Zero Draft of a Robust Global Geodesy Supply Chain

DRAFT: 15 April 2026

United Nations

United Nations Global Geodetic Centre of Excellence

Content

1. Overview and guiding principles 3
2. Robust targets 4
   2.1 Geodetic products requirements document 4
   2.2 Observatory station targets 4
   2.3 Data centre targets 5
   2.4 Analysis and geodetic product targets 5
   2.5 Plenary, Executive Council and Secretariat targets 5
3. Rough Order of Magnitude Costs 7

1. Overview and guiding principles

A robust global geodesy supply chain enables accurate and reliable satellite services. In particular, satellite services are required by governments and the private sector to support critical infrastructure operations, economic growth and societal needs.

To support the development of a shared vision, the United Nations Global Geodetic Centre of Excellence (UN-GGCE) has developed a zero draft reference architecture for a robust global geodesy supply chain. This zero draft is intended as a starting point for discussion among countries, regions, and partners when considering potential obligations, targets, or cooperative actions under any future international arrangement, whether legally binding or non-binding.

The architecture described below is designed to illustrate the scale, functional components, roles, responsibilities and indicative resource requirements needed to establish and sustain a robust global geodesy supply chain. The quantitative elements are illustrative and indicative, intended to inform discussion rather than prescribe uniform implementation across regions.

The model is based on a *global coordination and regional implementation approach*, recognising the principle of subsidiarity[1] where countries retain sovereignty over national infrastructure, and regions coordinate, assure, and integrate contributions to meet collectively agreed objectives.

Recognising significant disparities in technical capacity, infrastructure maturity, and financial resources across regions, implementation can follow different pathways based on regional readiness. For example, regions beginning from lower baselines may implement in phases, with interim targets established through regional consultations and supported by capacity development mechanisms.

[1] Principle of subsidiarity: matters should be handled by the lowest, smallest, or least centralized competent authority that can address them effectively. Higher authorities only intervene when local or regional levels cannot achieve the objectives sufficiently.

2. Robust targets

2.1 Geodetic products requirements document

A geodetic products requirements document — still to be developed — would set out the geodetic products needed by governments, the private sector, and the scientific community, along with specific product requirements and quality targets. It is envisaged that the document would be agreed at the Plenary level (see Section 2.5).

2.2 Observatory station targets

2.2.1 Globally

Globally the following number of observatory stations are proposed for a robust ground observatory network:

- At least 25 Very Long Baseline Interferometry (VLBI) stations
- At least 25 Satellite Laser Ranging (SLR) stations
- Aspire to at least five SLR and VLBI per region

At present, developed countries provide a strong foundation to support global requirements in terms of infrastructure, analysis, geodetic product development, and capacity. It is essential that this support is sustained.

2.2.2 Regionally

In addition to the global targets, each region (Africa, Americas, Arab States, Asia-Pacific, Europe) should operate, maintain and sustain:

- ~5 Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) beacons
- ~25 Global Navigation Satellite System Continuously Operating Reference Stations (GNSS CORS)
- ~3 superconducting gravimeter stations
- ~10 absolute gravimeter stations

Where possible, observatory stations should be collocated to support the mitigation of inter-system biases and improve product quality.

At least 5 well-distributed VLBI stations per region, distributed as evenly as possible across the region — including in the Southern Hemisphere — to ensure adequate baseline coverage for both geodetic (EOP, ITRF) and astrometric (ICRF) requirements, acknowledging that these are served by different telescope networks operating at different frequency bands, including VGOS and multi-frequency VLBI networks (S/X, K- and Ka-band).

The countries in which ground observatories are located should be responsible for their operation and maintenance. Countries from within the region should coordinate with each other to meet the regional targets. Regions are encouraged to consider meeting these targets through distributed national contributions, pooled funding mechanisms, hosting arrangements, or other cooperative models.

The station numbers above reflect the understanding that redundancy is essential to ensure continuity of operations during maintenance, upgrades, and outages.

2.3 Data centre targets

Each region should aim to operate one data centre responsible for storing, quality-assuring, archiving, and making publicly available the geodetic data from the *global* network of observing stations (Section 2.2). This would provide five *global* data centres which are mirrored.

The geodetic products developed from the global network would also be stored and made publicly available in the five global data centres.

Data centres should operate in accordance with internationally recognised good practice standards.

2.4 Analysis and geodetic product targets

2.4.1 Regionally supported

Each region should aim to operate at least three GNSS analysis centres.

2.4.2 Globally supported

Globally a robust global geodesy supply chain should operate and maintain:

- ~5 VLBI correlation centres
- ~5 VLBI analysis centres
- ~2 VLBI combination centres
- ~5 SLR analysis centres
- ~2 SLR combination centres
- ~3 DORIS analysis centres
- ~2 DORIS combination centres
- ~3 Gravity analysis centres
- ~2 Gravity combination centres
- 2 GNSS analysis combination centre
- 1 global geodetic product development centre

The globally supported analysis and geodetic product functions should be provided by IAG Services with support from the Secretariat (Section 2.5) in line with the geodetic product requirements document (Section 2.1).

