The New Structure of the International Association of Geodesy (IAG) and its Relevance to the International Federation of Surveyors (FIG)

1 Introduction

This document examines the new structure of the International Association of Geodesy (IAG) and identifies potential areas of synergy with the International Federation of Surveyors (FIG). The author, Matt Higgins, is Chair of FIG Commission 5 on "Positioning and Measurement" and has developed this document in consultation with Prof. Chris Rizos, incoming Chair of the new IAG Commission 4 on "Positioning and Applications". It also incorporates comments on an earlier draft by FIG Officers.

At this stage, this document is an overview designed to help relevant FIG officers identify the areas in IAG's new structure where liaison might be beneficial. The document also comments briefly on other current issues of relevance to FIG - IAG liaison.

It should be noted that the new structure of IAG is still being developed. Finalisation is expected toward the end of 2003 and should be published in a new edition of the Geodesist's Handbook in January 2004. As such this document can be considered a "work in progress" that can be further developed once the new structure of IAG in finalised.

This document may also be of use to IAG officers. In that case, IAG officers can find details of FIG Commissions, Task Forces, contact details etc at the FIG web site at: http://www.fig.net

This document should also be read in addition to the existing Memorandum of Understanding between FIG and IAG. The MoU is available at: http://www.fig.net/figtree/admin/ga/2001/appendices/mou-iag.htm

2 The New Structure of IAG

As already stated, the new structure of IAG is still being developed and the following is based on information available at the time of writing.

IAG Commission 1. Reference Frames
The sub-commission structure is still being finalised but the Commission deals with the following topics:

1. *Establishment, maintenance, improvement of the geodetic reference frames.*
2. *Advanced terrestrial and space observation technique development for the above purposes.*
3. *International collaboration for the definition and deployment of networks of terrestrially-based space geodetic observatories.*
4. *Theory and coordination of astrometric observation for reference frame purposes.*

5. *Collaboration with space geodesy/reference frame related international services, agencies and organizations.*

This entire Commission is of direct interest to FIG Working Group 5.2 on "Reference Frame in Practice" (FIG WG 5.2) and close liaison is required. It is expected that the new IAG Commission 1 will continue to address reference frame issues on a regional basis and FIG is well placed to also work at the regional level. An example of a possible mechanism for cooperation is that the North American chair of the emerging IAG Subcommission 1.3 on Regional Reference Frames has joined FIG WG 5.2.

IAG Commission 2. Gravity Field
The sub-commission structure is still being finalised but the Commission deals with the following topics:
1. *Terrestrial, marine, and airborne gravimetry.*
2. *Satellite gravity field observations.*
3. *Gravity field modeling.*
4. *Time-variable gravity field.*
5. *Geoid determination.*
6. *Satellite orbit modeling and determination.*

FIG WG 5.2 on "Reference Frame in Practice" has an interest in these matters and particularly their application to vertical datum and problems of heighting using GNSS techniques.

IAG Commission 3. Earth Rotation and Geodynamics
The sub-commission structure is still being finalised but the Commission deals with the following topics:
1. *Earth Orientation (Earth rotation, polar motion, nutation and precession).*
2. *Earth tides.*
3. *Tectonics and Crustal Deformation.*
4. *Sea surface topography and sea level changes.*
5. *Planetary and lunar dynamics.*
6. *Effects of the Earth's fluid layers (e.g., post glacial rebound, loading).*

This Commission also has relevance to FIG WG 5.2 on "Reference Frame in Practice". However, the topics tend to be more scientific in nature and therefore less relevant for FIG Commission 5's role, which is more in the application of science.

Topic 3 above is of direct relevance to FIG Commission 6 on Engineering Surveying through WG 6.1 on "Deformation Measurement and Analysis".

Topic 4 above is also of interest to FIG Commission 4 on Hydrography.

IAG Commission 4. Positioning and Applications.
The incoming Chair of the new IAG Commission 4 has submitted the following sub-commissions to the IAG Executive for approval:
SC4.1 "Multi-sensor Systems" Chair: Dorota Brzezinska (OSU, USA)
SC4.2 "Applications of Geodesy in Engineering" Chair: Heribert Kahmen (TUV, Austria)

SC4.3 "GNSS Measurement of the Atmosphere" Chairs: Susan Skone (UCalgary, Canada), Hans van der Marel (DUT, The Netherlands)
SC4.4 "Applications of Satellite & Airborne Imaging Systems" Chair: Xiaoli Ding (PolyU, HK)
SC4.5 "Next Generation RTK" Chair: Yang Gao (UCalgary, Canada)

This Commission has the most general relevance to FIG Commission 5 as a whole and the two relevant IAG and FIG Commission Chairs are already liaising closely on areas of cooperation. Specifically, FIG WG5.3 on "Integrated Positioning, Navigation and Mapping Systems" and its sub-groups need to work in close cooperation with IAG Sub-commissions SC4.1, SC4.4 and SC4.5. In some cases, there is already good cooperation between the individuals involved and some cross membership between the FIG and IAG bodies.

