
Economic and Social Council

05 July 2024

Committee of Experts on Global Geospatial Information Management Fourteenth Session

New York, 7 - 9 August 2024

Item 8 of the provisional agenda*

Global geodetic reference frame

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Note by the Secretariat

Summary

The present paper contains the report prepared by the United Nations Global Geodetic Centre of Excellence jointly with its international advisory committee for consideration by the Committee of Experts on Global Geospatial Information Management.

At its thirteenth session, held in New York from 2 to 4 August 2023, the Committee of Experts adopted decision 13/106, in which it welcomed the considerable efforts to continue to implement General Assembly resolution [69/266](#) of 26 February 2015 and grow the critical understanding, awareness and importance of the global geodetic reference frame as a vital foundation for global geospatial and Earth observation infrastructure. The Committee also welcomed the establishment and inauguration of the United Nations Global Geodetic Centre of Excellence at the United Nations campus in Bonn, Germany, in March 2023 and acknowledged that, as the first dedicated resource to support the implementation of resolution [69/266](#), the Centre would be an important platform to encourage investment in geodetic infrastructure, improve international cooperation, provide technical assistance and capacity development, and foster more significant planning and international coordination in pursuit of strengthening partnerships and opportunities enabled by geodesy.

The Committee of Experts noted the revised terms of reference of the Subcommittee and the establishment of three new working groups and welcomed the establishment of the International Advisory Committee of the United Nations Global Geodetic Centre of Excellence, which would provide the required guidance and advice on the development, implementation and review of the substantive annual programme of work of the Centre in a transparent and inclusive manner. The Committee reiterated the importance of consulting and engaging with Member States to determine their operational geodetic requirements and encouraged the Subcommittee to work with United Nations Global Geospatial Information Management regional committees and relevant partners.

In this present report, the United Nations Global Geodetic Centre of Excellence, jointly with its international advisory committee, provides updates of the Centre's first year of operation. The Centre was focused on working closely with the Subcommittee on Geodesy to understand the operational geodetic requirements of Member States. These efforts included convening nine virtual "listening" sessions and two in-person expert consultation sessions with over 550 registered participants from 110 Member States, including representatives from the government, science, policy and defence sectors, as well as partner organizations. The operational geodetic requirements of Member States have been compiled as part of a global geodesy needs assessment and translated into goals, objectives and activities in the first joint development plan for global geodesy. The plan includes actions to first stabilize the global geodesy supply chain and then take steps to make it more robust. The global geodesy needs assessment, and the joint development plan are provided as background documents to the report.

* E/C.20/2024/1

In this report, the United Nations Global Geodetic Centre of Excellence discusses efforts to demonstrate the importance of geodesy. The Centre has produced a document on hidden risks, which discusses the weaknesses in the global geodesy supply chain that could have catastrophic impacts on critical infrastructure and national economies. The document is provided as background information to the report. In the report, the Centre recognizes the important role played by Member States, regional committees, and international and regional geodetic organizations in the geodetic community. In particular, the enormous contribution of Member States and organizations is highlighted in developing, operating and sustaining vital elements of the global geodesy supply chain. To recognize this contribution to the global geodesy supply chain, the Centre has created the United Nations Global Geodetic Centre of Excellence Partnership Programme, which is described in a background document to the report.

