

# **Proposal to Establish the *Integrated Global Geodetic Observing System (IGGOS)* as IAG's First Project**

*On behalf of the IGGOS Planning Group:*

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## **1. PREAMBLE**

The new IAG structure was developed after the IUGG General Assembly in Birmingham in summer 1999. Between summer 1999 and summer 2001 a thorough review of the IAG work and structure was performed by the so-called IAG Review Committee, the work of which is documented in (Beutler et al., 2002, IAG Symposium 125, pp. 603-608), a report presented at the IAG Scientific Assembly in Budapest in September 2001 in Budapest. The proposed new structure was accepted by the IAG Executive Committee and later on by the IAG Council, which held an extraordinary meeting on September 8, 2001 in Budapest.

At the same meeting (Rummel et al., 2002, IAG Symposium 125, pp. 609-614) proposed to create the IGGOS, the Integrated Global Geodetic Observing System as IAG's first project. In view of the fact that the new structure was not yet in place in 2001, the rules to set up the IGGOS as the first IAG project (defined in the new IAG Bylaws) could not be followed literally. The IAG Executive Committee therefore asked Reiner Rummel and Gerhard Beutler to establish the IAG Planning Group with the goal to set up IGGOS as IAG's first and only project in summer 2003. The group was created in spring 2002 after an organizational meeting of a smaller group convened by Reiner Rummel in Munich in December 2001.

## **2. THE IGGOS PLANNING GROUP AND ITS MEETINGS**

The planning group for IGGOS is composed as follows:

- Members related to the realization of the reference frame: *Claude Boucher, Hermann Drewes, Markus Rothacher*
- Members related to the gravity field and sea level: *Rene Forsberg, Reiner Rummel, C.K. Shum*
- Members related to Earth rotation and geodynamics: *Veronique Dehant, Suzanna Zerbin, Kosuke Heki*
- Members related to services related to geometry: *Mike Pearlman, Chris Reigber, Norman Beck*
- Members related to services related to gravity and sea level: *Fernando Sanso, Phil Woodworth, Mike Watkins*
- Members related to networks: *Wolfgang Schlüter, John Manning*
- Relation to NASA project: *Tom Yunck, Ruth Neilan*

The planning group is chaired by Gerhard Beutler till summer 2003, Hermann Drewes is the planning group's secretary. The group met twice, once in Washington and once in Munich. Jan Kouba served as deputy for Norman Beck at the Munich meeting.

The planning group held a first meeting in Washington on May 27, 2002 in Washington. The meeting was intense and at times controversial. The establishment of IGGOS seemed to be far from trivial. A vision and a mission statement as well as objectives for IGGOS were subsequently proposed by Gerhard Beutler, Jim Ray, John Manning, Hermann Drewes, and Reiner Rummel.

The second meeting of the planning group took place on November 22, 23 in Munich at DGFI, the German Geodetic Research Institute. This meeting was extremely constructive and successful. In a first phase the vision, mission and objectives for IGGOS were briefly reviewed and finalized (to the extent that such statements may ever reach a final form).The

agreed upon version of the IGGOS vision, mission, and objectives are reproduced in this document. The primary (and ambitious) goals of the November 2002 IGGOS planning group meeting were to reach a consensus on the following four aspects:

- Strategy to develop an IGGOS Science Rationale,
- strategy to develop an IGGOS Science Plan,
- strategy to develop an IGGOS Structure, and
- outline of a realistic IGGOS Schedule.

### **3. IGGOS VISION, MISSION, and OBJECTIVES**

#### **Vision:**

- IGGOS provides the scientific and infrastructure basis for all geodetic global change research in Earth sciences.
- IGGOS views the Earth system as a whole by including the solid Earth as well as the geophysical fluid components, the mean and (climate-sensitive) time-varying gravity field in its products.
- IGGOS integrates different techniques, different models, and different approaches in order to achieve a better consistency, long-term reliability and understanding of geodetic, geophysical, geodynamical and global change processes.
- IGGOS provides geodesy's contribution (products and discoveries, and their uncertainties) to Earth sciences.
- IGGOS integrates the work of IAG and is the bridge to the other geosciences.

