

FIG Commission 5 – Positioning and Measurement

Work Plan 2019-2022

1. Title

Positioning and Measurement

2. Terms of Reference

- The science of measurement (instrumentation, methodology and guidelines)
- The acquisition of accurate and reliable survey data related to the position, size and shape of natural and artificial features of the earth and its environment and including variation with time consistent with internationally adopted standards and models.

3. Mission statement

The mission of Commission 5 is to:

- Focus on modern technologies, and technical developments and assist individual surveyors, engineers and GIS/LIS professionals through guidelines and recommendations, to choose and utilise those methods, technologies and instruments that are most appropriate to different applications.
- Follow technical developments through collaboration with other FIG Commissions and other international organisations; participation in appropriate meetings; and the preparation of appropriate publications.
- Support research and development and stimulate new ideas in the fields of expertise represented within the commission.
- Collaborate with manufacturers on the improvement of instrumentation and associated software.
- Present and promote the work of the Commission and its working groups on an ongoing basis at FIG Congresses, FIG Working Weeks, FIG Regional Conferences and other relevant technical meetings and in appropriate FIG and other media.

4. General

This work plan covers the development, use and integration of technologies for positioning and measurement and the associated standardisation, best practice and fundamental reference frame issues. Many of the issues are global in nature and Commission 5 along with many other Associations is well suited to tackle the technological challenges we face. There will be an ongoing cooperation with United Nations Agencies to address global problems such as sustainable development and humanitarian needs. The disciplines covered by Commission 5 will deliver solutions for the spatial aspects of these important global problems. Specific activities aimed at developing countries include examination of Low Cost Surveying Technologies, assistance with implementation of modern Geodetic and Vertical Reference Frames and associated infrastructure and contribution to appropriate Continuing Professional Development programs.

Specifically, to work closely with the International Association of Geodesy (IAG) and the United Nations Global Geospatial Information Management (UN GGIM) on the development of new models, standards and tools for implementing a Global Geodetic Reference Frame (GGRF) that includes aspects of the International Terrestrial reference Frame (ITRF) and the International Height Reference Frame (IHRF). The GGRF will serve as a global standard for all Nations to implement their respective national datums. As such. This directly impacts FIG Members who must implement these new datums and the requirements to access them.

In addition to the specific activities above, the Commission will support and contribute to FIG Task Forces and the Standards Network. The Commission will also respond to the FIG Council to address new issues as they emerge.

5. Working Groups

Working Group 5.1 – Standards, Quality Assurance and Calibration

Policy Issues

- Influence the development of standards affecting positioning and measurement instruments and methods, in collaboration with the FIG Standards Network and through participation in the relevant technical committees (TCs) of the International Standards Organisation (ISO) and other appropriate bodies.
- Acceptance controls, quality assurance and certification and their impact on the surveying profession.
- Testing and calibration of measuring instruments.
- Assist other Commission Working Groups to implement Standards from TC 172/SC 6 and ISO TC211 as appropriate.

Chair

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Specific project(s)

- Guide for the expression of uncertainty in measurements (GUM) for surveying
- Connection to ISO TC211

Workshop(s)

- Participation in FIG Working Weeks and other major Commission events with dedicated Technical Sessions and/or Workshops as appropriate.
- Special Session on ISO TC211 at a FIG Working Week.

Publication(s)

- A dedicated publication regarding the implementation of the “Guide for the expression of uncertainty in measurements” (GUM) for surveying

Timetable

- Draft publications will be presented at FIG Working Weeks during the term of this plan and according to a timetable to be developed by the Working Group Chairs.
- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Beneficiaries

FIG member associations, manufacturers and users of survey equipment, governments, standardisation organisations, decision makers, GIS developers and users, surveying businesses, individual surveyors.

Working Group 5.2 – 3D Reference Frames

Policy issues

- Work to bring together all organisations involved in defining or using reference frames to develop common approaches and avoid duplication. Such organisations include FIG, the International Association of Geodesy (IAG), UN-GGIM, ISO, groups of national mapping agencies, and other influential national agencies.
- Continue the existing co-operation with IAG on the Regional Reference Frame Projects such as AFREF, APREF, EUREF, NAREF, and SIRGAS.
- Develop and expand upon the relationships with UN-GGIM's Sub-Committee on Geodesy (UN-SCOG), the UN SCOG WG's, and the various UN-GGIM regional bodies.
- Consider options for the development and implementation of 4 dimensional datums that incorporate the effects of plate tectonic and regional effects such as those due to earthquakes or local effects such as landslides.
- Provide background technical information on relevant issues written in a way that is accessible to surveying practitioners.
- Examine how surveying practitioners can access the reference frame, through less emphasis on networks of ground monuments and more emphasis on Global Navigation Satellite Systems (GNSS) base stations.
- Provide information on the maintenance of CORS networks to ensure long-term stability

Chair

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Specific project(s)

- Review of Reference Frames in Practise Manual,
 - o Rob Sarib and Graeme Blick will provide primary development
 - o Support from WG 5.3 and others as required for all sections
- Connection to ISO-TC211: Geodetic Registry Network.