I. Introduction

1. The United Nations Global Geodetic Centre of Excellence (UN-GGCE) vision is a future where all countries have strong political support for geodesy which enables them to – together – implement the United Nations General Assembly resolution 69/266, entitled ‘A global geodetic reference frame for sustainable development’ and accelerate the achievements of the Sustainable Development Goals to derive social, environmental, and economic benefits.
2. At its tenth session in August 2020, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), in making decision 10/104, welcomed and supported an offer by Germany to establish and host what has now become the United Nations Global Geodetic Centre of Excellence (UN-GGCE) at the UN Campus in Bonn, Germany. The UN-GGCE, established in March 2023, is envisioned to be a federated centre and welcomes offers of support from Member States, including financial contributions, in-person secondments, and virtual secondment.
3. An agreement “On the Operationalization of the United Nations Global Geodetic Centre of Excellence” between the United Nations and the Federal Republic of Germany was signed on 4 November 2022. The agreement formalizes the offer from Germany to host the UN-GGCE at the United Nations Campus in Bonn, Germany to support the work of enhancing global geodesy cooperation and coordination across Member States and relevant geodetic stakeholders, strengthening geodetic infrastructure, as well as supporting Member States in improving their national contributions to the global geodetic infrastructure, as outlined in the Framework Plan of the UN-GGCE as annexed to the agreement.
4. The UN-GGCE’s overarching goal is to assist Member States and geodetic organizations to coordinate and collaborate towards sustaining, enhancing, accessing and utilizing an accurate, accessible, and sustainable Global Geodetic Reference Frame (GGRF) to support science, society, and global development. The objective of the UN-GGCE is to support, within available resources, the implementation of General Assembly resolution 69/266 through strengthening and advancing: global geodetic cooperation and coordination; worldwide geodetic infrastructure; standards and policies; education, training and capacity development; and communication and awareness, while also coordinating measures and overseeing their implementation.
5. The Committee of Experts is invited to take note of the report and to express its views on the activities and recommendations of the United Nations Global Geodetic Centre of Excellence and its International Advisory Committee provide guidance and the way forward as appropriate. Points for discussion and decision are provided in paragraph 37.

II. International Advisory Committee

6. In accordance with the Agreement between the United Nations, represented by the Department of Economic and Social Affairs (DESA), and the Federal Republic of Germany, represented by the Federal Ministry of the Interior and Community (BMI), the UN-GGCE has a Steering Committee and an International Advisory Committee. These committees were established to provide governance and oversight of the UN-GGCE. The IAC is comprised of nineteen international experts, with broad geographic representation and diversity. The UN-GGCE Head of Office is an ex-officio member of the IAC.
7. The IAC provides the UN-GGCE with access to international scientific and operational expertise from the global UN-GGIM community, including the Subcommittee on Geodesy (SCoG), regional committees, thematic groups, and international organizations, including the International Association of Geodesy (IAG) and the International Federation of Surveyors (FIG). The role of the IAC, as an “advisory” group, is not to develop and implement the UN-GGCE programme of work, and not to make decisions, but rather to provide current knowledge, critical thinking, advice and guidance to the UN-GGCE.

8. The IAC works under the auspices of and reports its activities directly to, the UN-GGCE Steering Committee. Additionally, in accordance with UN-GGIM decision 12/101, the IAC and the UN-GGCE will formally report on the implementation and progress of the programme of work of the UN-GGCE to the annual sessions of UN-GGIM, through the preparation of written reports and background documents, under the standing agenda item 'Global geodetic reference frame'.

III. The global geodesy supply chain

9. Modern society is dependent on satellites. In many countries, satellite information is essential for economic growth, the operation of critical infrastructure and is a cornerstone of national defence forces. The satellites are reliant on constant updates about their 'place in space' (satellite orbit information) and the Earth's 'place in space' (shape, orientation, coordinate reference frame and gravity field). These are collectively known as geodetic products. Without constant updates of geodetic products, satellite applications society take for granted would degrade or fail.

10. The geodetic products are created through the global geodesy supply chain which includes:

- (a) ground observatories operated by scientists who constantly observe the movement of the Earth and satellites;
- (b) data centres operated by specialists who quality check the data from observatories and make it available to the global geodesy analysis community; and,
- (c) analysis centres, correlation centres and analysts who translate the raw data into geodetic products.

11. It is a global geodesy supply chain because no single country can fulfil all the requirements of accurately and reliably observing and analysing the Earth and satellites. To measure the constant changes, with the frequency and level of precision required to produce the geodetic products that satellites and users demand, ground observatories and highly qualified people within governments and universities all around the world are needed.

