

FIG Commission 5

Annual Report of Activities 2012

1. General

The Commission 5 2011-14 work plan consists of realising tangible outcomes for our FIVE missions, which are -

- FOCUS on modern technologies, technical developments and applications
- FACILITATE and follow technical developments through collaborations with other FIG Commissions and like organisations
- FOSTER and support research and development and stimulate new ideas in the fields of expertise represented within the commission.
- FORMULATE and formalise collaboration with manufacturers on the improvement of instrumentation and associated software.
- FIG EVENTS - present and promote the work of the Commission and its working groups through technical events and necessary media

The year of 2012 for Commission 5 was primarily centred on the technical activities associated with the FIG 2012 Working Week in Rome and the Regional Conference in Montevideo, Uruguay. Commission 5 were especially pleased about the outcome of the FIG / IAG / ICG Technical Seminar on Reference Frame in Practice that was held just prior to the FIG Working Week in Rome. We also continued our effective collaboration with our sister organisations at events to promote and fulfil the objectives of our work plan, especially at events such as the Machine Control and Guidance (Stuttgart, Germany) and ICG-7 (Beijing, China). In addition to this, the Commission has been involved in the preparations for the next FIG Technical Seminar on Reference Frames in Practice in Manila, and the FIG Working Week in Abuja.

A summary of the working group activities in 2012 is as follows:

2. Working Groups

WG 5.1 – Standards, Quality Assurance and Calibration

Chaired by David Martin

Standards play important role in surveying. This is even truer in the modern black-box world where the details of instrumentation and techniques are often opaque for the average practicing surveyor. They are very reliant upon standards underpinning the correct functioning of their instruments.

Working Group 5.1 was active at the FIG Working week in Rome. In addition the working week sessions, and an active participation in the first Technical Seminar on Reference Frames in Practice; a Standards Network meeting for all delegates interested in “standards” was convened. This meeting was well attended by Commission 5 representatives.

At this meeting there was a discussion around who will replace Ian Greenway as the FIG liaison to the ISO Technical Commission (TC) 211 (<http://www.isotc211.org/>). Ian Greenway advocated the new representative should come from one of Commission 4, 5 or 6. This is where there is considerable work in the field of standards right now.

Briefly, TC 211 is concerned with standardization in the field of digital geographic information. This commission aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations. The work links to appropriate standards for information technology and data where possible, and provides a framework for the development of sector-specific applications using geographic data.

Nic Donnelly of Land Information New Zealand (LINZ) has agreed to replace Ian Greenway as the FIG liaison to the ISO Technical Commission (TC) 211. Current work items include:

- 19119 – services (revision)
- 19157 – data quality (at FDIS stage so no real chance to change now)
- 19159-1 – calibration of remote sensitive imagery sensors (optical)
- 19160-1 – addressing: conceptual model
- 19161 – geodetic references
- 19162 – well known coordinate reference systems

There was also some discussion concerning FIG Publication No. 9. At the FIG working week held in Marrakesh it was decided that FIG publication No. 9 Recommended Procedures for Routine Checks of Electro-Optical Distance Meters - (http://www.fig.net/pub/figpub/pub09/FIG-Publication_Nr9_english.pdf) should be revised with additions for recommendations for hand held distance-meters and reflector-less instruments. Unfortunately due to a very heavy workload this has not advanced.

Ian Greenway initiated a discussion concerning work of the Royal Institution of Chartered Surveyors (RICS) on International Measurement Standards, with particular reference to the field of valuation and real estate management

Several other standards under Technical Committee ISO/TC 172/SC 6 "Geodetic and surveying instruments" are also presently under discussion and/or revision:

- ISO 09849 Geodetic and surveying instruments - Vocabulary (Edition 3)
- ISO 12858-1 Optics and optical instruments -- Ancillary devices for geodetic instruments -- Part 1 Invar levelling staffs (Edition 2)
- ISO 12858-2; 1999 Amendment 1
- ISO 17123-5 Field procedures for testing geodetic and surveying instruments - Part 5 - Total stations (Edition 2)
- ISO 17123-6 Field procedures for testing geodetic and surveying instruments - Part 6 - Rotating lasers (Edition 2)
- ISO 17123-7 Field procedures for testing geodetic and surveying instruments - Part 7 - Optical plumbing devices

