germany, Iran, Japan, 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 definitions 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 six P-member countries were requested, through their Head of Delegation, to prepare similar case studies for presentation at a follow up project team meeting in Canada. 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 to be delivered to ISO/TC211.

Project team 19122 held a workshop in Lawrencetown, Canada, evaluating the initial set of case studies and to produce a first draft of Technical Report. This draft, including the initial case studies has been available for the ISO/TC211 meeting in Adelaide, Australia.

In Adelaide, a second request for further case studies was made by Head of the German Delegation in connection with the presentation of the status of the project to the plenary. The result was very positive (fourteen more case-studies).

4.3 Technical Report

A Technical Report provides the results of the background research on a topic of interest to ISO/TC211. 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 TC211 for decision on the appropriate process which may lead, eventually, to standardization.

The template for this Technical Report includes the background to the Project 19122; the common ISO/TC211 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/TC211, 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/TC211 Technical Report 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) as part of the normal, inclusive ISO/TC211 procedures.

5. CURRENT STATUS

The meeting in Lisbon was critical to the success of project team 19122. 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 TC211 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 TC211 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 TC211 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 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, in the meantime there are more than twenty, are essential background work, leading to a set of recommendations to TC211 on the respective role of ISO/TC211, its P-member countries, its class A-liasion members and other international professional associations. After presentation and discussion at FIG-Congress 2002 in Washington with the global professional associations and involved institutions there are expected a set of recommendations and other results. The Project Team will consider all contributions. And after the next ISO/TC-Plenary in Mai 2002 all recommendations will be delivered in the form of a preliminary draft Technical Report (PDTR).

ACKNOWLEDGEMENTS

The author wishes to thank his colleagues from PT19122, especially Dr. Robert Maher, Centre of Geographic Sciences, Nova Scotia, Canada, for their cooperation and support.

REFERENCES

- DGDI – Figura, J. 2000. Zertifizierte Geodaten, Intergeo 2000, Berlin, Proceedings, www.gzgi.de
- DIN CERTCO 2000: Personalzertifizierung nach DIN EN 12837, Berlin, zentrale@din.certco.de
- Enemark, S. and F.Plimmer. 2000. Mutual recognition and professional qualifications in the surveying profession, FIG – Working Week 2000, Prague, Proceedings.
- Greenway, I. 2000. Surveyors and Standardization. FIG – Working Week 2000, Prague, Proceedings.
- Hawerk, W and H.Knoop. 1999. Report of the results of the FIG questionnaire on standards, FIG-standards task force, FIG – Working Week 1999, Sun City, Proceedings
- Knoop, H. 1999. International standardization and the progress of the FIG task force on standards, FIG-Com3 meeting, Budapest, Proceedings.

- Knoop, H. 2001. ISO/TC211 Project 19122, Geographic Information / Geomatics - Qualifications and Certification of Personnel, FIG-Working Week 2001, Seoul, Proceedings
- ISO/TC211-N573. New Work Item Proposal, 1998-01-04.
- ISO/TC211-N639. Result of voting on New Work Item Proposal, 1999-01-04
- ISO/TC211 -N902. Questionnaire regarding Project19122, Geographic Information / Geomatics: Qualifications and Certification of Personnel, 2000-04-10.
- Oestensen, O. 2001. ISO Standards for GIS: Overview and Future Directions – global standards in support of sustainable geospatial infrastructures, FIG-Working Week 2001, Seoul, Proceedings

BIOGRAPHICAL NOTES

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 Tachymetry; 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 Department ‘Surveying, Geoinformation’ of German Institute For Standardization (DIN), Berlin and as well Head of German delegation in CEN/TC287 (since 1990) and ISO/TC211 (since 1994). Member of ISO/TC211 –PT19122. Representative of ISPRS to ISO/TC211. 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. Expert of Twinning Project Phare 2000 in Poland. Appointed Honorary Professor of Wuhan Technical University of Surveying and Mapping (WTUSM), China. Honory Advisor of Hongkong Institution of Engineering Surveyors. Numerous international and national publications.