

**Group on Earth Observations (GEO)
2007-2009 Activities
Individual Task for 2007-2009**

Societal Benefit Area or Transverse Area	Task Title
ARCHITECTURE	Ensure the availability of accurate, consistent, homogeneous, long-term stable, global geodetic reference frames as a mandatory framework and the metrological basis for Earth observation.
Task No.	
AR-07-xx	

Description of the Work to be Performed

- (1) Identify steps towards ensuring consistent, high-accuracy, homogeneous, and long-term stable global geodetic reference frames for Earth observation and the observing systems contributing to GEOSS.
- (2) Advocate the continuous support of the global geodetic infrastructure required for the maintenance and development of the global geodetic reference frames at an appropriate level.
- (3) Facilitate an assessment of the current status and future requirements for the geodetic reference frames and geodetic observations with particular focus on the needs of the nine benefit areas.
- (4) Critically assess the sustainability of the global geodetic infrastructure and the Services, which are currently based on
 - the best efforts of a large number of national agencies and research institutions and
 - the voluntary commitment of many organizations and individuals,
 and consider alternative organizational models, including an intergovernmental framework for the maintenance of the geodetic reference frames, which would support the transition to fully operational reference frames.
- (5) Improve the accessibility and applicability of the geodetic reference frames for all GEOSS components.
- (6) Consider the potential of regional organizations to address reference frame related challenges in their regions and to stimulate cross-disciplinary solutions.
- (7) Promote the establishment of sufficient geodetic infrastructure in regions currently lacking such infrastructure, particularly in Africa and parts of Asia and Latin America.
- (8) Identify user-oriented capacity building needs with respect to reference frames.

Output & Deliverables

In 2007: Strategy report “The Global Geodetic Observing System: Meeting the Requirements of a Global Society on a Changing Planet in 2020” as input to the GEO Plenary.

Calendar (incl. milestones)

Start in 1st Quarter 2007 – Continuous activity

Responsible Entity, Participants

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Leading organization(s):

IAG/GGOS (Markus Rothacher, Chair, GGOS Steering Committee, rothacher@gfz-potsdam.de, Ruth Neilan, Vice-Chair, GGOS Steering Committee, ruth.neilan@jpl.nasa.gov, Hans-Peter Plag, Vice-Chair, GGOS Steering Committee, hpplag@unr.edu)

Contributing organizations:

More than 80 countries, including most of the GEO Members, contribute currently to the determination and maintenance of the global geodetic reference frames. It is expected that many countries will contribute to the proposed task and will nominate contact persons for the task.

A number of Participating Organisations in GEO are also contributing or related to IAG activities. Examples are IUGG and ICSU. It is expected that a number of organizations will join this task as contributors.

IAG/GGOS: Chair M. Rothacher (rothacher@gfz-potsdam.de); International GNSS Service (IGS) Central Bureau (ruth.neilan@jpl.nasa.gov); International VLBI Service for Geodesy and Astrometry (IVS) Coordinating Center (dbb@ivscc.gsfc.nasa.gov); International Laser Ranging Service (ILRS) Central Bureau (carey.noll@nasa.gov); International DORIS Service Central Bureau (Laurent.Soudarin@cls.fr); International Earth Rotation and Reference Systems Service (IERS) Central Bureau (richter@iers.org).

Contributing Users:

There are extremely many users of the geodetic reference frames. Most of the GEO Participating Organizations are in fact users of the geodetic reference frames, and it is expected that a number of them will join this task as users. Moreover, there are also many other users, who would be interested in contributing to the task. The following are a few examples of users expected to contribute actively to the proposed task:

National surveying and mapping agencies
Space agencies
International Civil Aviation Organization (ICAO)
IGOS-P
The Global Observing Systems
GEO itself

Financial Contributions (from GEO Operations Budget)

Potentially: publication of the strategy reports (deliverables) as GEO reports

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GEO Member Potential Contributions Reported to date:

Some of the specific work proposed in the task description is already under way and the proposed task would link these activities formally to GEO and the GEO Architecture Committee. If required, a more detailed summary of the on-going work can be provided. The following is a brief summary of relevant activities and the general context.

With the global geodetic reference frames, the *International Terrestrial Reference Frame (ITRF)* and the *International Celestial Reference Frame (ICRF)*, GGOS provides the metrological basis for all Earth observations independent of the targeted benefit areas. These reference frames depend on considerable global infrastructure comprising not only the global *in situ* networks of several space-geodetic techniques (GNSS, VLBI, SLR, DORIS) with up to 400 stations in more than 80 countries, and gravimetric techniques, but also the GNSS satellites and, increasingly, dedicated satellite missions. In total, an estimated 500 person years/year are provided on a best effort and voluntary commitment basis by national operational and research institutes to maintain the networks, data centers, analysis centers and user interfaces, that are required to determine and maintain the reference frames as well as to make them accessible for a wide range of applications.

Maintaining a terrestrial reference frame at the level that allows, for example, the determination of global sea level changes at the sub-millimeter per year level, pre- co- and post-seismic displacement fields associated with large earthquakes at the sub-centimeter level, timely early warnings for earthquakes, tsunamis, landslides, and volcanic eruptions, as well as the monitoring of mass transport in the Earth system at the few Gigatons level requires an Earth system approach, crossing all Earth sciences. Among others, this has recently been acknowledged by IGOS-P, for which a proposal for an Earth System Dynamics Theme is in preparation. This activity contributes to the proposed item (3) in the task description.

The IAG and in particular GGOS are aware of the enormous challenge implied in the demand to improve the accuracy from an average level of close to 10^{-9} to an instantaneous level of 10^{-10} , which is required in order to meet emerging user requirements. Therefore, GGOS is currently preparing a document that reviews the wide range of scientific and societal applications of geodetic observations and products. This document (the proposed first deliverable of the task) will provide the scientific basis for an implementation of the geodetic observing system that meets the requirements of the society at large and GEO and IGOS-P in particular. This activity contributes to the items (3), (4) and (6) to (8).

Currently, GGOS is facing an increasing demand from science, the Earth observation community, and society at large for improved services, observations and products. Funding for the global geodetic infrastructure depends on the national decisions and priorities in many countries and this implies considerable fluctuations, sometimes threatening the proper maintenance of the reference frames and the Services. GGOS therefore has started a dialog on international level for example with UNESCO and on national level with various agencies in order to assess the need for an intergovernmental framework for the reference-related activities. This dialog will be part of the proposed task and through the task be linked to other GEO activities. This activity contributes to items (1) and (2).

Taking into account that the geodetic observations and products are relevant at least for the GEO benefit areas of water, disasters, energy, weather, climate, and agriculture, and that the GGOS is a major component in the architecture of GEOSS, the proposed task facilitates the assessment of the GEO requirements for the reference frames as well as the status of the GGOS, and the development of the geodetic frames and services such that they meet these requirements.