- ISO 17123-8 Field procedures for testing geodetic and surveying instruments - Part 8 - GNSS field measurement systems in real-time kinematic (RTK) (Edition 2)
- ISO 17123-9 Field procedures for testing geodetic and surveying instruments - Part 9 - Terrestrial laser scanners (TLS) A principal aim of Working Group 5.1 over the coming year remains the examination and promotion of guidelines and recommendations for standards and quality in survey measurements based on the ISO Guide to Uncertainty in Measurement (GUM) and its supplements.

Nic Donnelly, from Land Information New Zealand, spoke about the importance of Metadata standards. This is an important field - not just in surveying and geodesy. He is looking to establish a joint FIG/IAG working group to study this important subject.

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WG 5.2 – Reference Frames

Chaired by Graeme Blick

Over the past year WG 5.2 has focused on four main activities.

Development of 4 Dimensional Datums: A small focus group continues to work on issues around the establishment of 4 dimensional datums, i.e. those including a time variable component to account for the effects of crustal deformation. Of particular interest has been how deformation following an event such as an earthquake can be incorporated into a datum. The concept of a patch to model the deformation has been refined and this is being trialled as a method to incorporate the effects of ground movements as a result of the recent Canterbury Earthquakes in New Zealand into their geodetic datum. Formats for deformation models are also being refined, and a draft format has been circulated to interested parties for review. While the Canterbury Earthquakes are a highly relevant case study for this work, the aim is to develop deformation modelling processes that will be widely applicable internationally for earthquakes and other deformation events. Several papers on the topic were presented at the FIG Working Week meeting in Rome and Technical Seminar on Reference Frames in Practice also held in Rome.

eGeodesy: Work has also continued into the development of geodetic data models and data transfer formats and standards. The most substantial piece of work has been the use of the data model to develop a Geography Markup Language (GML) compliant schema. The advantage of compliance with GML is that the transfer format will then be more widely supported by software vendors, as many already support GML. A GML standard has been published by the International Standards Organisation (ISO), so the use of GML should ensure wide support for the geodetic transfer format being developed. The Use Case documentation has been developed, which outlines the major behaviours expected of an automated geodetic management system. Nic Donnelly (New Zealand) spent several months at JPL looking into the topic and he presented some preliminary findings in Rome. This initiative continues through a small Australia/New Zealand working Group.

Technical Seminar on Reference Frames in Practice: The inaugural Technical Seminar on Reference Frames in Practice was held as part of the 2012 FIG Working Week Rome meeting. This seminar was given as a series of short presentations covering a range of topics including the role of Geodesy – GGOS and future trends, regional and national reference systems, and gravity and world height systems. With over 20 delegates this initial seminar proved to be very successful and a follow up seminar is planned to be held in Manila in June 2013.

Reference Frames in Practice Manual: Leading on from the Technical Seminar on Reference Frames in Practice seminar a decision was made to develop a manual on the topic. This is being produced as a series of two page fact sheets so that they can be easily updated and used individually. A draft manual has been developed covering the following topics:

- Introduction
- Geodesy and Global Reference Frames
- Key International Geodetic Groups
- Global Terrestrial Reference Systems and Frames
- Regional and National Reference Frames
- Height Systems
- Standards and Traceability of Terrestrial Reference Frames – Quality and Standards
- Standards and Traceability of Terrestrial Reference Frames – Example and References
- Global Navigation Satellite Systems
- GNSS CORS Networks and Linking to ITRF
- Transforming Between Datums
- Transforming Between Datums in Non-static Reference Frames

It is anticipated that the manual will be available for review at the next Commission 5 meeting in Manila.