12. In recognition of the importance of the global geodesy supply chain, and to support the implementation of UN General Assembly resolution 69/266, the UN-GGCE has been established to work with Member States and geodetic organizations to strengthen their collective impact to:

- (a) Enhance investment in the global geodesy supply chain.
- (b) Improve coordination and collaboration amongst Member States and geodetic organizations.
- (c) Share geodetic data and improve standards, voluntarily, to contribute to the global reference frame and regional densifications.
- (d) Provide greater technical assistance, especially for capacity development in geodesy for developing countries.
- (e) Make geodesy and its benefit more visible and understandable to society.

13. The UN-GGCE Strategy and Operating Plan is provided as a background document to this present report.

IV. Activities of the UN-GGCE

14. The activities described below summarise the activities of the UN-GGCE since the arrival of the UN-GGCE Head of Office in October 2023.

Listening World Tour sessions

15. Between November 2023 and April 2024, the UN-GGCE staff met with over 500 people from 110 Member States to introduce the role of the UN-GGCE and listen to representatives from governments, private sector and academia to better understand the current state of the global geodesy supply chain from a global, regional and country perspective. The Listening World Tour included nine virtual sessions along with three in-person expert consultations and meetings and workshops. Each listening session followed a similar theme exploring the current issues Member States and partner organizations are facing.

16. A number of weaknesses in the global geodesy supply chain were identified by participants including: i) insufficient evidence to influence decision-makers; insufficient resources to sustain the supply chain; ii) inadequate governance mechanisms; iii) decreasing capacity; and iv) a lack of awareness of geodesy from decision makers. These weaknesses are the shared concern of the Member States, the private sector and organizations such as the International Association of Geodesy, the International Federation of Surveyors, the International Organization for Standardization Technical Committee 211 and the International Hydrographic Organization.

17. Between 18-21 March 2024, a summary of the global and regional needs collected from the listening sessions and expert consultation sessions was presented to Member States and partners at the Fourth plenary meeting of the Subcommittee on Geodesy and the Second meeting of the UN-GGCE International Advisory Committee in the United Nations campus in Bonn. As part of the four-day meeting, the UN-GGCE coordinated and facilitated a workshop to discuss and refine the findings in the draft needs assessment. A finalized version of the Global Geodesy Needs Assessment is provided as a background document to this present report.

Expert consultation and meeting with defence, science and policy representatives

18. Between 22-23 April 2024, the UN-GGCE coordinated and facilitated an expert consultation and meeting at the United Nations campus in Bonn on strengthening the global geodesy supply chain. This meeting brought representatives from Member States' civilian science, defence and policy agencies together to:

- (a) Introduce the global geodesy supply chain and explain why it is vital for national economies and the operation of critical infrastructure.
- (b) Discuss the weaknesses in the global geodesy supply chain and the threat to our use of space from a civilian and defence perspective.
- (c) Discuss pathways and actions to address weaknesses in the global geodesy supply chain in the short, medium and long term.

19. The meeting was attended by 46 representatives from 14 Member States' defence, policy and science agencies from across four regions and included participants from international geodetic research institutions and relevant stakeholders. The representatives acknowledged the risks associated with the failure and degradation of the global geodesy supply chain and discussed pathways and actions to address the weaknesses in the short and medium term were discussed.

20. The representatives of Member States resolved to prevent further degradation of the supply chain, so it can deliver basic operational requirements to support the essential positioning, navigation and timing applications of Member States. Following this, Member States agreed to consider how to make the supply chain more robust in the future. The pathways and actions discussed by Member States and partners in this meeting are reflected in the goals, objectives and activities of the First Joint Development Plan for Global Geodesy which is provided as a background document to this present report.

Strengthening evidence and raising awareness

21. The UN-GGCE is working together with Member States and partners to provide the evidence they need to explain the importance of the global geodesy supply chain in ways decision makers can understand. The IAC supports the UN-GGCE strategy to prioritise investment in the development of strong evidence as it is necessary to address the other weaknesses in the supply chain including lack of resources, capacity and governance.

22. The UN-GGCE has developed the Hidden Risk Report, policy brief, and video presentation which provides background information for decision-makers on how weaknesses in the global geodesy supply chain have impacts on critical infrastructure and national economies. The Hidden Risk Report and policy brief are provided as background documents to this present report.

