

**Report to the 35th General Assembly
FIG Working Week 2012 in Rome, Italy**

FIG Commission 5 – Positioning and Measurement

Report of Activities 2011-2012

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

During 2011, the Commission 5 team took steps forward in achieving our goals by focusing our energy to ensure the FIG 2011 Working Week in Marrakech was a success. We also effectively collaborated with our sister organisations at events to promote and fulfil the objectives of our work plan, especially at events such as the General Assembly for the International Union of Geodesy and Geophysics (Melbourne, Australia) and ICG-6 (Tokyo, Japan). In addition to this, the Commission has been involved in the preparations for the upcoming FIG Technical Seminar on Reference Frames in Practice in conjunction with the FIG Working Week in Rome.

Working group chairs and members from Commission 5 have been actively representing FIG at numerous related symposia around the world as well as progressing the work of the working groups. Some of the working group activities are as follows:

2. Working Groups

WG 5.1 – Standards, Quality Assurance and Calibration

Chaired by David Martin

Standards remain a very important part of surveying – even more so 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 Marrakech. One session was dedicated to GNSS CORS Infrastructure and Standards. The main item at Marrakech was a meeting to discuss future actions regarding 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). Attendees of the meeting were provided with background information to the subject document and then primarily focused their discussion on the scope and the following review options:

1. maintain the guide as it is,
2. re-edit it with minor or major modifications,
3. consider withdrawing it definitively; and
4. depending on what option chosen, how FIG should proceed.

At the meeting in Marrakech it was decided that the publication should be revised with additions for recommendations for hand held distance-meters and reflector-less instruments.

An important initiative is underway to submit to ISO a proposal for a standard related to ITRS. The French standardization agency AFNOR has established at national level an ad hoc committee chaired by Claude Boucher for this purpose. After several discussions, the committee has decided:

- That France propose to ISO to establish an ad hoc structure dealing with standardization on geodetic references;
- That this structure should be established within the ISO TC 211 on Geospatial Information;
- That this structure should take care of the establishment of the standard related to ITRS as one of its future work items.

The first step proposed by France is to undertake a preliminary work (stage 0) on Geodetic references within ISO TC211. The purpose of this work will be to re-assess at international level and within the frame of ISO TC211 the initial work done by France through the AFNOR committee. A strong liaison with FIG, as well as IAG and other international organizations is an important part of this stage 0 work.

Another important standard under development under the supervision of ISO TC211 is Geographic information – Calibration and validation of remote sensing imagery sensors – Part 1: Optical sensors:

“Imaging sensors are one of the major data sources for geographic information. The image data capture spatial and spectral measurements and are applied for numerous applications ranging from road/town planning to geological mapping. Typical spatial outcomes of the production process are a vector maps, Digital Elevation Models, and 3-dimensional city models. There are typically 2 streams of spectral analysis data, that is, the statistical method, which includes image segmentation and the physics-based method which relies on characterisation of specific spectral absorption features.

In each of the cases the quality of the end products fully depends on the quality of the measuring instruments that has originally sensed the data. The quality of measuring instruments is determined and documented by calibration.”

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

- Optics and optical instruments -- Field procedures for testing geodetic and surveying instruments -- Part 4: Electro-optical distance meters (EDM measurements to reflectors)
- Optics and optical instruments -- Field procedures for testing geodetic and surveying instruments -- Part 5: Total stations
- Optics and optical instruments -- Field procedures for testing geodetic and surveying instruments -- Part 6: Rotating lasers
- Optics and optical instruments -- Ancillary devices for geodetic instruments -- Part 1: Invar levelling staffs.

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.

WG 5.2 – Reference Frames

Chaired by Graeme Blick

One of the focuses of this group has been 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. A small sub-group meet in Sydney in July 2011 and has been discussing ideas, some of which will be presented during the Technical Seminar on Reference Frames in Practice in Rome. Following on from this seminar it is hoped that presentations can be brought together in what might be the beginning of a technical document on Reference Frames in Practice. Another area of investigation is looking at geodetic data models and data transfer formats and standards and this will be reported on at future meetings.