Obviously, IAG SC4.2 is of direct relevance to FIG Commission 6 on Engineering Surveying. The relevant IAG and FIG Commission Chairs are already liaising closely. There is also a history of good cooperation on this topic.

IAG Services
These generate products, using their own observations and/or observations of other services, relevant for geodesy and for other sciences and applications. At the present time the Association related Services are the following:
1. *International GPS Service*
2. *International VLBI Service*
3. *International Laser Ranging Service*
4. *International Gravimetric Bureau*
5. *International Geoid Service*
6. *International Center for Earth Tides*
7. *International Earth Rotation Service*
8. *Permanent Service for Mean Sea Level*
9. *Time Section of the International Bureau of Weights and Measures*

While the products of all these services are of interest to FIG; of particular interest would be:
- *Permanent Service for Mean Sea Level* for FIG Commission 4
- *International GPS Service, International Geoid Service and International Earth Rotation Service* for FIG Commission 5

IAG Inter-Commission Committee on Theory

Theoretical aspects are clearly more the domain of IAG than FIG. However, FIG can play a role in bringing latest developments to the attention of practitioners and manufacturers of equipment and software.

FIG Commission 2 on Education can also play a role in helping latest theories make their way into relevant curricula of Surveying and Spatial Science courses at Universities.

IAG Inter-Commission Committee on Geodetic Standards

This is an effort to better formalise IAG's activities in relation to Standards. In recent years, FIG has also put considerable effort into being able to respond better on Standards issues and the Chair of the FIG "Standards Network" is interested in developing cooperation with this IAG Committee as it evolves.

Closer cooperation can also enable IAG liaison with specific FIG Commissions on particular topics, for example, FIG WG 5.1 on "Standards, Quality Assurance and Calibration".

IAG Communication and Outreach Branch

The Communication and Outreach Branch provides the Association with communication, educational/public information and outreach links to the membership, to other scientific Associations and to the world as a whole.

This is of relevance for the FIG Permanent Office for general liaison and collaboration but could also be of interest to FIG Commission 2 on Education.

There may also be opportunity for FIG to work with this Branch of IAG for outreach activities associated with FIG's liaison with the United Nations.

IAG Project IGGOS (Integrated Global Geodetic Observing System)

This project is of significance for practicing surveyors involved in geodetic work especially using GNSS techniques. FIG Commission 5 Steering Committee needs to monitor this project and investigate any role that FIG may play in the development and application of IGGOS.

3 Other Issues Not Directly Related to the New Structure of IAG

Participation in IAG and FIG Events

Generally speaking, there appears to be strong potential for IAG to be more closely involved in the Regional FIG events to take advantage of the presence of other international and regional organisations; especially those associated with the UN.

Specific examples of cooperation between IAG and FIG in upcoming events of mutual interest include:

- Optical 3-D Measurement Techniques, Zurich, Switzerland, September 2003, which is co-organized by FIG (Com 6), IAG and ISPRS.
- FIG Regional Conference in Marrakech, Morocco, December 2003. FIG (Com 5) is hosting a technical session and meeting to present to FIG practitioners the latest information on IAG's AFREF (African Reference Frame) project.
- The 4th International Symposium on Mobile Mapping Technology, Kuming, China, March 2004, which is co-organized by FIG (Com 5), IAG and ISPRS.

- There will also be Special Sessions on Mobile Multi-sensor systems at the next ISPRS Congress, Istanbul, Turkey, July 2004, which will also involve relevant FIG (Com 5) and IAG officers.
- FIG Regional Conference in Jakarta, Indonesia, October 2004. It is hoped that the new President of the IAG will be able to attend the FIG Regional Conference in Jakarta in 2004. Chair of IAG Commission 4 and FIG Commission 5 have already agreed to close cooperation and joint sessions.
- IAG Scientific Assembly, Cairns, Australia, August 2005. Chair of IAG Commission 4 and FIG Commission 5 have already agreed to close cooperation and joint sessions.

Liaison with United Nations Committees on GIS Infrastructure

Some of the United Nations Committees on GIS Infrastructure have Geodesy Sub-Committees and there is potential for FIG, IAG and those UN Sub-Committees to work more closely together. One goal would be to encourage more liaisons in the UN Regions between practitioners (FIG), researchers (IAG) and government organisations (UN Sub-Committee). There may be an opportunity to begin such liaison by involving the UN Geodesy Sub-Committee for the Asia Pacific in the FIG Regional Conference in Jakarta in 2004.

4 Recommendations

1. It is recommended that this document be used as a background document for the upcoming meeting between the Presidents of FIG and IAG.

2. It is recommended that FIG Commissions and other relevant groups within FIG (such as Standards Network and UN Cooperation Network) note this document and establish appropriate liaison with the relevant IAG officers as soon as possible after the IAG Executive has ratified its new structure.

3. As such liaison is developed, it is suggested that FIG Officers inform the Director of the FIG Office and Chair of Commission 5 to allow the overall level of cooperation under the MoU to be monitored.

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Chair FIG Commission 5

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