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Committee of Experts on Global Geospatial Information Management
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Item 3 of the provisional agenda*
Global geodetic reference frame

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Note by the Secretariat

Summary

The present paper contains the report of the Working Group on the Global Geodetic Reference Frame for consideration by the Committee of Experts on Global Geospatial Information Management.

At its third session, held in July 2013, the Committee of Experts recognized the growing demand for positioning services that are more precise and the economic importance of a global geodetic reference frame; the need to improve global cooperation within geodesy, including to openly share data in order to contribute to regional and global reference frames; and the need for appropriate commitment to national contributions aimed at improving national geodetic infrastructure as a means to enhance the global geodetic reference framework. The Committee of Experts unanimously agreed that actions should be taken to facilitate the submission of a resolution to the General Assembly at its sixty-eighth session in order to seek support and commitment at the highest level and requested the Secretariat to establish a working group, with equitable regional representation, to develop the conceptual note and draft text of the resolution through an open and inclusive process. The report describes the establishment of the Working Group on the Global Geodetic Reference Frame and the process whereby it formulated the conceptual note and draft text of the resolution to be submitted to the General Assembly at its sixty-eighth session in consultation with Member States and the international scientific community, including the International Association of Geodesy.

* E/C.20/2014/1

I. Introduction

1. At its third session, held in July 2013, the Committee of Experts considered the report by the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP) and the International Association of Geodesy (IAG), and the consultations and responses to a global geodetic questionnaire in which over 100 Member States responded. It was noted that a significant number of questionnaire respondents (81%) were from Member State agencies that contributed to the global geodetic community, and considered that the geodetic data, products and services of the International Association of Geodesy (IAG) and the Global Geodetic Observing System (GGOS) were of high to critical importance in their country. Further, over 50% of agencies that responded indicated that they are potentially able to share the majority of their static Global Navigation Satellite System (GNSS) and geodetic levelling data internationally, particularly if a mandate was in place to do so.

2. The majority of Member States (75%), recognizing the economic value of a precise positioning capability, indicated that their organizations would benefit from having a high level mandate in place that would provide clear responsibilities for national governments and international agencies. It was felt that such a mandate would:

(a) Provide recognition for and raise the profile of those national agencies providing geodetic infrastructure to help inform government and decision makers of its importance;

(b) Encourage additional investment by Member States in geodetic infrastructure;

(c) Encourage free and open geodetic data access policies and reduce data security concerns;

(d) Motivate Member States to improve international engagement on geodetic matters;

(e) Facilitate improved intergovernmental coordination of geodetic activities, standards and infrastructure development; and

(f) Recognize common-good contributions by Member States to the global geodetic infrastructure.

3. At its third session, the Committee of Experts also noted the outcomes of the Second High Level Forum on GGIM held in Doha, Qatar in February 2013. Participants agreed that, while the science of establishing a geodetic reference frame is available, it was essential to have governments accept the responsibility of establishing and maintaining a sound national geodetic reference frame which could serve as the foundation for a global system. Some countries had expanded their national system on account of economic benefits through better positioning services. In this regard, the participants of the High Level Forum committed to working together as an international community, under the coordination of the United Nations, to work with all stakeholders to improve a sustainable operational global geodetic reference frame and infrastructure, to support the increasing demand for positioning and monitoring applications with associated societal and economic benefits.

4. At its third session, the Committee of Experts agreed that actions be taken to facilitate the submission of a resolution to be tabled at the 2013-14 Session of the UN General Assembly to seek support and commitment at the highest level, and requested the Secretariat to establish a working group, with equitable regional representation, to develop the conceptual note and draft text of a UN General Assembly resolution through an open and inclusive process (E/2013/46, Decision 3/102). The present report describes the establishment of the Working Group on the Global Geodetic Reference Frame and the process whereby it formulated the conceptual note and draft text of the resolution, in consultation with Member States and the international scientific community, to be submitted to the General Assembly at its sixty-eighth session. The Committee of Experts is invited to take note of the report, to endorse the draft conceptual note and resolution, and to express its views on the way forward for the international community, under the coordination of the United Nations, to work with all stakeholders to improve intergovernmental coordination for a sustained operational global geodetic reference frame and infrastructure. Points for discussion and decision are provided in paragraph 13.