WG 5.3 – Geodetic and Positioning Infrastructure

Chaired by Neil D. Weston

One of the big projects the IGS is gearing up for is "repro2" which will involve the re-processing all the GNSS data collected at the IGS reference stations. Supplemental data will be included from a number of regional networks to strengthen the ties around the globe. Completing repro2 by 2012 does not seem feasible and therefore plans to have something complete by the end of 2013 seem more appropriate. The following milestones will need to be met to complete the re-analysis of the GNSS data.

- 1) Agree to and finalize a set of analysis standards (mid 2012),
- 2) Implementing all software enhancements (late 2012),
- 3) Begin the reprocessing effort -all ACs and
- 4) Combine the results of the individual analyses (late 2013).

Another area with significant interest is in the real-time sector. In the United States, the National Geodetic Survey will hold a symposium of all the real-time network operators to discuss how each party can benefit by following an agreed upon set of standards and guidelines. The goal is to ensure network providers are tied to the national reference frame

and the coordinates they produce in their software packages are consistent from one regional network to the next. The symposium is set to take place in the summer of 2012.

Probably the biggest endeavour the geodetic agencies in the United States are working on is to move to a geometric datum that is aligned to the ITRF. The initial plans are to switch the current horizontal datum in the United States (NAD83) sometime in 2020. Although final implementation is a long way off, a significant amount of work has to be performed on the legislative side. A grass-roots effort will begin soon to educate the positioning communities about the impacts and benefits to switching to a 3-D geometric datum.

WG 5.4 – Kinematic Measurements

Chaired by Volker Schwieger

The geodetic world and therefore the surveying profession are moving from static to kinematic measurements, consequently Commission 5 established this new Working Group (WG) for the term 2011-14. The main activity for this WG in 2011 was to find active group members and define the fields of activity more in detail. Up to now a small but active group of practitioners and academics from four continents have converged. New group members are still welcome. The two technical main points identified are; multi-sensor-systems related to monitoring and machine guidance. Covered topics are e.g. synchronisation of measurement and modelling of movements. The main task is to facilitate the interchange of knowledge about kinematic measurements among practitioners and researchers at FIG Working Weeks and Regional Conferences. For the Working Week in Rome a dedicated session is planned. Also joint conferences with other organisations like the Mobile Mapping Technology and the Machine Control and Guidance are the focus of the WG.

WG 5.5 – Ubiquitous Positioning

Chaired by Allison Kealy

Ubiquitous positioning systems typically rely on the fusion of multiple sensors, signals or measurements to deliver a position solution in environments that are 'difficult' for Global Navigation Satellite System (GNSS). To fully deliver a ubiquitous positioning capability requires an understanding of the performance capabilities of the sensors used to augment or replicate that of a GNSS. These activities were the focus of Working Group 5.5 in 2011.

Working Group 5.5 was active at the FIG Working week in Marrakech. One session was dedicated to Alternatives and Backups to GNSS. Four of the six papers in this session were delivered based on outcomes generated collaboratively by members of Working Group 5.5. The members of the working group took this opportunity to discuss the objectives of the group's activities for 2011/2012. These discussions included:

1. a redefinition of ubiquitous positioning systems,
2. provision of complete and representative data sets for use by the positioning user community via a dedicated web portal,
3. a focus on collaborative positioning techniques; and
4. broadening the use of sensors beyond MEMS inertial sensors to include other alternative positioning technologies.

The working also maintained a strong and active presence at the following international events.

- Mobile Mapping Technology (MMT) Symposium, Krakow Poland. This included participating as part of the scientific program committee, presentation of working group outcomes as well as the coordination of two pre symposium tutorials;
 - Title: Mobile mapping technology: paradigm shift and future trends
 - Title: Applications of MMT in land transportation systems and infrastructure from planning through
- 2011 International Union of Geodesy and Geophysics (IUGG) General Assembly, Melbourne, Australia. Presentations and posters as part of our on-going collaborations with the International Association of Geodesy (IAG). Working group co-chair Allison Kealy and member Dorota Brzezinska are the current vice president and president of IAG Commission 4, Positioning and Applications. This will continue to strengthen links between the two organisations.
- **ION GNSS 2011: 24th Institute of Navigation GNSS Conference**, Portland, Oregon. Participation with papers, program chair (Dorota Brzezinska) and track chair (Allison Kealy)
- International Symposium on Location-Based Services, Vienna, Austria. Co-chair Guenther Retscher played an important role in involving the FIG in this event which offers a wealth of knowledge for FIG members interested in alternative positioning technologies.
- International GNSS Symposium, Sydney, Australia. Papers presented on behalf of the working group on emerging issues in collaborative navigation.