#### **Mission:**

- IGGOS integrates the three pillars of geodesy, namely
  1. *geometry and kinematics*,
  2. *Earth orientation and rotation*, and
  3. *gravity field and its variability*to achieve maximum benefit for the scientific community and society in general.
- IGGOS promotes the scientific research in geodesy.
- IGGOS recognizes the achievements of Space Geodesy and other fields of geodesy.
- IGGOS identifies a consistent set of geodetic products, establishes the requirements concerning the products' accuracy, time resolution, and consistency.
- IGGOS identifies IAG service gaps and develops strategies to close them.
- IGGOS stimulates close cooperation between existing and new IAG services.
- IGGOS is geodesy's central interface to the scientific community and to society in general.

#### **Objectives:**

- IGGOS aims at maintaining the stability of and providing the ready access to the existing time series of geometric and gravimetric reference frames by ensuring the generation of uninterrupted time series of state-of-the-art global observations related to the three pillars of geodesy.
- IGGOS focuses *in the first phase* on all aspects relevant to ensure the *consistency of geometric and gravimetric products*. This includes space-borne and terrestrial aspects.
- The targeted overall accuracy and consistency of IGGOS products is of the order of  $10^{-9}$  or better.
- IGGOS shall be established as an official partner in the *IGOS*, United Nation's *Integrated Global Observing Strategy*.

#### **4. Science Rationale and Development of an IGGOS Science Plan**

*Science Rationale:* IGGOS shall have a *central theme* and a *master product*. This general theme must be scientifically sound, broad and include all the activities IGGOS might envisage in future.

**Global Deformation Processes and Mass Exchange Processes** is proposed to be the central theme.

Under the umbrella of *geometry plus Earth rotation plus gravity field* this theme encompasses virtually all facets of geodesy. In addition, it may easily be translated and broken down into tangible individual sub-themes and -products. From the general theme *one general product* may be derived, encompassing the following scientific questions/areas:

- The global patterns of tectonic motion (global with, in addition, “enlargements” of regional scenes) including inter-plate and intra-plate deformation,
- The global patterns of height changes (in one datum, and on all time scales, of geodynamic as well as of anthropogenic origin) on land, of ice covers (including glaciers), and of sea level,
- Deformation (loading as well as expansion) due to the mass exchange between atmosphere, oceans, hydrology, ice and solid Earth,
- Separation of effects of ocean mass changes from motion and from thermal expansion and salinity contraction,
- Separation of ocean effects from solid earth effects (“absolute” sea level),
- Quantification of atmosphere water vapor, which is the largest greenhouse gas,
- Quantification of angular momentum exchange, torque, and
- quantification of mass exchange between the components of system Earth.

The above list is not meant to be final and will be further developed.

The master theme and the products derived from it will address the relevant science issues related to geodesy and geodynamics in the 21<sup>st</sup> century, but also issues relevant to society (global risk management, natural resources, climate change, earthquake, volcanic eruptions, shoreline erosions, subsidence, extreme weather forecasting, ocean forecasting and others). It is a master theme of a dimension that can neither be produced in splendid geodetic isolation (one would in any event need GLOSS and others) nor by one geodetic entity alone (it requires the cooperation of the services, the “big players”, of regional projects and input from national organizations).

In order to shape the master theme and the master-product a sound and comprehensive **IGGOS Science Plan** is required. The IGGOS science plan shall provide a logical framework for the work of IGGOS. The master theme and the corresponding product(s) must be put into a broader science and application context. It should also include an analysis of our state-of-art in the science field under discussion, strength and deficiencies, recommendations of what should be done. If possible, priorities should be set.

The IGGOS Science Plan should serve as the basis for the implementation of IGGOS in 2005. A working plan should be derivable from it. Furthermore it should be an attractive document for presentation to potential future partners and clients.

#### **5. Initial IGGOS Structure**

The following *general principles* will be observed:

- IGGOS will be based on the existing IAG Services. IGGOS is in particular *not* taking over tasks of existing, and well working IAG services.
- New entities will be established only if there is a stringent requirement.
- IGGOS must be recognized by partners outside IAG, e.g., by UNESCO, ICSU, IGOS, GOOS, GTOS, governments, inter-government organizations, WCRP, IGBP, etc., as geodesy’s contribution to Earth sciences. For this purpose contacts have to be established to these organizations.

