

**Report to the 29th General Assembly
FIG Congress in Munich, October 2006**

FIG Commission 5 – Positioning and Measurement

Report of Activities 2002-2006

1. General

The work of Commission 5 on *Positioning and Measurement* deals with the acquisition of accurate and reliable data related to the position, size and shape of natural and artificial features of the earth and its environment and including variation with time. The Commission's work includes the science of measurement (instrumentation, methodology and guidelines).

Positioning and Measurement answers our clients questions involving the word, "where?" As such, the discipline of *Positioning and Measurement* is at the core of the surveying profession and legitimizes our claim as a major player in all things spatial.

During my term as Chair, the Commission 5 Steering Committee has built on the excellent work of my predecessor Jean-Marie Becker by continuing core activities related to Standards, Calibration, Geospatial Reference Frames and Integrated Positioning and Mapping Systems. We have also given the Commission a more strategic focus by deepening and better organising our cooperation with sister associations and to develop a new area of cooperation with a United Nations organisation relevant to Commission 5.

2. Achievements

Commission 5 achievements during the period from 2003 to 2006 can be summarised as:

- Fulfilment of the Commission Work Plan through significant Working Group achievements outlined below;
- Creation of a new MoU with the United Nations Office for Outer Space Affairs;
- Re-invigoration of the existing MoU with the International Association of Geodesy, including the establishment of a joint liaison committee to oversee ongoing cooperation;
- Development of a Cooperation Agreement with the US based Institute of Navigation;
- For 2005 and 2006, I was a member of FIG Council representing the Advisory Committee of Commission Officers (ACCO – all ten Commissions)
- Throughout this period, Commission 5 consistently ranked in the top 3 Commissions for the number of papers submitted to Working Weeks and Regional Conferences.

2.1 Working Groups

During the period 2003 to 2006, all the Working Groups made excellent progress towards the objectives of the Work Plan. In doing so, a useful approach to Working Group membership was to offer two levels of possible participation:

- The first level of participation was as a “*core member*” of a Working Group contributing directly to discussions, publications etc;
- The second level of participation was as part of a “*reference group*” to review publications, provide feedback on issues etc.

All Commission 5 Working Groups were also very well represented with at least one relevant technical session or workshop at all FIG and allied events during this term. The following outlines some of the notable achievements of each of the Working Groups.

2.1.1 Working Group 5.1 - Standards, Quality Assurance and Calibration

The Working Group Chair was Professor Rudolf Staiger from Germany. Rudolf was also Commission Chair Elect for 2004-2006 and will be Commission Chair for 2007-2010.

Major achievements of Working Group 5.1 in the period 2003 to 2006 include:

- FIG continues to have excellent involvement in the International Standards Organisation (ISO) Technical Committee 172, Sub-Committee 6, which deals with *Geodetic and Surveying Instruments*. For example, the Working Group was well represented by Professor Hans Heister (Germany) at a meeting of Sub-Committee 6 in Washington DC, USA in September, 2004;
- The Working Group has also begun participating in a new ISO Work Item on *Surveying with GPS*;
- The Working Group has begun to capture a digital version of the previous FIG publication on *EDME Calibration*, which was available in paper form only. The plan is to capture the existing content then update and republish it on the FIG web site to be freely available in electronic form;
- A questionnaire on “*Certification of Instruments*” was developed, circulated and analysed by Vaclav Slaboch (Czech Republic).

2.1.2 Working Group 5.2 - Reference Frame in Practice

The Working Group was jointly Chaired by Mikael Lilje from Sweden and Cyril Romieu from France. Cyril took over from Michel Kasser in December 2004. The Commission’s Vice-Chair for Administration, Robert Sarib from Australia, has also been very active, applying his technical knowledge to assist the Chairs in this Working Group.