WG 5.3 – Geodetic and Positioning Infrastructure

Chaired by Neil D. Weston

The national developments regarding geodetic and positioning infrastructure was as intense as usual during 2012. Many countries are developing their infrastructure to meet the demands of the users. The development of national GNSS CORS is rapid. The International GNSS Service (IGS) is playing a very important role to develop standards and recommendations on how a reference station should be set up. These issues were raised and discussed at FIG events such as the Reference Frame Technical Seminar and Working Week in Rome, and at other related symposiums. This working group also provided presentations or assistance with technical sessions, and often together with our sister organisations IAG, at e.g. the ICG-7 (Beijing, China), the PPP-RTK and Open Standards Symposium (Frankfurt, Germany) and the IGS Workshop (Olzтын, Poland).

A proposal to investigate ‘standardization needs’ for geodetic references, has been submitted by France to the International Standardization Organization (ISO) in early 2012. This proposal was specifically sent to the ISO Technical Committee 211 on Geographical

Information / Geomatics. This proposal was approved in June by ISO TC 211 under the title of Project 19161. FIG endorses this initiative and needs to be actively involved in this effort in the future.

This working group has also been liaising and working with both Commission 5.2 and 5.4 on their respective technical publications.

WG 5.4 – Kinematic Measurements

Chaired by Volker Schweiger

The technical main points identified by Working Group 5.4 are multi-sensor-systems related to monitoring and to machine guidance. This was the reason to support the 3rd International Conference on Machine Control and Guidance (MCG 2012) that was held in Stuttgart, Germany on 27 - 29 March 2012. A total of 33 papers were accepted. The conference papers were included in sessions about the topics: Global Navigation Satellite Systems, Kinematic Measurements, Sensor Integration, Data Management and Communication, Control Algorithms, Agriculture and Construction. The content of the lectures ranged from scientific contributions (e.g. regarding the development of new control algorithms) to best-practise reports of construction companies as well as presentation about teaching possibilities in the field of machine control.

WG 5.4 was also active at the events held at the FIG Working Week in Rome and the Regional Conference in Montevideo. Especially in Rome a dedicated session called “multi-sensor-systems”, where a broad range of presentations were given, including an overview report about “Challenges of Kinematic Measurements”.

In collaboration with FIG Commission WG 5.5, a special issue for the Journal of Applied Geodesy on the topic “Multi-sensor positioning and navigations systems” is being prepared. Papers that investigate new technologies and techniques for multi-sensor systems delivering enhanced positioning and navigation capabilities have been invited. Also papers that describe new integration architectures, algorithms and applications for multi-sensor systems are particularly encouraged. The peer-review process for this special edition will start in 2013.

WG 5.5 – Ubiquitous Positioning

Chaired by Allison Kealy

In 2012 a major activity undertaken by members of the joint IAG Working Group WG 4.1.1 and FIG WG 5.5 was field experiments at the University of Nottingham from May 14 to 18, 2012. These revolved around the concept of collaborative navigation, and partially indoor navigation. Collaborative positioning is an integrated positioning solution which employs multiple location sensors with different accuracy on different platforms for sharing of their absolute and relative localizations. Typical application scenarios are dismounted soldiers, swarms of UAV's, team of robots, emergency crews and first responders. The stakeholders of the solution (i.e., mobile sensors, users, fixed stations and external databases) are involved in an iterative algorithm to estimate or improve the accuracy of each node's position based on statistical models. For this purpose different sensor platforms have been fitted with similar type of sensors, such as geodetic and low-cost high-sensitivity GNSS receivers, tactical grade IMU's, MEMS-based IMU's, miscellaneous sensors, including magnetometers, barometric

pressure and step sensors, as well as image sensors, such as digital cameras and Flash LiDAR, and ultra-wide band (UWB) receivers. The employed platforms in the tests include a train on the roof of the Nottingham geospatial building, mobile mapping vans, a personal navigator and a foot tracker unit.

In terms of the tests, the data from the different platforms are recorded simultaneously. The personal navigator and a foot tracker unit moved on the building roof, then through the building down to where it logged data simultaneously with the vans, all of them moving together and relative to each other. The platforms then logged data simultaneously covering various accelerations, dynamics, etc. over longer trajectories. Promising preliminary results of the field experiments showed that a positioning accuracy on the few meter level can be achieved for the navigation of the different platforms.