II. Background

5. Many Member States now have a vision of a 'location-enabled' society and expectations that positioning services will be available continuously, along with other critical services such as telecommunications, power and water. Modern economic development in location-based services now relies heavily, and mostly without redundancy, on the guaranteed availability of and ubiquitous access to a unique, homogeneous, high-quality global geodetic reference frame. However, a key weakness of this vision is the sustainability of the global geodetic reference frame and associated infrastructure. The global cooperation within the geodetic reference frame community is based on voluntary international collaboration between national geospatial information agencies and international scientific agencies, relying almost entirely on a 'best efforts' principle. The infrastructure is operated by national governments through their national geospatial or space agencies, but a significant proportion of this infrastructure also relies on research organizations and universities which contribute on a research project basis, which lacks long term stable funding. In such circumstances, progress is naturally strongest in the developed world and weakest in developing nations, emphasising the need for global cooperation.

6. Although vitally important to society, many national governments and the consumer community have a limited understanding of the network and associated infrastructure requirements that enable the sustainability of the global geodetic reference frame. Importantly, it is not well understood that no one country can maintain the global geodetic reference frame alone, and that its sustainability requires global cooperation and contributions. The current contributions to this global effort are less than optimum for various historical, political, security or resource reasons. Additionally, key elements of this global infrastructure will not meet the future anticipated requirements. The impact is twofold: the global geodetic reference frame realisation is not as robust is it needs to be; and access to the global geodetic reference frame in many countries is very poor. This means that geospatial data interoperability is almost impossible to achieve.

7. With the growing demand for more precise positioning services, and clearer accountability of fiscal budgets, it is crucial to improve global cooperation within geodesy by moving away from the best efforts principle and move towards mutual

and acknowledged global efforts under the mandated umbrella of structures such as the United Nations. Improving intergovernmental coordination for a sustained operational global geodetic reference frame and infrastructure requires global recognition and a global mandate. It is necessary to elevate global geodetic collaboration to the highest level in order to ensure a more efficient and optimum investment in critical geodetic infrastructure, and sustainable geodetic services, to the overall benefit of Member States and the international community.

8. At its 37th General Assembly, held on 21 June 2014, the International Federation of Surveyors (FIG) made a unanimous decision on the global geodetic reference frame. Recognising a growing need for an accurate and stable global geodetic reference frame to support, *inter alia*, earth observation, including sea level and climate change monitoring, natural hazard and disaster management and a wide range of other activities in public and private sectors throughout the world, the FIG General Assembly urged Member States and their representatives within UN-GGIM-AP, together with all Member States and their representatives at the fourth session of UN-GGIM, to support the approval of a draft resolution on the global geodetic reference frame, and to submit to the 2013-14 session of the UN General Assembly for final adoption.

9. In its 2012-2015 work plan, the Group on Earth Observations (GEO) recognized the need for an enhanced global geodetic reference frame. It undertook to: (IN-01-C3) Promote geodetic reference frames and the monitoring of global change signals (e.g. in gravity field or Earth rotation). The "International Terrestrial Reference Frame" and "International Celestial Reference Frame" provide foundations for most Earth observations (GGOS); and (IN-02–C1) Ensure the availability of accurate, homogeneous, long-term, stable, global geodetic reference frames as a mandatory framework and the metrological basis for Earth observation. The work plan also called on GEO to build upon the Earth System Spatial Grid (ESSG) as a new Earth system three-dimension grid and spatial framework for Earth data sets, and make synergies with the UN Global Geospatial Information Management initiative (UN-GGIM).