23. The IAC welcomes the positive feedback the UN-GGCE has received at events, meetings and workshops including, but not limited to the five UN-GGIM regional committee meetings, the meeting of the Bureau of the Committee of Experts and its expanded bureau, and scientific and professional fora (including the International Federation of Surveyors meeting in Ghana, the Geospatial World Forum in Rotterdam). The IAC is particularly pleased to hear about the breadth and depth of engagement with Member States and the communication and outreach the UN-GGCE has undertaken.

24. The IAC has seen the importance of geodesy being highlighted and discussed in the number of high-level meetings between Member States, organizations and stakeholders worldwide, where previously geodesy was not on the agenda. This is came from the clear and direct messaging from the UN-GGCE explaining the impact of degradation or failure of satellite services like Global Navigation Satellite Systems due to weaknesses in the global geodesy supply chain. One such example -

“This lack of resilience poses risk to critical infrastructure, national development and economies given that global geodetic infrastructure that is trusted, verifiable and accessible supports telecommunications, emergency services, transportation, agriculture, to name just some sectors, and for us, individually, the devices in our hands, so we and our economies can locate consistently and reliably. The United Nations Global Geodetic Centre of Excellence is preparing, in consultation with Member States, a Joint Development Plan to address this hidden risk.”¹

25. The IAC also welcomes the UN-GGCE plans to work with developing countries, Small Island Developing States (SIDS) and regional development organizations to develop capacity through weeklong capacity development workshops hosted by the UN-GGCE at the United Nations campus in Bonn in 2025. These workshops will be introduced in a series of webinars the UN-GGCE will be providing after the Fourteenth session on how to modernize a country’s Geospatial Reference System.

26. As part of the UN-GGCE’s strategy to improve awareness of the importance of geodesy to decision makers, the UN-GGCE is combining its communication efforts with those from the Subcommittee on Geodesy. In January 2024 the UN-GGCE merged the UN-GGCE and the Subcommittee on Geodesy’s LinkedIn- and X (Twitter)-accounts in the spirit of working “**Stronger - Together**”, and hopefully being “**Clearer – Together**”. The UN-GGCE has also continued the tradition of the Subcommittee on Geodesy in preparing newsletters to share information about efforts towards strengthening the global geodesy supply chain.

Partnership program

27. The UN-GGCE Partnership Program has been created to recognize contributions of national geodetic and space entities and agencies of Member States, universities and

¹ Co-Chair (Mexico) of the Thirteenth session of the Committee of Experts at the Coordination Segment of the United Nations Economic and Social Council from 31 January – 1 February 2024.

organizations, and enable them to use the UN-GGCE logo to promote themselves, as recognition for the valuable contribution they make in sustaining the global geodesy supply chain.

28. The UN-GGCE and IAC welcome contributions and secondments from Member States and partners, and hopes the UN-GGCE Partnership Program will help shine a light on the most interesting science people have never heard of. Information about the UN-GGCE Partnership Program can be found in the background document to this present report.

29. To date, the UN-GGCE is proud to have the following twelve institutions and organizations recognized as either Founding Partners, or Partners:

- (a) Bundesamt für Kartographie und Geodäsie (Germany) – Founding Partner
- (b) Kartverket (Norway) – Founding Partner
- (c) Chalmers University of Technology and Onsala Space Observatory (Sweden) – Partner
- (d) University of Santiago de Chile (Chile) – Partner
- (e) TU Wien (Austria) – Partner
- (f) Geoscience Australia (Australia) – Partner
- (g) National Geographic Institute – Royal Observatory of Belgium (Joint Application) (Belgium) – Partner
- (h) Deutsches Geodätisches Forschungsinstitut of the Technical University of Munich (DGFI-TUM) – Partner
- (i) Instituto Geografico Militar (Chile) – Partner
- (j) FrontierSI (Australia) – Partner
- (k) University of Tasmania (Australia) – Partner
- (l) University of Bonn (Germany) – Partner