Major achievements of Working Group 5.2 in the period 2003 to 2006 include:

- A major focus for 2003 to 2006 has been strong involvement in the African Reference Frame (AFREF) project, which is aimed at developing a unified geospatial reference frame for the African continent. Our involvement has been in close cooperation with the International Association of Geodesy (IAG) and the AFREF Steering Committee. Our contributions included convening technical and workshop sessions on AFREF at FIG events in Marrakech, Morocco (2003), Cairo, Egypt (2005), Accra, Ghana (2006) and at the IAG Scientific Assembly in Cairns, Australia (2005). The most recent workshop in Ghana was facilitated by Commission 5 with the support of UN Economic Commission for Africa, the UN Regional Centre for Training in Aerospace Surveys, IAG and key members of the AFREF Steering Committee;

- Another major focus for Working Group 5.2 has been to redesign the content on the FIG web pages for this Working Group. That has made the web content more user focussed and relevant to practising Surveyors by presenting practical information on reference frame issues and giving links to key web sites and other resources on the topic. The content for the updated web pages will go live in the lead up to the FIG Congress in Munich.

2.1.3 Working Group 5.3 - Integrated Positioning, Navigation and Mapping Systems

The Working Group Chair was Professor Naser El-Sheimy from Canada.

Major achievements of Working Group 5.3 in the period 2003 to 2006 include:

- Continued collaboration with Commission 4 of IAG and Commission II of the International Society for Photogrammetry and Remote Sensing (ISPRS) ensuring the ongoing success of the Mobile Mapping Technology symposia series;
 - MMT 2004 was held successfully in Kunming, China in 2004;
 - Planning is well advanced for the 2007 MMT Symposium in Padova, Italy;
- As part of the cooperation with UN Office for Outer Space Affairs, the Working Group Chair also drafted a curricula on GNSS for the UN Space Technology Education Centres;
- We have also established Sub-Group 5.3.3 on Developments and Modernization of Global Navigation Satellite Systems (GNSS). The Sub-Group Chair is jointly Chaired by Larry Hothem from the USA and Georgia Fotopoulos from Canada;
 - The goal is to present current information to FIG members about international efforts on the development and improvement of GNSS (eg GPS, GLONASS, GALILEO and others). The Sub-Group will also act as a forum to raise issues that can then be taken to the new International Committee on GNSS (ICG – see UN Cooperation below). The intention is to give FIG members a voice in and feedback on deliberations about the future of this key technology, which is used by many thousands of surveyors around the world;
 - The web pages for the sub-group are being used to publish up to date information of relevance for surveyors;
 - There is also an agreement between Professor Chris Rizos (President of IAG Commission 4) and myself to use relevant events around the world to present a regularly updated version of a paper on "*New GNSS Developments and their Impact on Survey Service Providers and Surveyors*".

2.1.4 Working Group 5.4 - Cost Effective Surveying Technology and Techniques for Developing Countries

The Working Group Chair was Dan Schnurr from the United Kingdom. This was a joint activity with Commissions 3 and 7.

Major achievements of Working Group 5.4 in the period 2003 to 2006 include:

- Work on this topic did not commence in earnest until some way into this work period but progress has been made;
- A draft structure for a proposed FIG publication on the topic has been developed;
- Feedback has been sought from UN Habitat and other stakeholders on that draft document structure;

- There have been meetings and technical sessions at FIG events, especially the Regional Events, where there is strong participation from UN Agencies and FIG Members from developing countries.

2.1.5 WG 4.2 Vertical Reference Frame (Joint WG with Commission 4)

This was a Joint Working Group led by Commission 4. Commission 5 has been actively involved in relevant workshops at FIG and IAG events. Commission 5 has also been contributing technical content for the development of a White Paper on the topic.

2.2 Cooperation

2.2.1 Cooperation with Other Commissions

A significant factor for our cooperation with other commissions was that I was a member of FIG Council representing the Advisory Committee of Commission Officers (ACCO – all ten Commissions) during 2005 and 2006. General cooperation with all Commissions has also been achieved through strong participation in ACCO meetings and through many joint technical sessions at FIG events. Commission 5 has had particularly close cooperation with Commissions 3, 4 and 7 through joint Working Groups 4.2 and 5.4 (outlined above).