10. At its 28th Strategic Implementation Team (SIT) meeting the Committee on Earth Observing Satellites (CEOS) resolved that: (SIT 28-32) Chair to write to GGOS acknowledging the importance of the ITRF and the GGOS Services to the space activities of the CEOS membership, and endorse the decade long initiative for the global geodetic observing proposed by GGOS; and (SIT 28-33) CEOS agencies are encouraged to endorse, support and contribute to the Decade Long initiative for the Geodetic Observing Network.

III. Activities of the Working Group on the Global Geodetic Reference Frame

11. The Global Geodetic Reference Frame Working Group (GGRF-WG), comprising 20 Member States and the International Association of Geodesy (IAG), was established in December 2013, and co-chaired by Australia and Norway. The Working Group has focused on four primary activities in these first six months:

(a) **Development of the Working Group Terms of Reference** (Annex I). The ToRs were developed by the co-chairs and circulated to the members for editorial comment. Significant feedback was received and subsequently incorporated into the document.

(b) **Development of the draft resolution and concept note** (Annex II and III). The draft resolution was developed jointly by the co-chairs and the IAG representative initially, with considerable assistance from the UN-GGIM Secretariat on the preamble. The document was then circulated to the full Working Group membership for comments and editorial. Again significant comments were received and incorporated where possible. In early April 2014, the draft resolution, concept note, a fact sheet, presentation material, and an animated video were sent to the global UN-GGIM community for review and comment.

(c) **Development of communication tools** (provided as Background Documents). The communication tools have been developed almost exclusively by Norway, and the Working Group gratefully acknowledges Norway's leadership of this output. These tools were also circulated for global comment. The tools have been used extensively for output (d) below.

(d) **Briefing of Governments and Ministries of Foreign Affairs**, and the associated Permanent Missions to the United Nations, by the Working Group members. This output is by far the most complicated of the 4 described here. The briefing process has required geodetic experts to establish contact with very senior dignitaries within their respective governments and explain the purpose of this current initiative, specifically the value proposition of the global geodetic reference frame, the current issue, why change is needed, and what we hope to achieve. The most poignant question is "what is the impact on our country". In addition to "in country" briefings a delegation of Working Group members also provided a briefing to a gathering of UN Mission representatives in New York in May 2014. This briefing was very successful with a series of direct and insightful questions being directed to Working Group members afterwards.

12. The Working Group has had two formal meetings since its inception: 1) Vienna (April 2014); and 2) Kuala Lumpur (June 2014), with good member participation at both. During the meetings all draft documents were further reviewed with very minor improvements suggested. The resultant documents are attached as Annexures I to III and Background Documents.

IV. Points for discussion

13. The Committee is invited to:

(a) Take note of the work done by the Working Group on the Global Geodetic Reference Frame;

(b) Endorse the Working Group's Terms of Reference;

(c) Endorse the draft Resolution and Concept Note;

(d) Refer the Resolution to ECOSOC for endorsement and further referral to the General Assembly;

(e) Commit to providing the necessary support in the process of tabling the Resolution in ECOSOC and the UN General Assembly;

(f) Provide guidance on the planned activities of the Working Group, specifically the development of a Roadmap for the Global Geodetic Reference Frame.

ANNEX I

Terms of Reference of the
Global Geodetic Reference Frame Working Group (GGRF-WG)
A Working Group of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)

DRAFT (25 June 2014)

Background and Purpose
Recognizing the vital economic importance of an internationally standard Global Geodetic Reference Frame (GGRF) for integrating geospatial information, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), at its third session in July 2013 in Cambridge, requested that the GGRF Working Group be established. The initial purpose of the Working Group is to facilitate the development of a resolution to be tabled at the 2013-14 Session of the UN General Assembly to seek multilateral cooperation and commitment at the highest level for a GGRF and its component geodetic infrastructure. Additional objectives are listed below.