Data related to these tests can be accessed from <http://ubpos.net/>

The working group also maintained a strong and active presence at the following international events through participation in coordinating workshops, scientific and organizing committees, delivering short courses and tutorial, publishing papers and presentations, session chairing, etc.

- PLANS 2012, Myrtle Beach, South Carolina, USA, Apr. 24-26, 2012
- FIG Working Week: May 6-10, 2012 in Rome, Italy
- ION GNSS, Nashville, Tennessee, USA, Sep. 17-21, 2012
- UPINLBS 2012, Helsinki, Finland, Oct. 3-4, 2012
- LBS 2012, Munich, Germany, Oct. 16-18, 2012
- IPIN 2012, Sydney, Australia, Nov. 13-15, 2012

3. Cooperation

3.1 Cooperation with Other Commissions

During the 2012 period Commission 5 worked with other FIG Commissions as required. This work primarily consisted of holding joint technical sessions and meetings at FIG related events as well as co-sponsoring symposiums. For example, FIG Commission 5's alliance with Commission 6 to address contemporary issues relating to deformation measurement, calibration of instruments, long range measurement, satellite and terrestrial imagery measuring techniques such as mobile and static laser scanning.

3.2 Cooperation with Sister Organisations

Commission 5 has continued to maintain a successful working relationship with the International Association of Geodesy (IAG), the Permanent Committee for GIS Infrastructure Asia-Pacific (PCGIAP) and the International Committee on GNSS (ICG). This was achieved by convening joint technical sessions and holding joint administrative meetings (e.g. during the FIG Working Week in Rome) on significant issues such as geospatial and positioning infrastructure and how to continue the joint technical seminar on Reference Frames in Practice

FIG Commission 5 is also taking a lead role as a liaison with ISO (ISO/TC 211 and ISO/TC 172/SC 6). Nic Donnelly from Land Information New Zealand will be our delegate.

During 2012, the following events were held with sister organisations or where the Steering Committee held discussions with our sister organisations;

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- 3rd International Conference on Machine Control and Guidance (Stuttgart, Germany)
- ICG-7, International Committee on GNSS (Beijing, China)
- PPP-RTK and Open Standards (Frankfurt, Germany)
- IGS Workshop (Olzтын, Poland)
- Interexpo Geo-Siberia 2012 (Novosibirsk, Russian Federation)

For more detailed reports from these events please refer to our Commission website.

3.2 Cooperation with UN

The International Committee on Global Navigation Satellite Systems (ICG), met in Beijing, China during 4 - 7 November 2012. Chair Mikael Lilje attended representing FIG, and Matt Higgins as Co-Chair of Working Group D of the ICG. Mikael Lilje was also at the meeting as our Commission's representative on Task Force D1 on Geodetic References. A full report can be found on our Commission website.

4. Events

2012

A summary of the Commission 5 activities at events in 2012 can be found on our website <http://www.fig.net/commission5/index.htm>

2013

In the first half of 2013 Commission 5 will endeavour to send representatives to the following conferences -

- 8-11 April, Washington DC
Annual World Bank Conference on Land and Poverty, The World Bank
- 24-26 April, Novosibirsk, Russian Federation
Interexpo Geo-Siberia-2013. Organised by Siberian State Academy of Geodesy (SSGA). Co-sponsored by FIG, Web site: www.expo-geo.ru
- 1-3 May, Tainan, Taiwan
The International Symposium on Mobile Mapping Technology (MMT2013). Web site: <http://conf.ncku.edu.tw/mmt2013/>
- 6-10 May, Abuja, Nigeria
Environment for Sustainability. FIG Working Week and General Assembly.
Web site: <http://www.fig.net/fig2013>

- 18-20 June, Manila, Philippine
The 12th South East Asia Survey Congress "Geospatial Cooperation towards a Sustainable Future".

5. Communication and Publications

Commission 5 have issued numerous reports and periodic newsletters to our delegates. These communiqués can also be found on websites -

- <http://www.fig.net/commission5/reports/reports.htm> and
- http://www.fig.net/commission5/news/news_1.htm

Mikael Lilje

Chair

Chair of FIG Commission 5

February 2013