2.2.2 Cooperation with FIG Standards Network

Commission 5 continues as a key participant in the important work of the Standards Network through Working Group 5.1.

2.2.3 Cooperation with Sister Organisations

A major focus for Commission 5 from 2003 to 2006 was to re-invigorate the relationship with the International Association of Geodesy (IAG). The strengthened cooperation has been greatly assisted by the strong commitment and encouragement by the Presidents of both organisations. Highlights of the cooperation with IAG include:

- I initiated a document to better identify potential areas for liaison between the FIG and IAG. It is designed as a reference document giving substance to the MoU. Professor Chris Rizos (President of IAG Commission 4) was a key player from the IAG side. The fact that Chris and I are both based in Australia has helped that development;
- A clear topic for strong cooperation was the African Reference Frame Project (see Working Group 5.2 Report above);
- There has also been strong three-way collaboration with IAG associated with our GNSS based cooperation with the United Nations Office for Outer Space Affairs (UN OOSA – see below);
- There was also excellent cooperation at IAG's 4-Yearly Scientific Assembly at the Dynamic Planet 2005 Symposium in Cairns, Australia in August 2005. That included IAG/FIG Open Forums on Dynamic Datum and on Vertical Reference Frames. These discussions were attended by a mix of participants from theoreticians to practicing hydrographers and surveyors and resulted in very fruitful discussions on making the transition from conventionally defined (static) vertical reference frames to a modern approach that incorporates the effects of dynamic Earth systems.

It should also be mentioned that the International Society for Photogrammetry and Remote Sensing (ISPRS) and the International Cartographic Association (ICA) have also been involved in the AFREF work and in the UN OOSA work on future GNSS.

During this period, I have had meetings with Professor Dorota Brzezinska (US Institute of Navigation - ION) to develop a Cooperation Agreement between Commission 5 and ION. ION is a key organisation globally in GNSS development and runs the best recognised annual international Conference on GNSS. Commission 5 Vice Chair, Naser El-Sheimy and I also met with Dorota and Chris Rizos (IAG Commission 4) in Melbourne in 2005. This enabled discussions toward possible 3-way cooperation between FIG, IAG and ION, especially on GNSS matters. Discussions are continuing with ION and it is hoped that the Cooperation Agreement can be finalised in the lead up to the FIG Congress in Munich.

2.2.4 Cooperation with the United Nations

I am especially happy to be able to report that during my term as Chair, Commission 5 has developed a strong relationship with the UN Office for Outer Space Affairs (UN OOSA).

This culminated in December 2004 with the signing of a MoU by Sergio Camacho, the Director of UN OOSA and Holger Magel, the President of FIG. Three main topics were identified as areas for cooperation:

- Issues associated with GNSS (see below);
- Space Science and Technology Education, and;
- Space Technology for Disaster Management.

The progress towards the MoU grew out of my participation in a series of meetings and workshops on the use and applications of Global Navigation Satellite Systems (GNSS) hosted by UN OOSA and also supported by the US Department of State. Those meetings came from recommendations of the UN Committee on the Peaceful Use of Outer Space (COPUOS), as ratified by the General Assembly of the UN.

A major outcome has been the establishment of the International Committee on GNSS (ICG) under the auspices of the UN. For the first time in the more than 40 years history of GNSS, the ICG will allow organised, global input by civilians. The ICG will involve the key players delivering GNSS components including:

- The USA's Global Positioning System (GPS), represented by the US Directorate for Position, Navigation and Timing and by the Department of State and Department of Transport and Interagency GPS Executive Board;
- Russia's GLONASS, represented by Satellite Navigation Department of the Federal Space Agency, and;
- Europe's planned Galileo system, represented by the European Commission (EC) and European Space Agency (ESA).