- IGGOS must promote its master product and the related sub-products.
- IGGOS will enforce quality management (validation, calibration, ensure the 1 ppb level) either by a new IGGOS entity or by delegating this task to one or several of the existing services.

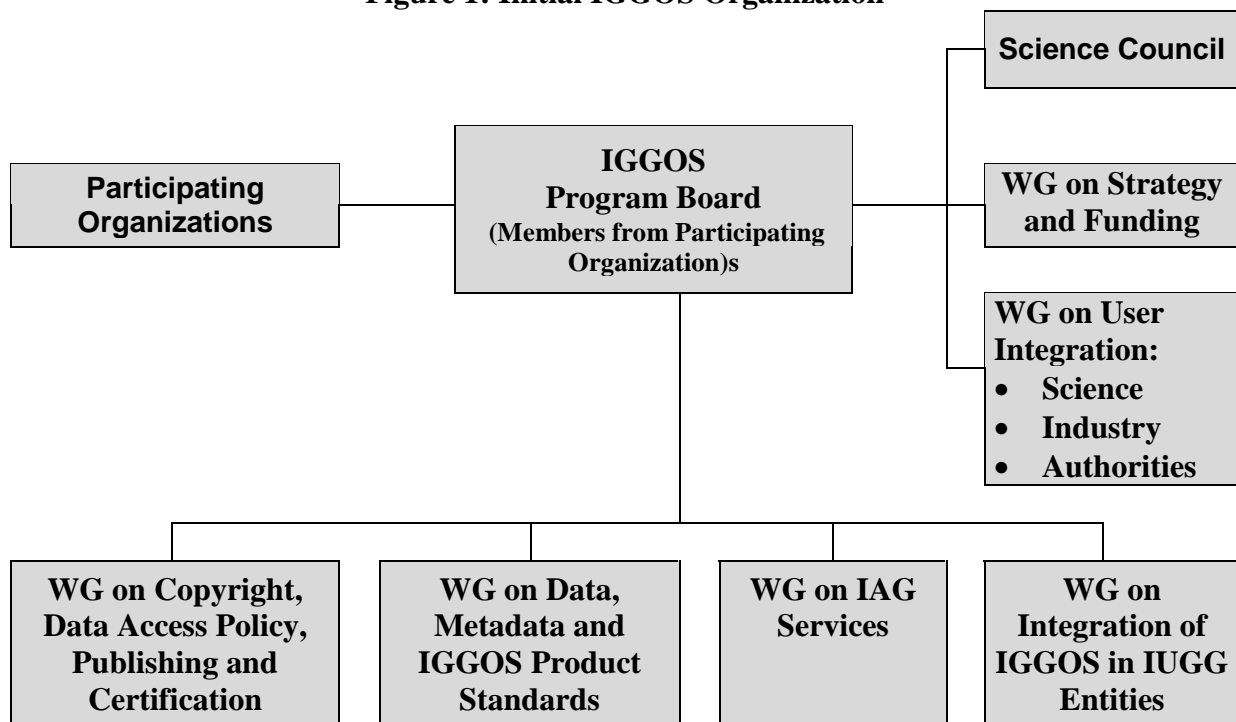
The initial structure to be established in summer 2003 for the definition phase of the IGGOS Project must be simple and should not be in conflict but cooperate with the existing IAG services.

The *key elements* of the initial IGGOS structure are:

1. The **IGGOS Program Board** as the central oversight entity.
2. Few well-defined **working groups**. The tasks of the working groups are to a high degree independent of the tasks of the IAG services.
3. The establishment of a **Science Council** may be considered.

The initial IGGOS (for the definition phase 2003-2005) is explained by Figure 1. The working groups specified should serve as typical examples. The precise structure still may be altered between the Nice and Sapporo Executive Committee meetings by the IGGOS Planning Group.