Workshop(s)

- Continuing Seminars on Reference Frames in Practise, 3D and vertical frames
- Participation in FIG Working Weeks and other major Commission events with dedicated Technical Sessions.
- An RFIP Workshop will be held with FIG 2019, SIRGAS 2020, FIG 2021, and FIG WW 2022.

Publication(s)

- FIG Publication on ITRF
- Publication regarding national datums (different types)

Timetable

- Draft publications will be presented at FIG Working Weeks during the term of this plan and according to a timetable to be developed by the Working Group Chairs.
- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Working Group 5.3 – Vertical Reference Frames

Policy issues

- Educate FIG member agencies on current and future status of regional and global vertical reference frames and height systems
- Educate FIG member agencies on practical aspects about the implementation of new geopotential datums including:
 - o access using geoid height models and a geometric datum
 - o redefining heights on existing bench marks to serve as secondary control
 - o ties between height systems and local and global mean sea level
- Develop and expand relationships in IAG Commission 2, UN SCOG, and WG focused on implementing vertical control based on IHRF around the world.
 - o IAG will develop an IHRF that will be a component of the UN GGRF.
 - o UN GGRF will encompass both ITRF and IHRF
 - o Time varying aspects of the geoid, vertical control and the gravity field must be addressed.

Chair

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Specific project(s)

- Solicit members for WG
- Inventory/catalogue of height systems and vertical datums in use by countries and/or FIG member agencies
- Capture planned changes and timelines for the evolution of height systems in countries and by FIG member agencies
- Provide guidelines to re-define the national vertical control, interpret and access the IHRF.

Workshop(s)

- Special Sessions regarding vertical reference systems at FIG Working Weeks, other major FIG events and at related conferences including Reference Frame in Practice Seminars.
- Splinter meetings to coordinate activities at national and international meetings including UN-GGIM, IAG (Commission2 and IGFS), and UNOOSA
- An RFIP Workshop will be held with FIG 2019, SIRGAS 2020, FIG 2021, and FIG WW 2022.

Publication(s)

- Chart of definitions of vertical datums (including tidal datums), height systems and their relationships.
- Review paper on principles of vertical reference frames and height system unification.
- FIG publication on “Reference Frames in Practise” covering practical aspects of and procedures for using vertical reference frames and height systems

- Develop a series of papers on practical aspects of implementing new national vertical datums consistent with global and regional height systems

Timetable

- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Beneficiaries

FIG member associations, government agencies, GIS developers and users, surveying businesses, individual surveyors.

Working Group 5.4 – GNSS

Policy issues

- Provide FIG input during planning and implementation phases associated with programs of modernisation and development of all GNSS
- Support and disseminate emerging positioning techniques using GNSS
- Research and dissemination regarding real time networks
- Multi-GNSS products and advancements
- Develop and expand upon the relationships between FIG, IAG, MGA, RTCM, UN-ICG, IAG and UN-GGIM.

Chair

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Co-Chair

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Specific project(s)

- Research and Publications on “Precise Point Positioning, Network RTK, Low-Cost GNSS, Multi-Frequency Multi-Constellation GNSS”
- Outreach of GNSS applications to other organisations
 - E.g., ICG, IAG, IHO, UN-GGIM
 - Involvement with regional GNSS training schools (e.g. UNOOSA, CSIS, AIT/GIC, University of Tokyo)
 - Other more industry driven groups (e.g. Precision Agriculture, Environment, Space, ITS etc)
 - Especially where they are related to some of the UN SDGs, which would leverage UN-GGIM and UN-GGRF activities
- Resilience in PNT (considering interference, spoofing, jamming, ionosphere).
 - Very technical topic that could benefit from simplification so that a larger section of the GNSS User community could better appreciate it.

Workshops

- Continuing seminars on Reference Frames in Practice, 3D and Vertical Frames
- Special technical session regarding these topics on FIG Working Weeks and Conferences
- Contribute to UN ICG Workshops on Applications of GNSS and MGA Conferences

Publications

- A number of papers relating to GNSS will be submitted to relevant conferences and technical journals.