Objectives
The principal objectives of the Working Group are:

1. To develop the conceptual note and draft text of a UN General Assembly resolution on the GGRF;
2. To provide an intergovernmental forum, with equitable international representation, for communication and cooperation on issues relating to the maintenance and enhancement of a GGRF;
3. To develop a roadmap for a collaborative global geodetic observation network and the associated infrastructure, with sustainable funding and investment, as well as strategic partnerships between mapping, space and other interested agencies;
4. To encourage open sharing of geodetic data and information that contribute to regional and global reference frames;
5. To advocate for guidelines and standards to advance the interchangeability and interoperability of geodetic systems and data;
6. To address various technical, institutional and policy issues related to the implementation of a GGRF;
7. To maintain dialogue between the Working Group and the international geodetic community; and
8. To pursue the implementation of a GGRF in association with the International Association of Geodesy (IAG).
9. To provide, through outreach, advocacy for the GGRF as the basis upon which all spatial data and positioning activities should be founded.

The Working Group will build on initiatives being undertaken within the global geodetic community in developing its approach to achieving these objectives.

Membership and Governance

The Working Group shall be comprised of experts from national governments who are appointed by the UN Member States. In appointing their national representatives, Member States should seek to designate experts with specific knowledge of global, regional or national geodetic reference frames or positioning, navigation or timing applications. Representation from the International Association of Geodesy (IAG) will also be included in the Membership. Other international organizations may be invited to participate in the Working Group as required.

The Working Group will elect a Chair to serve for a 2-year period, renewable for additional periods of 2 years, as long as required.

The Working Group will report to the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM).

Liaison

The Working Group will liaise with other international groups that have an interest in the GGRF, including:

- The International Association of Geodesy (IAG) Global Geodetic Observing System (GGOS), and the IAG services (IERS, IGS, ILRS, IVS, IDS, BIPM etc.).
- The Office for Outer Space Affairs as the executive secretariat of the International Committee on Global Navigation Satellite Systems (ICG).
- The International Federation of Surveyors (FIG).
- The Group on Earth Observations (GEO) and the Global Earth Observing System of Systems (GEOSS).
- The Committee on Earth Observation Satellites (CEOS).

Meetings and Secretariat

The Working Group will utilize telecommunication options wherever possible. They will also meet in conjunction with appropriate UN or other meetings where topic matter experts may be present.

The UN-GGIM Secretariat in the United Nations Statistics Division will support the Working Group Chair to coordinate, monitor and report on the activities of the Working Group.

ANNEX II

General Assembly

Draft resolution[1]

A Global Geodetic Reference Frame for Sustainable Development

The General Assembly,

Reaffirming the purposes and principles of the Charter of the United Nations,

Reaffirming also its resolution 54/68 of 11 February 2000 endorsing "The Space Millennium: Vienna Declaration on Space and Human Development", which included, inter alia, key actions to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility of space-based navigation and positioning systems, including Global Navigation Satellite Systems (GNSS),

Reaffirming further its resolution 57/253 of 20 December 2002, in which the United Nations endorsed the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation" 4 September 2002), and means of implementation which included, inter alia, strengthening cooperation and coordination among global observing systems and research programmes for integrated global observations, taking into account the need for building capacity and sharing of data from ground-based observations, satellite remote sensing and other sources among all countries,

Reaffirming its resolution 66/288 of 27 July 2012, in which it endorsed the outcome document of the United Nations Conference on Sustainable Development, entitled "The future we want", which recognizes the importance of space-technology-based data, in situ monitoring and reliable geospatial information for sustainable development policymaking, programming and project operations,