V. First Joint Development Plan for Global Geodesy

30. The 1st Joint Development Plan for Global Geodesy aims to transform the needs of Member States and partners described in the Global Geodesy Needs Assessment into strategic objectives and activities, which when achieved, will strengthen the global geodesy supply chain. The draft First Joint Development Plan for Global Geodesy outlines how to strengthen the supply chain in three phases, with each subsequent phase building on the activities of the previous phase. In Phase 1, Member States and partners are urged to take action to avoid further degradation of the global geodesy supply chain. In Phase 2, Member States and partners are encouraged to build a more robust supply chain which enhances the reliability for geodetic products essential for Member States operational requirements. Phase 3 looks to the future, and the next-generation supply chain requirements for improved accuracy of geodetic products required to assist in addressing scientific and societal challenges.

31. The activities proposed in the draft First Joint Development Plan for Global Geodesy have been divided into three categories, with proposed leadership responsibilities for Member States, partners, and the UN-GGCE. This is in recognition of the fact that the supply chain can only be strengthened when leadership is shown by all three groups.

32. The draft First Joint Development Plan for Global Geodesy is provided as a background document to this present report and the UN-GGCE urges for concerted and sustained contribution from Member States and partners.

VI. Staff resources

33. Dedicated resources are essential to translate the strategies and implementation plans from the Subcommittee on Geodesy and UN-GGCE into activities which will strengthen the global geodesy supply chain. As of June 2024, the UN-GGCE has three full-time United Nations Secretariat staff working out of its office at the United Nations Campus in Bonn and one more position is in the final stages of recruitment.

34. In addition to the United Nations Secretariat staff:

- (a) Germany provides two technical advisers on full-time in-person secondments.
- (b) Norway contributes with one strategic communications adviser on a full-time virtual secondment.
- (c) Spain contributes with one technical adviser on part-time virtual secondment.
- (d) Negotiations with France are in the final stages to provide one technical adviser on a part-time virtual secondment.

VII. Recommendations

35. The UN-GGCE IAC strongly recommends Member States:

- (a) Review the information provided in the Hidden Risk Report and policy brief.
- (b) Strengthen national geodetic engagement and coordination, for example, establish a national geodesy working group (including defence, science and policy representatives)
- (c) Consider the impact of degrading satellite services on their national economies, critical infrastructure, and other essential functions.
- (d) Review the draft First Joint Development Plan on Global Geodesy and engage in the consultation process to complete the Plan.
- (e) Perform the proposed Member State activities in the First Joint Development Plan on Global Geodesy to take action to mitigate further degradation of the global geodesy supply chain.
- (f) Work together with the UN-GGCE, other Member States and partners on strengthening the global geodesy supply chain via the activities proposed in the draft First Joint Development Plan on Global Geodesy.
- (g) Consider contributing to the UN-GGCE through either funding via trust funds or secondments (in-person, virtual and in-kind).

VIII. Background documents

36. The following are provided as background documents for this present report -

- (a) UN-GGCE Strategy and Operating Plan
- (b) Global Geodesy Needs Assessment
- (c) Hidden Risk Report
- (d) Hidden Risk policy brief
- (e) UN-GGCE Partnership Program
- (f) First Joint Development Plan for Global Geodesy

IX. Points for discussion

37. The Committee of Experts is invited to:

(a) Take note of the present report, the work and progress of the United Nations Global Geodetic Centre of Excellence and its International Advisory Committee, including the considerable operational efforts to implement General Assembly 69/266, and to grow the critical understanding, awareness and importance of the GGRF as a vital foundation for global geospatial and Earth observation infrastructure;

(b) Recognize the importance of the global geodesy supply chain, assist Member States and geodetic organizations through the UN-GGCE to coordinate and collaborate to implement A/RES/69/266 and to sustain, enhance, access and utilize an accurate, accessible and sustainable Global Geodetic Reference Frame to support science, society and global development;

(c) Take note of the draft First Joint Development Plan for Global Geodesy, express its view and provide further guidance with a view towards concerted and sustained contribution from Member States and partners; and

(d) Take note of the recommendations of the International Advisory Committee of the UN-GGCE and urge Member States to act on the recommendations.