Timetable

- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Beneficiaries

FIG member associations, government agencies, decision makers, GIS developers and users, surveying businesses, individual surveyors.

Working Group 5.5 – Multi-Sensor-Systems

(joint with IAG)

Policy issues

This group is a joint working group between FIG and IAG. It focuses on the development of shared resources that extend our understanding of the theory, tools and technologies applicable to the development of multi sensor systems. It has a major focus on:

- Performance characterization of positioning sensors and technologies that can play a role in augmenting core GNSS capabilities
- Theoretical and practical evaluation of current algorithms for measurement integration within multi sensor systems.
- The development of new measurement integration algorithms based around innovative modeling techniques in other research domains such as machine learning and genetic algorithms, spatial cognition etc.
- Establishing links between the outcomes of this WG and other IAG and FIG WGs (across the whole period)
- Generating formal parameters that describe the performance of current and emerging positioning technologies that can inform FIG and IAG members.

Chair

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Specific project(s)

- International field experiments and workshops on a range of multi sensor systems and technologies.
- Evaluation of UAV capabilities and the increasing role of multi-sensor systems in UAV navigation.
- Investigate the role of vision based measurements in improving the navigation performance of multi sensor systems.
- Development of shared resources to encourage rapid research and advancements internationally.

Workshops

Special Sessions at Working Weeks and Supporting Special international conferences and symposia including: Mobile Mapping Symposium, ION GNSS, IGNSS Australia, IPIN, etc.

Publications

A number of papers will be submitted to relevant conferences and technical journals. A special journal edition of papers from the Mobile Mapping Symposium in 2015 will be supported.

Timetable

- Draft publications will be presented at FIG Working Weeks during the term of this plan and according to a timetable to be developed by the Working Group Chairs.
- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Beneficiaries

FIG member associations, academic and research institutions, spatial data acquisition specialists, third party developers of LBS requiring mobile location information, GIS developers and users, surveying businesses, individual surveyors.

Working Group 5.6 – Cost Effective Positioning

Policy issues

- Educate FIG member associations and individual surveyors on when to use which surveying instrument or evaluation software taking into account economic reasons
- Design fit-for-purpose surveying systems that are cost-effective
- Support decision makers for establishing cost-effective positioning solutions

Chair

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Specific project(s)

Developing guidelines for cost-effective use and design of survey solutions including costs for labour and investment

Workshops

FIG workshop with Commissions 3 and 7

Publications

FIG Publication on cost effective surveying techniques

Timetable

- Working group final report and outcomes will be presented at dedicated session, FIG Congress, 2022.

Beneficiaries

FIG member associations, academic and research institutions, spatial data acquisition

specialists, GIS developers and users, surveying businesses, individual surveyors mainly dedicated to developing countries.

6. Co-operation with Other Commissions and organisations

- Commission 2 and YSN regarding Education, Training and Capacity Building
- Commission 4 regarding Hydrographic Surveying on the Ellipsoid
- Commission 6 and ISPRS on Laser Scanning
- Commission 6 on Deformation Monitoring
- Commission 7 and 3 on Cost-Effective Positioning

7. Co-operation with United Nation Organisations, Sister Associations and other Partners

- United Nations Office for Outer Space Affairs (UNOOSA) and United Nations International Committee on GNSS (UN-ICG). FIG is co-chairing of the Task Force on Geodetic Reference Systems. WG-D ensures interoperability of GNSS satellite orbit reference frames, time scales and now GNSS precise positioning services.
- UN GGIM is another field of cooperation between UN and FIG Commission 5. Specifically the UN Sub-Committee on Geodesy (UN SCOG) and the regional UN-GGIM groups (e.g., UN-GGIM-AP). UN-SCOG has a number of working groups that have closely aligned interests such as the WG for Education, Training and Capacity Building (ETCB). The regional groups usually have a WG aligned to implementing regional Geodetic Reference Frames (EUREF, SIRGAS, APREF) that directly impact the work of FIG Member institutions. The UN-GGIM Academic Network also provides a link to academic organizations aligned to ETCB.
- Strong Cooperation with International Association of Geodesy (IAG), with which FIG has a Memorandum of Understanding.
- Working group 5.5 is jointly organized with IAG.
- Good cooperation with International Society for Photogrammetry and Remote Sensing (ISPRS), the Permanent Committee on GIS Infrastructure Asia Pacific (PCGIAP) and the US based Institute of Navigation (ION).
- Contribution to International Standard Organizations, especially ISO TC 211/AWG12 and TC 172/SC6.

8. Commission Officers

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