Resourcing the IAG Services could be through distributed national contributions, pooled funding mechanisms, hosting arrangements, or other cooperative models.

2.5 Plenary, Executive Council and Secretariat targets

To provide inclusive and balanced governance, a Plenary and an Executive Committee should be established, drawing representation from governments, satellite operators, space agencies, the scientific community, non-governmental organisations, the private sector, academia, Indigenous and Local Communities (ILC), and UN organisations.

A Secretariat should be established to support integration across regions and to coordinate functions that are most efficiently delivered at the global level. The estimated requirements for a Secretariat are:

- 1 Manager
- 6 Technical staff

- 2 Administrative staff

The Secretariat would operate under decisions made by a Plenary[2] and Executive Committee and would complement, not replace, existing scientific services and institutions. Indicative responsibilities of the Secretariat staff include:

- Provide assistance to IAG Services performing GNSS, SLR, VLBI, DORIS analysis and correlation activities.
- Provide assistance to IAG Services performing GNSS, SLR, VLBI, DORIS analysis combination activities.
- Provide assistance to IAG Services developing geodetic products.
- Support to regions in meeting their observatory, data centre and analysis targets.
- Coordination of capacity development activities.
- Convene technical and coordination meetings.
- Liaise with IAG Services, GGOS and other partners to ensure coherent planning, avoid duplication, and integrate scientific governance with operational coordination.
- Establish and manage a Global Geodesy Fund which could be used to support regions to meet targets, undertake capacity development, or fund global analysis and geodetic product development activities.
- Coordination of a yearly Plenary meeting and Executive Committee meetings.

The Secretariat could operate as a co-located facility, distributed network, or virtual organisation, with staff provided through dedicated funding, institutional secondments, or both. Potential institutional arrangements include expansion of the role of the IAG Global Geodetic Observing System (GGOS), expansion of the UN-GGCE, hosting by another relevant organisation, or establishment of an independent entity.

Resourcing the Secretariat could be through distributed national contributions, pooled funding mechanisms, hosting arrangements, or other cooperative models.

[2] The yearly Plenary and Executive Committee (EC) meetings could be held in conjunction with the UN-GGIM Committee of Experts meetings in New York in August each year. Alternatively, parties could consider aligning with the UN Office of Outer Space Affairs (UNOOSA) and organising the Plenary meeting in the sidelines of the International Committee of GNSS (ICG) meetings.

3. Rough Order of Magnitude Costs

Table 1: Rough order of magnitude yearly budget for operations and maintenance of a robust global geodesy supply chain. provides rough order-of-magnitude (ROM) costs for annual operations and maintenance associated with the reference architecture. These estimates:

- Exclude capital expenditure for new installations or replacement of ground stations.
- Vary depending on labour costs, legacy infrastructure, hosting models, and in-kind contributions.

Table 1: Rough order of magnitude yearly budget for operations and maintenance of a robust global geodesy supply chain.

Category	Regional Rough Order of Magnitude cost (USD)	Global Rough Order of Magnitude cost (USD)	Notes
Very Long Baseline Interferometry (VLBI)	~8 M		5 stations per region that meet the International VLBI Service standards
Satellite Laser Ranging (SLR)	~8 M		5 stations per region that meet International SLR Service standards
DORIS Beacons	~2 M		5 stations per region that meet International DORIS Service standards
Global Navigation Satellite System (GNSS)	~2 M		25 stations per region that meet International GNSS Service standards
Data centre	~2 M		1 x data centre per region
Regional GNSS analysis centres	~3 M		3 x GNSS analysis centres
Global analysis and geodetic product development centres		~5 M	~5 VLBI correlation centres
		~5 M	~5 VLBI analysis centres
		~2 M	~2 VLBI combination centres
		~5 M	~5 SLR analysis centres
		~2 M	~2 SLR combination centres
		~3 M	~3 DORIS analysis centres
		~2 M	~2 DORIS combination centres
		~3 M	~3 Gravity analysis centres
		~2 M	~2 Gravity combination centres
		~2 M	2 GNSS analysis combination centre
		~7 M	1 global geodetic product development centre
Subtotal	**~25 M x 5 = ~125 M**	**~38 M**	
Secretariat		~2 M	1 x Manager
			6 x Technical staff
			2 x Administration staff
Subtotal		**~2 M**	

Total	**~125 M**	**~40 M**	**~165 M**

Of the ~US$165 M needed for a robust global geodesy supply chain, it is estimated that the funding currently being allocated to the operation of the global geodesy supply chain to be between €60-90 M (~US$70–106 M) per year worldwide - less than 0.05% of revenue generated from GNSS and Earth Observation services.[3]

This leaves up to a ~US$100 M shortfall in the funding required to transition to a robust global geodesy supply chain.

[3] UN-GGCE, 2024, Global Geodesy Needs Assessment, https://ggim.un.org/UNGGCE/documents/20240509-Global_Geodesy_Needs_Assessment.pdf; accessed 23 February 2026.