Noting resolution 2011/24 taken by the Economic and Social Council at its 47th plenary meeting in New York on 27 July 2012, in which it: established the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM); encouraged Member States to hold regular high-level, multi-stakeholder discussions on global geospatial information, including through the convening of global forums, with a view to promoting a comprehensive dialogue with all relevant actors and bodies; and emphasized the importance of promoting national, regional and global efforts to foster the exchange of knowledge and expertise, to assist developing countries in building and strengthening national capacities in this field,

Noting also resolution 1 adopted by the nineteenth United Nations Regional Cartographic Conference for Asia and the Pacific [2] in Bangkok, Thailand on 1

[1] At its third session, held in July 2013, UN-GGIM unanimously agreed that actions should be taken to facilitate the submission of a resolution to the General Assembly, and established a Global Geodetic Reference Frame Working Group to formulate the draft text of a UN General Assembly resolution through an open and inclusive process. The Working Group comprises of experts from Australia, Burkina Faso, Canada, Chile, China, Colombia, Fiji, France, Germany, Italy, Jamaica, Japan, Mexico, New Zealand, Nigeria, Norway, the Republic of Korea, Sweden, the United Kingdom of Great Britain, the United States of America, and the International Association of Geodesy. This current text of the draft resolution has been reviewed and commented upon by the global UN-GGIM community.

November 2012 which, realizing the need to improve the sustainability and capability of the Global Geodetic Observing System (GGOS), and the need to encourage and support the adoption of the International Terrestrial Reference Frame (ITRF) as the foundation reference frame, urged UN-GGIM to consult with Member States to adopt and sustain the Global Geodetic Reference Frame (GGRF) and provide a road map for its implementation, and to participate in and make commitments to the Global Geodetic Observing System to ensure its long-term sustainability,

Noting further decision 3/012[3] adopted by the Committee of Experts on UN-GGIM at its third session in Cambridge, United Kingdom on 26 July 2013, in which the Committee agreed that actions be taken to facilitate the submission of a resolution to be tabled at the 2013-14 session of the UN General Assembly to seek support and commitment at the highest level, and requested the Secretariat to establish a Working Group, with equitable regional representation, to develop the conceptual note and draft text of a UN General Assembly resolution through an open and inclusive process,

Recognizing the importance of international cooperation, as no one country can do this alone, to realize the Global Geodetic Reference Frame and services to underpin Global Navigation Satellite Systems technology and provide the framework for all geospatial activity, as a key enabler of spatial data interoperability, disaster mitigation and sustainable development,

Recognizing further the economic and scientific importance of and the growing demand for an accurate and stable Global Geodetic Reference Frame for the Earth, that allows the inter-relationship of measurements taken anywhere on the Earth and in space, combining geometric positioning and gravity field related observations, as the basis and reference in location and height for geospatial information, which is used in many Earth Science and societal applications, including sea-level and climate change monitoring, natural hazard and disaster management, and a whole series of industrial applications (including mining, agriculture, transport, navigation, construction) where precise positioning introduces efficiencies,

Recognizing also the extraordinary achievements made by national mapping and space agencies, geodetic commissions, research organizations and universities, and other international organizations such as the International Federation of Surveyors (FIG), building upon initiatives of the International Association of Geodesy (IAG), representing the global geodetic community, in measuring and monitoring changes in the Earth's system on a best-effort basis, including the development of the currently adopted International Terrestrial Reference Frame,

Recognizing further the investments of Member States in developing satellite missions for positioning and remote sensing of the Earth, supporting a range of scientific endeavors that improve our understanding of the “Earth system” and underpin decision making, and recognizing that the full societal benefits of these investments are only realized if they are referenced to a common Global Geodetic Reference Frame at the national, regional and global level,

Recognizing, with appreciation, that some Member States are already implementing open geodetic data sharing mechanisms for the benefit of realizing, improving and accessing the Global Geodetic Reference Frame at the national, regional and global level;

[2] E/CONF.102/8
[3] E/2013/46

Acknowledging that the Global Geodetic Reference Frame depends on participation from nations all around the globe, and the need to take action to strengthen international cooperation;