**Figure 1: Initial IGGOS Organization**



**Comments concerning Figure 1:**

- *Science Council*: It would be a primary task of the science council to develop the IGGOS science rationale and then the science plan. Should the decision be taken *not* to establish the science council, the IGGOS Program Board should take over these responsibilities. The Inter-Commission Committee on theory must be represented in the Science council or in the group setting up the science plan.
- *WG on Strategy and Funding*: Funding has to be addressed on a long-term basis by all permanent IAG entities requiring a heavy infrastructure. As IGGOS per se will be (at least initially) based – exactly like all IAG services – on a voluntary cooperation of the relevant research organizations in the field, the IGGOS funding strategy must be developed in close cooperation with these organizations. It seems therefore appropriate to establish a working group related to this topic. The aspect is clearly not dealt with consistently within the existing IAG services structure.

- *WG on User Integration*: This task is in part dealt with by the IAG services. A common policy on the IAG level is, however, missing. This WG must be set up in close cooperation with the services.
- *WG on Data, Metadata, and Data Standards*: A central issue for IGGOS, indeed. Here, the key products and their consistency levels have to be defined. This WG must be set up in close cooperation with the services.
- *WG on Copyright, Data Access Policy, Publishing and Certification*: Many of these issues have to be addressed today on a *case by case* basis. There should, however, be general rules for the entire field of IGGOS.
- *WG on IAG Services*: The key issue within this WG is a thorough analysis of the existing IAG structure. Does it make sense to combine certain services into one? (The question might be asked in the case of IGS, ILRS, and possibly IVS). What new services should be set up? Is it correct to distinguish within IAG between *level 1 services* (e.e., IGS, ILRS, IVS, etc.), dealing with raw observations and generating products which are more or less based on these observations only, and *level 2 services* (e.g., IERS) using the products of several level 1 services and generating new products or meta products, which are consistent with all the information from level 1? Shall there be one, two, or more level 2 services within IGGOS?
- *WG on Integration of IGGOS in IUGG entities*: This WG has the task to set (so-to-speak) the foreign ministry of IGGOS. It must be the goal to have IGGOS acknowledged as a member in the important international programs dealing with global change, etc. The IGGOS is but one important example.

## **7. Schedule for the Realization of IGGOS**

The schedule is based on the assumption that the IAG Executive Committee, at its meeting of April 11, 2003 in Nice will approve the plan presented in Section 8 to establish the IGGOS.

1. The IGGOS planning group will meet once between the Nice and Sapporo IAG Executive committee meetings with the goals (a) to propose a chairperson for the IGGOS definition phase, (b) to finalize the IGGOS structure for the IGGOS definition phase, (c) to formally establish the IGGOS Program Board, (d) to decide whether or not to establish an IGGOS Science Council, (e) agree on a final version for the science rationale.
2. The concrete proposals concerning the issues mentioned above will be presented for approval to the IAG EC at its Sapporo meeting.
3. The IGGOS, as IAG's first project, will be realized in two steps, namely (a) in the IGGOS definition phase (2003-2005), (b) in the official IGGOS project thereafter.
4. IGGOS, in particular the science plan developed between 2003 and 2005, should be a central issue of the IAG Scientific Assembly 2005.

## **8. Proposal for the Establishment of IGGOS to the IAG Executive Committee**

The IAG Planning Group proposes to establish the IGGOS as IAG's first project in the following way:

1. Vision, Mission and Objectives are those outlined in Section 3.
2. The definition phase for IGGOS will start on August 1, 2003 and it will end at the IAG Scientific Assembly in 2005.
3. The definition phase of IGGOS will be led by the IGGOS Program Board. Membership in and Chairperson of the IGGOS Board will be proposed by the IAG Planning Group of IGGOS at a meeting between the Nice and Sapporo meetings. Both issues need confirmation by the IAG Executive Committee and the IAG Council.
4. The initial IGGOS structure for the time interval 2003-2005 of the IGGOS definition phase is in essence as illustrated by Figure 1. Modifications by the IAG Planning Group still are possible and may be proposed at the meeting of the IAG planning group in spring

2003. The finalized structure needs approval by the IAG Executive at the Sapporo meeting.

5. Structure, vision, mission, and objectives of the official IAG Project will be developed during the IGGOS definition phase between 2003 and 2005 and presented to the IAG Executive for approval at its meeting in 2005 associated with the IAG Scientific Assembly.