Members of working group 5.5 undertook major collaborative endeavours at Ohio State University, USA and the University of Melbourne, Australia. These field based collaborations have generated significant data sets the analysis of which will form the basis of work in 2012. A priority of the group for the first quarter of 2012 is to have publications and data set available on the FIG official website.

3. Cooperation

3.1 Cooperation with Other Commissions

In 2011, Commission 5 continued to work with the other FIG Commissions as required. This work was primarily with Commission 6 on topics relating to deformation measurement, calibration of instruments, long range measurement, satellite and terrestrial imagery measuring techniques (in particular mobile and static laser scanning). This cooperation involved holding joint technical sessions and meetings at FIG related events as well as co-sponsoring symposiums. Examples of the latter are;

- Quality of Geodetic Measurements (Munich, Germany)
- Geo-Siberia (Novosibirsk, Russia)
- 7th International Symposium on Mobile Mapping Technology (Krakow, Poland)
- Innovative Technologies for an Efficient Geospatial Management on Earth (Ulanbaatar, Mongolia)

3.2 Cooperation with Sister Organisations

Commission 5 has continued to put in a lot of effort in maintaining 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). We achieved this by convening joint technical sessions and holding joint administrative meetings during the FIG Working Week and the IUGG General Assembly on significant issues such as geospatial and positioning infrastructure and the upcoming joint technical seminar on Reference Frame in Practice scheduled for Rome prior to the Working Week.

During 2011, the following events were held with sister organisations or where the Steering Committee held discussions with our sister organisations;

- General Assembly for the International Union of Geodesy and Geophysics, IAG (Melbourne, Australia)
- ICG-6, International Committee on GNSS (Tokyo, Japan)
- The Geodetic Infrastructure in Europe, CLGE (Umeå, Sweden)
- 3rd International Colloquium - Scientific and Fundamental Aspects of the Galileo Programme (Copenhagen, Denmark)
- UAV-g, ISPRS (Zurich, Switzerland)

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

3.3 Cooperation with UN

The International Committee on Global Navigation Satellite Systems (ICG), met in Tokyo, Japan during 5 - 9 September 2011. 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.

Note - the ICG was formed several years ago as a result of recommendations of the UN Committee on the Peaceful Use of Outer Space (COPUOS). At these meetings reports are given on the status of major GNSS sub-systems and the activities of task forces on geodetic and timing references.

4. Events

2011

A summary of the Commission 5 activities at events in 2011 can be found on our website <http://www.fig.net/commission5/index.htm>

2012

In the first half of 2012 Commission 5 will endeavour to send representatives to the following conferences -

- 12-13 March, Frankfurt am Main, Germany

Symposium and Workshop on PPP-RTK & Open Standards. Organised by Federal Agency for Cartography and Geodesy (BKG), RTCM and IAG, co-sponsored by FIG.

Website: <http://igs.bkg.bund.de/ntrip/symp>

- 27-29 March, Stuttgart, Germany
3rd International Conference on Machine Control Guidance, MCG. Organised by University of Stuttgart and University of Hohenheim, Germany. Co-sponsored by FIG
Invitation (pdf) Web site: <http://www.uni-stuttgart.de/ingeo/mcg2012/>
- 17-19 April, Novosibirsk, Russian Federation
Interexpo Geo-Siberia-2012. Organised by Siberian State Academy of Geodesy (SSGA).
Co-sponsored by FIG
Invitation Web site: www.expo-geo.ru

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, FIG Commission 5

February 2012