1. *Endorses* decision 3/102: Global Geodetic Reference Frame of the Committee of Experts of UN-GGIM on the work of its third session; that the Committee of Experts of UN-GGIM establish a Working Group, with equitable regional representation, to develop a global geodetic roadmap that addresses key elements of the Global Geodetic Reference Frame development and sustainability;

2. *Encourages* Member States and relevant international organizations to enhance global cooperation in providing technical assistance in geodesy for those countries in need to ensure the development, sustainability and advancement of a Global Geodetic Reference Frame;

3. *Urges* Member States to implement open sharing of geodetic data, standards and conventions to contribute to the global reference frame and regional densifications through relevant national mechanisms and intergovernmental cooperation, and in coordination with the International Association of Geodesy;

4. *Invites* Member States to commit to improve and maintain national geodetic infrastructure as an essential means to enhance the Global Geodetic Reference Frame;

5. *Invites* Member States to have multilateral cooperation that addresses infrastructure gaps and duplications towards the development of a more sustainable Global Geodetic Reference Frame;

6. *Invites* Member States to develop outreach programs that make the Global Geodetic Reference Frame more visible and understandable to society.

ANNEX III

DRAFT CONCEPT NOTE

GEOSPATIAL INFORMATION TECHNOLOGIES
25 June 2014

Geospatial information technologies support national development, economic growth, improved decision making, enhanced policy formulation and contribute to overcoming many global challenges. Their uses range from personal navigation tools to informing large-scale humanitarian or disaster responses. Governments, industry and society now recognise and understand that 'location' is a vital component for effective decision making.

However, the principles and methods that are required to obtain a positional location are generally not well understood. Positioning services around the world rely on the guaranteed availability of and access to a high quality global coordinate system: the Global Geodetic Reference Frame (GGRF). The GGRF enables geospatial information to be utilised in applications such as land titling and ownership, engineering construction, precision agriculture, intelligent transport, navigation, geodynamics, and other geoscientific studies, including climate change and sea level monitoring.

The GGRF is underpinned by an infrastructure that consists of globally distributed observatories and satellite tracking stations. It is operated by an internationally organized effort of data centres and analysis teams within governments and the scientific community that, on an ongoing basis and often in real-time, provide products, corrections and models that enable the GGRF to function. Although vitally important to society, this global cooperation relies almost entirely on a 'best efforts' principle. The infrastructure is operated by national governments through their national geospatial or space agencies, but a significant proportion of this infrastructure also relies on research organizations and universities which contribute on a research project basis.

In recognition of the growing importance of geospatial information globally, in July 2011 ECOSOC established the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) as the peak intergovernmental mechanism to provide a forum for coordination and dialogue, and to make joint decisions on the production and use of geospatial information within national and global policy frameworks.

The inherent weakness in the sustainability of the GGRF was first noted at the first session of UN-GGIM in 2011. At its third session, in July 2013, UN-GGIM considered a comprehensive report on the GGRF including responses to a questionnaire to which over 100 Member States responded. A significant number of respondents (81%) were from Member State agencies that currently contribute to the global geodetic community, and considered that the geodetic data, products and services were of high-critical importance in their country. Recognizing the economic value of precise positioning, the majority of Member States (75%) indicated that they would benefit from having a high level mandate in place that would provide clear responsibilities for national governments and international agencies. Over 50% of agencies indicated that they are potentially able to share the majority of their geodetic data internationally, particularly if a high level mandate was in place to do so. Importantly, it was noted that no Member State can maintain the GGRF alone, and that its sustainability requires global contributions and cooperation.

Recognizing the growing demand for positioning services, the economic importance of the GGRF, and the need to improve global cooperation within geodesy, in 2013, a decision by UN-GGIM to move forward with a resolution on the GGRF was brought to the attention of ECOSOC. Taking forward a draft resolution will be considered at an appropriate time in the near future.