The global user community will also be represented with major players in the many application areas, including key organisations for the surveying and mapping community:

- The International Association of Geodesy (IAG) represented by the President (Gerhard Beutler) and Chair of Commission 1 on Reference Frame (Herman Drewes)

- The IAG's International GNSS Service (IGS), represented by the President of the Board (John Dow) and the Director of IGS Central Bureau (Ruth Neilan);
- The International Cartographic Association (ICA) represented by the President (Milan Konecny)
- I will represent FIG.

A feature of the meetings leading up to the formation of the ICG has been a strong focus on improving infrastructure and capacity building for GNSS use in developing countries and countries in transition. Many countries have been represented, including: Austria, Brazil, Bulgaria, Colombia, Czech Republic, Egypt, Hungary, India, Italy, Japan, Kenya, Malaysia, Nigeria, Peru, Poland, Romania, Russian Federation, Slovakia, South Africa, Syrian Arab Republic, Ukraine, United Kingdom, United States of America and Zambia.

2.3 Events

Commission 5 continued to be very well represented at FIG and allied events during this term. The following are some of the many events where Commission 5 participated. Reports on many of these events were made available on the Commission 5 Web Site.

2003

- FIG Working Week, Paris, France 2003;
- 7th SEASC, Hong Kong, November 2003;
- 2nd FIG Regional Conference, Marrakech, Morocco December 2003;
- United Nations/United States of America International Workshop on the Use and Applications of Global Navigation Satellite Systems, Vienna, Austria, December 2003.

2004

- The 4th International Symposium on Mobile Mapping Technology (MMT 2004), Kunming, China, March 29-31, 2004;
- FIG Working Week in Athens, Greece May 2004;
- 3rd FIG Regional Conference, Jakarta, Indonesia October 2004;
- United Nations/United States of America International Workshop on the Use and Applications of Global Navigation Satellite Systems, Vienna, Austria, December 2004.

2005

- FIG Working Week in Cairo, Egypt, 16-21 April 2005;
- SE Asian Survey Congress, Brunei, November 2005;
- United Nations sponsored meeting to consider formation of the International Committee on GNSS, Vienna, Austria, December 2005;
- International Symposium on GPS/GNSS in Hong Kong, SAR China, December 2005.

2006

- 5th FIG Regional Conference, Accra, Ghana March 2006;
- Combined 5th Trans Tasman Surveyors Conference and 2nd Queensland Spatial Industry Conference 2006, Cairns, Australia September 2006;
- FIG XXIII Congress, Munich, Germany October 2006.

2.4 Publications

At Working Weeks and Regional Conferences, Commission 5 consistently ranks in the top 3 Commissions in terms of numbers of papers submitted. A search of the FIG Surveyors

Reference Library for proceedings of FIG Events from the Working Week in Athens in May 2004 to the FIG Regional Conference in Ghana in March 2006 shows 204 papers related Commission 5 sessions or joint sessions.

There are also several special purpose publications under development by the Working Groups as outlined above.

An important trend in Commission 5 during this period was to continue to change the emphasis from paper publications to making more and more of the technical and promotional material available via the Commission web pages.

2.5 Acknowledgments

In submitting this report to conclude my term as Commission Chair, I thank the General Assembly, the members of the FIG Council, my fellow Commission Chairs and Chairs Elect, the National Delegates to Commission 5 and all the excellent staff of the FIG Office. I also thank my Colleagues and Management in the Queensland Department of Natural Resources Mines and Water, without whose support my participation in FIG would not be possible.

I especially thank my colleagues in the Commission 5 Steering Committee for the generous donation of their valuable time to do an excellent job guiding their Working Groups, for their active participation in FIG and allied events and for their friendships, which I know will last forever.

Finally, I thank my wife, Jane and my children, Emma, George and Joseph for putting up with my global wanderings.

Matt Higgins

Chair of FIG Commission 5

July 2006